Appendix G. Assessment of Resources with Minor (or Lower) Adverse Impacts

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

G.1. Introduction

To focus on the impacts of most concern in the main body of this Draft EIS, BOEM has included the analysis of resources with no greater than **minor** adverse impacts below. These include air quality; bats; birds; coastal habitat and fauna; demographics, employment, and economics; land use and coastal infrastructure, sea turtles; and water quality. Those resources with potential impact ratings greater than **minor** are included in Draft EIS Chapter 3.

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3.4. Air Quality

This section discusses potential impacts on air quality from the proposed Project, alternatives, and ongoing and planned activities in the air quality geographic analysis area. The air quality geographic analysis area, as shown on Figure 3.4-1, includes the airshed within 25 miles (40 kilometers) of the Wind Farm Area (corresponding to the OCS permit area) and the airshed within 15.5 miles (25 kilometers) of onshore construction areas and ports that may be used for the Project. The geographic analysis area encompasses the geographic region subject to USEPA review as part of an OCS permit for the Project under the Clean Air Act (CAA). The geographic analysis area also considers potential air quality impacts associated with the onshore construction areas and the mustering port(s) outside of the OCS permit area. Given the generally low emissions of the sea vessels and equipment that would be used during proposed construction activities, any potential air quality impacts would likely be within a few miles of the source. BOEM selected the 15.5-mile (25-kilometer) distance to provide a reasonable buffer.

3.4.1 Description of the Affected Environment for Air Quality

The overall geographic analysis area for air quality covers much of southern New Jersey and the adjacent portions of Delaware Bay and the Atlantic Ocean. This includes the air above the Wind Farm Area and adjacent OCS area, the offshore and onshore export cable routes, the onshore substations, the construction staging areas, the onshore construction and proposed Project-related sites, and the ports used to support proposed Project activities. COP Volume II, Section 2.1.3 (Ocean Wind 2022), provides further description of the air quality geographic analysis area. Appendix I provides information on climate and meteorological conditions in the Project region.

Air quality within a region is measured in comparison to the National Ambient Air Quality Standards (NAAQS), which are standards established by USEPA) pursuant to the CAA (42 USC 7409) for several common pollutants, known as criteria pollutants, to protect human health and welfare. The criteria pollutants are CO, lead, nitrogen dioxide (NO_2), ozone, PM_{10}, $PM_{2.5}$, and SO_2. New Jersey has established ambient air quality standards (AAQS) that are similar to the NAAQS. Table 2.1.3-1 in COP Volume II (Ocean Wind 2022) shows the NAAQS and the New Jersey AAQS. Emissions of lead from Project-associated sources would be negligible because lead is not a component of liquid or gaseous fuels; accordingly, lead is not analyzed in this EIS. Ozone is not emitted directly but is formed in the atmosphere from precursor chemicals, primarily NO_X and VOCs, in the presence of sunlight. Potential impacts of a project on ozone levels are evaluated in terms of NO_X and VOC emissions.

USEPA designates all areas of the country as attainment, nonattainment, or unclassified for each criteria pollutant. An attainment area is an area where all criteria pollutant concentrations are within all NAAQS. A nonattainment area does not meet the NAAQS for one or more pollutants. Unclassified areas are those where attainment status cannot be determined based on available information and are regulated as attainment areas. An area can be in attainment for some pollutants and nonattainment for others. If an area was nonattainment at any point in the last 20 years but is currently attainment or is unclassified, then the area is designated a maintenance area. Nonattainment and maintenance areas are required to prepare a State Implementation Plan, which describes the region’s program to attain and maintain compliance with the NAAQS. The attainment status of an area can be found at 40 CFR 81 and in the USEPA Green Book, which the agency revises from time to time (USEPA 2021). Attainment status is determined through evaluation of air quality data from a network of monitors.

The nearest onshore designated areas to the proposed Wind Farm Area are Ocean, Atlantic, and Cape May Counties in New Jersey. Parts of these counties are in a designated nonattainment area for ozone. The nonattainment areas include facilities that the Project could use in Atlantic City, BL England, Oyster

Creek, Hope Creek, Port Elizabeth, and Repauno/Paulsboro. Atlantic City and Repauno/Paulsboro also are in areas designated as maintenance for CO. More distant ports that may be used include Norfolk, Virginia, which is in an ozone maintenance area, and Charleston, South Carolina, which is in an area designated in attainment for all pollutants. Figure 3.4-2 displays the nonattainment and maintenance areas that intersect the geographic analysis area.

The CAA prohibits federal agencies from approving any activity that does not conform to a State Implementation Plan. This prohibition applies only with respect to nonattainment or maintenance areas (i.e., areas that were previously nonattainment and for which a maintenance plan is required). Conformity to a State Implementation Plan means conformity to a State Implementation Plan’s purpose of reducing the severity and number of violations of the NAAQS to achieve attainment of such standards. The activities for which BOEM has authority are outside of any nonattainment or maintenance area and therefore not subject to the requirement to show conformity.

The CAA defines Class I areas as certain national parks and wilderness areas where very little degradation of air quality is allowed. Class I areas consist of national parks larger than 6,000 acres and wilderness areas larger than 5,000 acres that were in existence before August 1977. Projects subject to federal permits are required to notify the federal land manager responsible for designated Class I areas within 62 miles (100 kilometers) of the Project.[1] The federal land manager identifies appropriate air quality–related values for the Class I area and evaluates the impact of the Project on air quality–related values. The Brigantine Wilderness Area, approximately 25 miles north-northwest of the geographic center of the Project, is the only Class I area within 62 miles (100 kilometers) of the Project. Air quality–related values identified by USFWS for Brigantine Wilderness include aquatic resources, fauna/wildlife, soils, vegetation, and visibility.

The CAA amendments directed USEPA to establish requirements to control air pollution from OCS oil- and gas-related activities along the Pacific, Arctic, and Atlantic Coasts and along the U.S. Gulf Coast off Florida, east of 87° 30′ west longitude. The OCS Air Regulations (40 CFR 55) establish the applicable air pollution control requirements, including provisions related to permitting, monitoring, reporting, fees, compliance, and enforcement for facilities subject to the CAA. These regulations apply to OCS sources that are beyond state seaward boundaries. Projects within 25 nm of a state seaward boundary are required to comply with the air quality requirements of the nearest or corresponding onshore area, including applicable permitting requirements.

[1] The 100-kilometer distance applies to notification and is not a threshold for use in evaluating impacts. Impacts at Class I areas at distances greater than 100 kilometers may need to be considered for larger emission sources if there is reason to believe that such sources could affect the air quality in the Class I area (USEPA 1992).

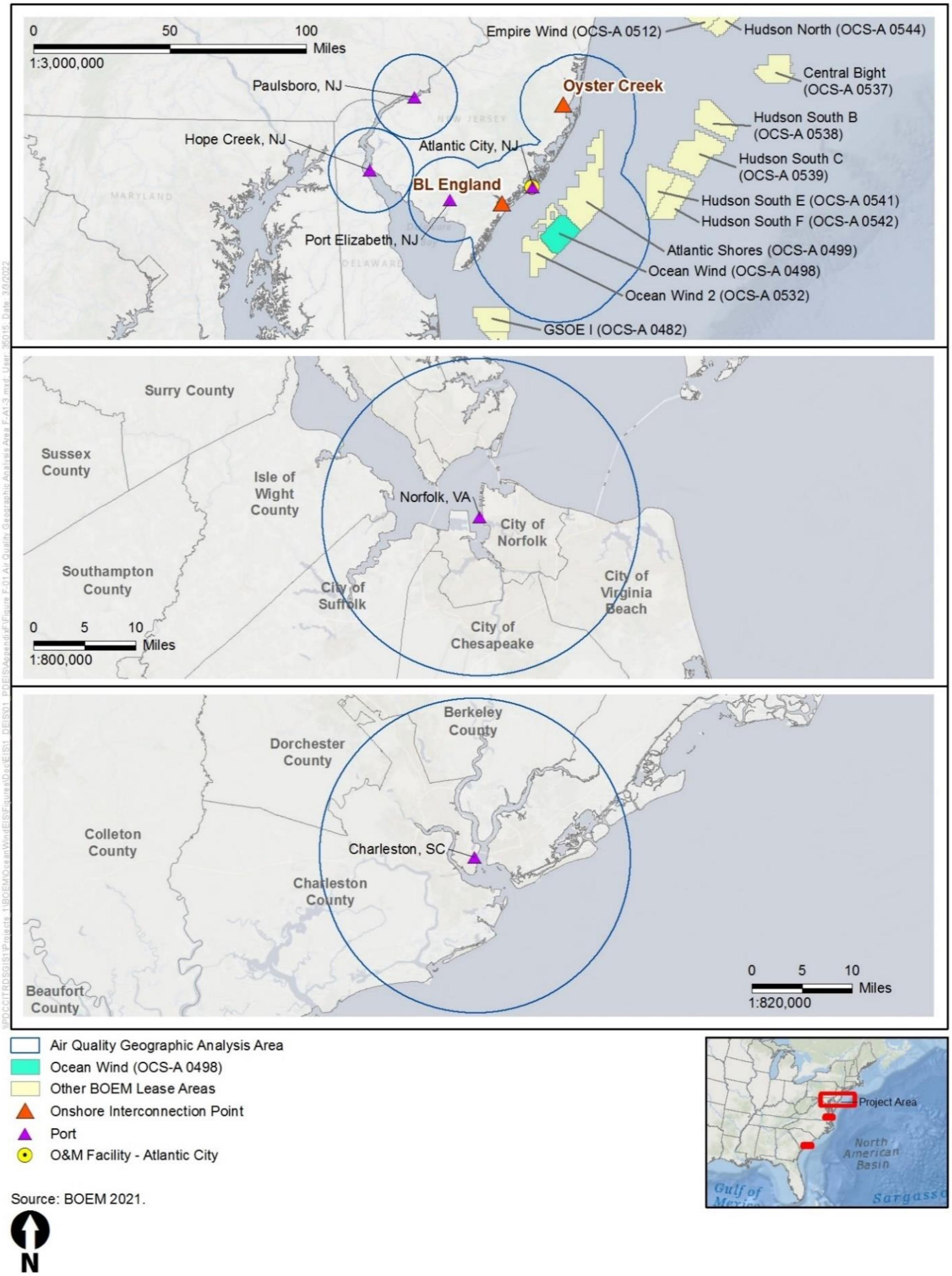

Figure 3.4-1 Air Quality Geographic Analysis Area

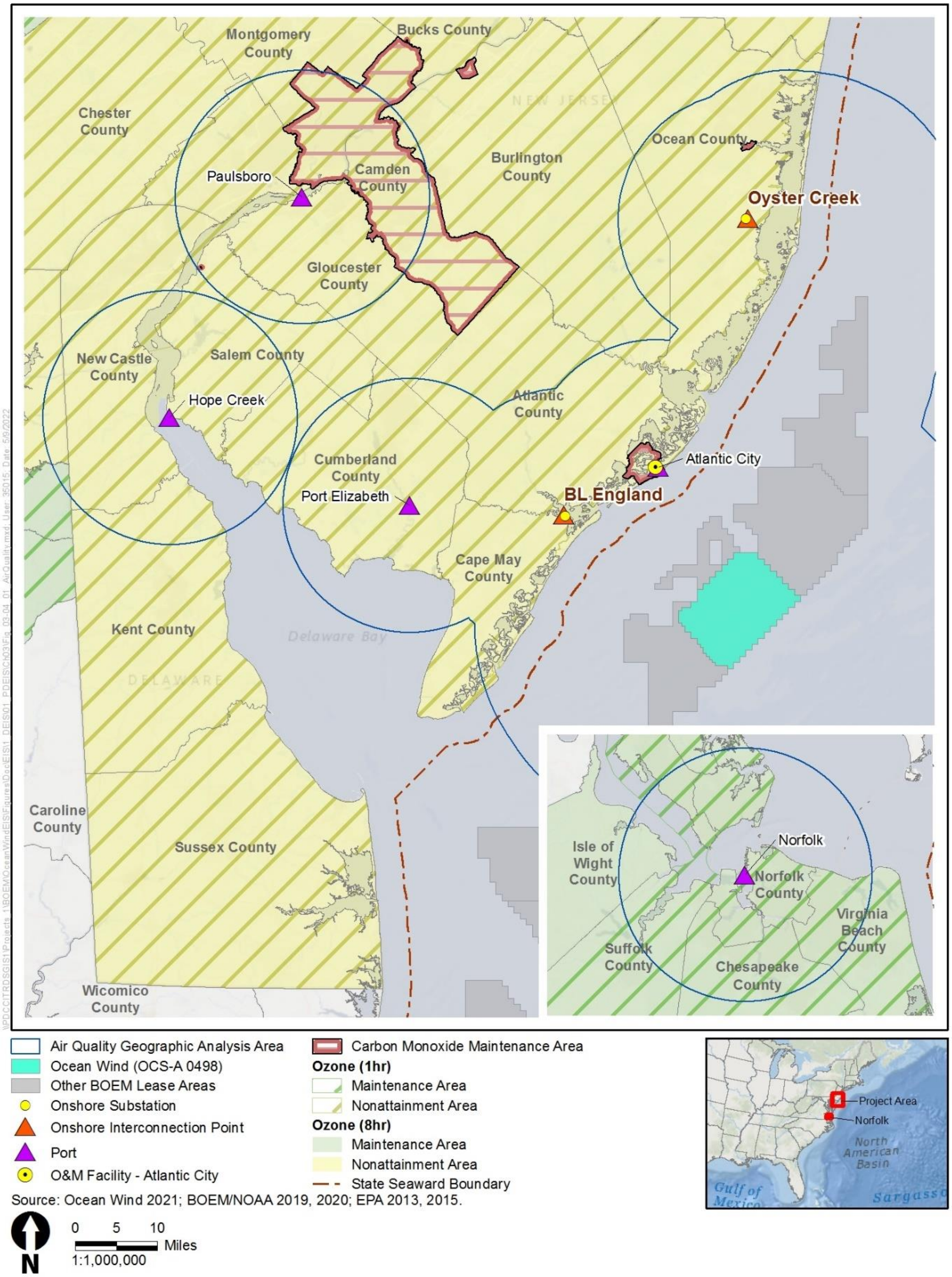

Figure 3.4-2 Air Quality Nonattainment and Maintenance Areas in the Geographic Analysis Area

3.4.2 Environmental Consequences

3.4.2.1. Impact Level Definitions for Air Quality

Definitions of impact levels are provided in Table 3.4-1. Impact levels are intended to serve NEPA purposes only, and are not intended to establish thresholds or other requirements with respect to permitting under the CAA.

Table 3.4-1 Impact Level Definitions for Air Quality

Impact Level	Type of Impact	Definition
Negligible	Adverse	Increases in ambient pollutant concentrations due to Project emissions would not be detectable.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would not be detectable.
Minor to Moderate	Adverse	Increases in ambient pollutant concentrations due to Project emissions would be detectable but would not lead to exceedance of the NAAQS.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be detectable.
Major	Adverse	Changes in ambient pollutant concentrations due to Project emissions would lead to exceedance of the NAAQS.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be larger than for minor to moderate impacts.

3.4.3 Impacts of the No Action Alternative on Air Quality

When analyzing the impacts of the No Action Alternative on air quality, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

3.4.3.1. Ongoing and Planned Non-offshore Wind Activities

NJDEP has projected that under a scenario of continuation of current regulations and policies, emissions from electricity generation would decline slowly through 2050 due to improvements in efficiency and switching to cleaner fuels (NJDEP 2019). Under the No Action Alternative, without implementation of other offshore wind projects, the electricity that would have been generated by offshore wind would likely be provided by fossil fuel-fired facilities.[2] As a result, a continuation of ongoing activities under the No Action Alternative could lead to less decline in emissions than would occur with offshore wind development. An overall mix of natural gas, solar, wind, and energy storage would likely occur in the future due to market forces and state energy policies. New Jersey Executive Order 92 (November 19, 2019) sets a goal of developing 7,500 MW of offshore wind energy off the coast of New Jersey by 2035. The New Jersey Energy Master Plan (BPU 2019) sets a goal of transitioning New Jersey to 100 percent renewable electricity by 2050. In addition to electricity generation, emissions from other ongoing activities including vessel and vehicle emissions and accidental releases of fuel or other hazardous material would continue to contribute to ongoing regional air quality impacts.

[2] In 2020, the generation mix of the PJM Interconnection, the regional grid that serves New Jersey, was approximately 40 percent natural gas, 34 percent nuclear, 19 percent coal, 3 percent wind, 2 percent hydroelectric, and 2 percent other sources, on an annual average basis (Monitoring Analytics 2021).

Impacts from fossil-fuel facilities are expected to be mitigated partially by implementation of other planned offshore wind projects near the proposed geographic analysis area, including in the regions off New England, New York, New Jersey, Delaware, and Maryland, to the extent that these wind projects would result in a reduction in emissions from fossil-fueled power generating facilities. Other planned activities that could contribute to air quality impacts include construction of undersea transmission lines, gas pipelines, and other submarine cables; marine minerals use and ocean-dredged material disposal; military use; marine transportation; oil and gas activities; and onshore development activities (see Section F.2 in Appendix F for a complete description of planned activities). These activities could contribute to air quality impacts associated with the IPFs of air emissions, climate change, and accidental releases. See Table F1-1 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for air quality.

3.4.3.2. Offshore Wind Activities (without Proposed Action)

BOEM expects other offshore wind activities to affect air quality through the following primary IPFs.

Air emissions: Most air pollutant emissions and air quality impacts from offshore wind projects would occur during construction, potentially from multiple projects occurring simultaneously. All projects would be required to comply with the CAA. Primary emission sources would include increased public and commercial vehicular traffic, air traffic, combustion emissions from construction equipment, and fugitive emissions from construction-generated dust. As wind energy projects come online, power generation emissions overall could decrease and the region as a whole could realize a net benefit to air quality.

The offshore wind projects other than the Proposed Action that may result in air pollutant emissions and air quality impacts within the air quality geographic analysis area include projects within all or portions of the following lease areas: OCS-A-0499, OCS-A-0532, and OCS A-0549 (Table F2-4). Projects currently proposed in these lease areas include Atlantic Shores South, Ocean Wind 2, and Atlantic Shores North, respectively. These projects would produce 5,262 MW of renewable power from the installation of 468 WTGs (Table F2-1). Based on the assumed offshore construction schedule in Table F2-1, those projects within the geographic analysis area would have overlapping construction periods beginning in 2024 and continuing through 2030.

During the construction phase, the total emissions of criteria pollutants and ozone precursors from offshore wind projects other than Ocean Wind 1 proposed within the air quality geographic analysis area, summed over all construction years, are estimated to be 6,034 tons of CO, 27,571 tons of NO_X, 913 tons of PM_{10}, 880 tons of $PM_{2.5}$, 181 tons of SO_2, 618 tons of VOCs, and 1,738,387 tons of CO_2 (Table F2-4). Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of the emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases. Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. As a result, air quality impacts would be minor, shifting spatially and temporally across the air quality geographic analysis area.

During operations, emissions from offshore wind projects within the air quality geographic analysis area would overlap temporally, but operations would contribute few criteria pollutant emissions compared to construction and decommissioning. Operational emissions would come largely from commercial vessel traffic and emergency diesel generators. The aggregate operational emissions for all projects within the air quality analysis area would vary by year as successive projects begin operation. Estimated operational emissions would be 121–261 tons per year of CO, 519–1,106 tons per year of NO_X, 17–36 tons per year of PM_{10}, 16–35 tons per year of $PM_{2.5}$, 1–3 tons per year of SO_2, 9–20 tons per year of VOCs, and 33,566–73,226 tons per year of CO_2 (Table F2-4). Operational emissions would result in negligible air quality impacts because emissions would be intermittent, localized, and dispersed throughout the 342,733-acre combined lease areas and vessel routes from the onshore O&M facility.

Offshore wind energy development could help offset emissions from fossil fuels, potentially improving regional air quality and reducing GHGs. An analysis by Katzenstein and Apt (2009), for example, estimates that CO_2 emissions can be reduced by up to 80 percent and NO_X emissions can be reduced up to 50 percent by implementing wind energy projects.[3] An analysis by Barthelmie and Pryor (2021) calculated that, depending on global trends in GHG emissions and the amount of wind energy expansion, development of wind energy could reduce predicted increases in global surface temperature by 0.3–0.8 °C (0.5–1.4 °F) by 2100.

Estimations and evaluations of potential health and climate benefits from offshore wind activities for specific regions and project sizes rely on information about the air pollutant emission contributions of the existing and projected mixes of power generation sources, and generally estimate the annual health benefits of an individual commercial scale offshore wind project to be valued in the hundreds of millions of dollars (Kempton et al. 2005; Buonocoure et al. 2016).

The potential health benefits of avoided emissions can be evaluated using USEPA's CO-Benefits Risk Assessment (COBRA) health impacts screening and mapping tool (USEPA 2020a). COBRA is a tool that estimates the health and economic benefits of clean energy policies. COBRA was used to analyze the avoided emissions that were calculated for development of 36 GW of reasonably foreseeable wind power on the OCS (Appendix F, Table F2-1). Table 3.4-2 presents the estimated monetized health benefits and avoided mortality for this example scenario.

Table 3.4-2 COBRA Estimate of Annual Avoided Health Effects with 36 GW Reasonably Foreseeable Offshore Wind Power

Discount Rate[1] (2023)	Monetized Total Health Benefits (Million U.S. dollars/year)		Avoided Mortality (cases/year)	
	Low Estimate[2]	High Estimate[2]	Low Estimate[2]	High Estimate[2]
3%	7,765	17,516	698	1,580
7%	6,929	15,619	698	1,580

[1] The discount rate is used to express future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis. Therefore, COBRA accounts for the "time value of money" preference (i.e., a general preference for receiving economic benefits now rather than later) by discounting benefits received later (USEPA 2020b).
[2] The low and high estimates are derived using two sets of assumptions about the sensitivity of adult mortality and non-fatal heart attacks to changes in ambient $PM_{2.5}$ levels. Specifically, the high estimates are based on studies that estimated a larger effect of changes in ambient $PM_{2.5}$ levels on the incidence of these health effects (USEPA 2020b).

BOEM anticipates that the air quality impacts associated with offshore wind activities other than the Proposed Action in the geographic analysis area would result in minor adverse impacts due to emissions

[3] Katzenstein and Apt (2009) modeled a system of two types of natural gas generators, four wind farms, and one solar farm. The power output of wind and solar facilities can vary relatively rapidly, and the natural gas generators change their power output accordingly to meet electrical demand. When gas generators change their power output their emission rates may increase above their steady-state levels. As a result, the net emissions reductions realized from gas generators reducing their output in response to wind and solar power can be less than the reduction that would be expected based on the amount of wind and solar power. The study found that reductions in CO_2 emissions would be about 80 percent, and in NO_X emissions about 30–50 percent, of the emissions reductions expected if the power fluctuations caused no additional emissions.

of criteria pollutants, VOCs, hazardous air pollutants (HAP), and GHGs, mostly released during construction and decommissioning. Impacts would be minor because these emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS or New Jersey AAQS. Offshore wind projects likely would lead to reduced emissions from fossil-fueled power generating facilities and consequently minor to moderate beneficial impacts on air quality.

Construction and operation of offshore wind projects would produce GHG emissions that would contribute incrementally to climate change. CO_2 is relatively stable in the atmosphere and, for the most part, mixed uniformly throughout the troposphere and stratosphere. As such, the impact of GHG emissions does not depend upon the source location. Increasing energy production from offshore wind projects could reduce regional GHG emissions by displacing energy from fossil fuels. This reduction could more than offset the relatively small GHG emissions from offshore wind projects. This reduction in regional GHG emissions would be noticeable in the regional context, would contribute incrementally to reducing climate change, and would represent a moderate beneficial impact in the regional context but a negligible beneficial impact in the global context.

Accidental releases: Offshore wind activities could release air toxics or HAPs because of accidental chemical spills within the air quality geographic analysis area. Section 3.21, *Water Quality*, includes a discussion of the nature of releases anticipated. Based on Table F2-3, up to about 1,527,193 gallons (5.8 million liters) of coolants, 2,121,777 gallons (8.0 million liters) of oils and lubricants, and 471,492 gallons (1.8 million liters) of diesel fuel would be contained in the 482 wind turbine and substation structures for the wind energy projects within the air quality geographic analysis area. If accidental releases occur, they would be most likely during construction but could occur during operations and decommissioning of offshore wind facilities. These may lead to short-term periods (hours to days)[4] of HAP emissions through surface evaporation. HAP emissions would consist of VOCs, which may be important for ozone formation. By comparison, the smallest tanker vessel operating in these waters (a general-purpose tanker) has a capacity of between 3.2 and 8 million gallons (12.1 million and 30.3 million liters). Tankers are relatively common in these waters, and the total WTG chemical storage capacity within the geographic analysis area for air quality is much less than the volume of hazardous liquids transported by ongoing activities (U.S. Energy Information Administration 2014). BOEM expects air quality impacts from accidental releases would be negligible because impacts would be short term and limited to the area near the accidental release location. Accidental spills would occur infrequently over a 30-year period with a higher probability of spills during future project construction, but they would not be expected to contribute appreciably to overall impacts on air quality.

3.4.3.3. Conclusions

Under the No Action Alternative, air quality would continue to reflect current regional trends and respond to IPFs introduced by other ongoing and planned activities. Additional, higher-emitting, fossil-fuel energy facilities could be built, or could be kept in service, to meet future power demand, fired by natural gas, oil, or coal. These larger impacts would be mitigated partially by other offshore wind projects surrounding the geographic analysis area, including offshore New England, New York, New Jersey, Delaware, and Maryland. Although the proposed Project would not be built under the No Action Alternative, BOEM expects ongoing and planned non-offshore wind activities and offshore wind activities to have continuing regional air quality impacts primarily through air pollutant emissions, accidental releases, and climate change.

[4] For example, small diesel fuel spills (500–5,000 gallons) usually will evaporate and disperse within a day or less (NOAA 2006).

BOEM anticipates that ongoing non-offshore wind activities would result in moderate impacts on air quality because of air pollutant emissions and GHGs. Planned non-offshore wind activities may also contribute to impacts on air quality because air pollutant and GHG emissions would increase through construction and operation of new energy generation facilities to meet future power demands. Although there are no such energy generation facilities planned within the air quality geographic analysis area, continuation of current regional trends in energy development could include new power plants that could contribute to air quality and GHG impacts in New Jersey and the Mid-Atlantic states. BOEM anticipates that the impacts of planned non-offshore wind activities would be moderate. BOEM expects the combination of ongoing and planned activities other than offshore wind to result in moderate impacts on air quality, primarily driven by recent market and permitting trends indicating future electric generating units would most likely include natural-gas-fired facilities.

Offshore wind activities in the geographic analysis area would contribute to the emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning. Impacts would be minor because these emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS or New Jersey AAQS. Pollutant emissions during operations would be generally lower and more transient. Most air pollutant emissions and air quality impacts would occur during multiple overlapping project construction phases from 2024 through 2030 (Table F2-4). Overall, adverse air quality impacts from offshore wind projects are expected to be relatively small and transient. Offshore wind projects likely would lead to reduced emissions from fossil-fueled power generating facilities and consequently minor to moderate beneficial impacts on regional air quality after offshore wind projects are operational.

Under the No Action Alternative, existing environmental trends and activities would continue, and air quality would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **moderate** impacts on air quality. BOEM anticipates that the No Action Alternative combined with all other planned activities (including other offshore wind activities) would result in **moderate** adverse impacts due to emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning, and **minor** to **moderate beneficial** impacts on regional air quality after offshore wind projects are operational.

3.4.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on air quality:

- Emission ratings of construction equipment and vehicle engines;
- Location of construction laydown areas;
- Choice of cable-laying locations and pathways;
- Choice of marine traffic routes to and from the Wind Farm Area and offshore export cable routes;
- Soil characteristics at excavation areas, which may affect fugitive emissions; and
- Emission control strategy for fugitive emissions due to excavation and hauling operations.

Changes to the design capacity of the WTGs would not alter the maximum potential air quality impacts for the Proposed Action and other action alternatives because the maximum-case scenario involved the maximum number of WTGs (98) allowed in the PDE.

Ocean Wind has committed to measures to minimize impacts on air quality. Low-sulfur fuels would be used to the extent practicable (AQ-01) and specific engines designed to reduce air pollution would be used when practicable (AQ-02), in addition to limiting engine idling times (AQ-03), complying with international air emission standards for marine vessels (AQ-04), and implementing a dust control plan (AQ-05) (COP Volume II, Table 1.1-2; Ocean Wind 2022).

3.4.5 Impacts of the Proposed Action on Air Quality

The Project may generate emissions and affect air quality in the New Jersey region and nearby coastal waters during construction, O&M, and decommissioning activities. Onshore emissions would occur in the onshore export cable corridors and at points of interconnection, potentially including BL England and Oyster Creek, in Ocean, Atlantic, and Cape May Counties in New Jersey. Offshore emissions would be within the OCS, including state offshore waters. Offshore emissions would occur in the Lease Area and the offshore export cable corridors. COP Volume I, Section 4 (Ocean Wind 2022), provides additional information on land use and proposed ports.

Air quality in the geographic analysis area may be affected by emissions of criteria pollutants from sources involved in the construction or maintenance of the proposed Project and, potentially, during operations. These impacts, while generally localized to the areas near the emission sources, may occur at any location associated with the proposed Project, be it offshore in the Wind Farm Area or at any of the onshore construction or support sites. Ozone levels in the region also could be affected.

The proposed Project's WTGs, substations, and offshore and onshore cable corridors would not themselves generate air pollutant emissions during normal operations. However, air pollutant emissions from equipment used in the construction, O&M, and decommissioning phases could affect air quality in the geographic analysis area and nearby coastal waters and shore areas. Most emissions would occur temporarily during construction, offshore in the Wind Farm Area, onshore at the landfall sites, along the offshore and onshore export cable routes, at the onshore substations, and at the construction staging areas. Additional emissions related to the Project could also occur at nearby ports used to transport material and personnel to and from the Project site. However, the Project would provide beneficial impacts on the air quality near the proposed Project location and the surrounding region to the extent that energy produced by the Project would displace energy produced by fossil-fueled power plants.

The majority of air pollutant and GHG emissions from the Proposed Action alone would come from the main engines, auxiliary engines, and auxiliary equipment on marine vessels used during offshore construction activities. Fugitive dust emissions would occur as a result of excavation and hauling of soil during onshore construction activities. Emissions from the OCS source, as defined in the CAA, would be permitted as part of the OCS permit for which Ocean Wind has begun the application process. The Project must demonstrate compliance with the NAAQS. The OCS air permitting process includes air dispersion modeling of emissions to demonstrate compliance with the NAAQS. Preliminary results of air dispersion modeling of emissions conducted in support of the OCS air permitting are provided in Table 3.4-4 and Table 3.4-6. The CAA also provides protection of air quality in Class I wilderness areas by means of national standards for air quality and the prevention of significant deterioration program and gives federal land managers a responsibility to protect the air-quality related values of Class I areas from the adverse impacts of air pollution. If emissions from the Project would cause or contribute to adverse impacts on the air-quality related values of a Class I area, the permitting authority (i.e., USEPA) can deny the permit. As part of the air-quality related values analysis, the Project must demonstrate that significant visibility degradation would not occur as a result of increased haze or plumes. Long-range transport modeling is under review in conjunction with the OCS air permitting process and will be presented in the Final EIS.

Air emissions – construction: Fuel combustion and solvent use would cause construction-related emissions. The air pollutants would include criteria pollutants, VOCs, and HAPs, as well as GHGs.

During the construction phase, the activities of additional workers, increased traffic congestion, additional commuting miles for construction personnel, and increased air-polluting activities of supporting businesses also could have impacts on air quality. Construction equipment would comply with all applicable emissions and fuel-efficiency standards to minimize combustion emissions and associated air quality impacts. The total estimated construction emissions of each pollutant are summarized in Table 3.4-3.

Table 3.4-3 Ocean Wind 1 Total Construction Emissions (U.S. tons)

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
Year 1	2.5	5.1	0.3	0.3	0.02	0.4	3,539
Year 2	2,154	11,168	365.3	349.3	115.3	292.6	662,421
Total	2,156	11,173	365.6	349.5	115.3	293.0	665,960

Source: COP Volume II, Table 2.1.3-3 (Ocean Wind 2022)
Sum of individual values may not equal total due to rounding.

Offshore Construction

Emissions from potential sources or construction activities would vary throughout the construction and installation of offshore components. Emissions from offshore activities would occur during pile and scour protection installation, offshore cable laying, turbine installation, and substation installation. Offshore construction-related emissions also would come from diesel-fueled generators used to temporarily supply power to the WTGs and substations so that workers could operate lights, controls, and other equipment before cabling is in place. There also would be emissions from engines used to power pile-driving hammers and air compressors used to supply compressed air to noise-mitigation devices during pile driving (if used). Emissions from vessels used to transport workers, supplies, and equipment to and from the construction areas would result in additional air quality impacts. The Project may need emergency generators at times, potentially resulting in increased emissions for limited periods. Ocean Wind's APMs include compliance with applicable fuel-efficiency and emissions standards (AQ-02, AQ-04; see COP Volume II, Table 1.1-2; Ocean Wind 2022).

Table 3.4-4 presents an initial summary of the Project's estimated offshore construction emissions in the OCS permit area and a comparison of the total OCS permit area emissions in relation to the total emission inventories of the potentially affected counties. The OCS permit area, measured as 25 nm from the center of the Wind Farm Area, extends into Atlantic County, Cape May, and Ocean County, New Jersey. The estimated construction emissions are currently under review through the OCS air permitting process and the refined estimates will be presented in the Final EIS. This summary is a conservative analysis because it assumes all emissions would directly affect the nearest county's air; however, depending on the wind conditions at the time of emissions, it is likely that not all emissions generated offshore would reach land.

Table 3.4-4 Estimated Ocean Wind 1 Construction Emissions (U.S. tons) in OCS Permit Area

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
OCS Permit Area Year 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OCS Permit Area Year 2	1,342	7,486	244.3	232.8	94.5	216.6	424,114
Total	**1,342**	**7,486**	**244.3**	**232.8**	**94.5**	**216.6**	**424,114**
Atlantic County, New Jersey 2017 Inventory	29,820.4	4,492.6	1,828.1	839	267	15,084.2	1,598,849.4

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
Percentage of Atlantic County, New Jersey 2017 Inventory	4.5	166.6	13.4	27.7	35.4	1.4	26.5
Cape May County, New Jersey 2017 Inventory	18,830.5	2,883.3	958.9	475.2	63.5	9,015.3	833,591.8
Percentage of Cape May County, New Jersey 2017 Inventory	7.1	259.6	25.5	49.0	148.8	2.4	50.9
Ocean County, New Jersey 2017 Inventory	63,398.4	7,737.8	3,237.8	2,064.3	187.1	20,865.9	3,702,977.4
Percentage of Ocean County, New Jersey 2017 Inventory	2.1	96.7	7.5	11.3	50.5	1.0	11.5

CO_2e = carbon dioxide equivalent

Air quality impacts due to offshore wind projects within the air quality geographic analysis area are anticipated to be small relative to larger emission sources such as fossil-fueled power plants. The largest air quality impacts are anticipated during construction, with smaller and more infrequent impacts anticipated during decommissioning. During the construction phase, the total emissions of criteria pollutants and ozone precursors from all offshore wind projects, including the Proposed Action, proposed within the air quality geographic analysis area, summed over all construction years, are estimated to be 8,190 tons of CO, 38,744 tons of NO_X, 1,279 tons of PM_{10}, 1,229 tons of $PM_{2.5}$, 297 tons of SO_2, 911 tons of VOCs, and 2,394,700 tons of CO_2 (Table F2-4). Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of the emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases.

The Proposed Action would contribute an average of approximately 34 percent of the total offshore wind project emissions that may generate impacts, depending on the pollutant, due to construction and decommissioning activities within the air quality geographic analysis area. This suggests that about two-thirds of the air quality impacts resulting from offshore wind development, depending on the pollutant, would be due to other offshore wind projects in total and the addition of the Proposed Action would yield a noticeable contribution to the total air quality impacts. BOEM anticipates that air quality impacts from construction and decommissioning of the Proposed Action would be minor.

Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. As a result, air quality impacts would shift spatially and temporally across the air quality geographic analysis area. The largest combined air quality impacts from offshore wind would occur during overlapping construction and decommissioning of multiple offshore wind projects. The Proposed Action is anticipated to overlap with Atlantic Shores South for 2 years of construction in 2024 and 2025. Construction of other wind projects within the air quality geographic analysis area would overlap with the proposed Project's operations (Table F2-4). Most air quality impacts would remain offshore because the highest emissions would occur in the offshore region and the westerly prevailing winds would result in most emission plumes remaining offshore. Although OCS sources in the Atlantic are subject to CAA requirements including requirements not to violate any NAAQS, the amount of human exposure offshore is typically very low. Ozone and some particulate matter are formed in the atmosphere from precursor emissions and can be transported longer distances, potentially over land.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts on air quality from ongoing and planned activities including offshore wind, which would be moderate during construction. Impacts would be greatest during overlapping construction activities but these effects would be short term in nature, as the overlap in the air quality geographic analysis area would be limited in time.

Onshore Construction

Onshore activities of the Proposed Action would consist primarily of HDD, duct bank construction, cable-pulling operations, and substation construction. Emissions would primarily be from operation of diesel-powered equipment and vehicle activity such as bulldozers, excavators, and diesel trucks, and fugitive particulate emissions from excavation and hauling of soil. Ocean Wind's APMs include complying with applicable fuel-efficiency and emissions standards, implementing anti-idling practices, and developing and implementing a fugitive dust control plan (AQ-01, AQ-02, AQ-03, AQ-04, AQ-05; see COP Volume II, Table 1.1-2; Ocean Wind 2022).

These emissions would be highly variable and limited in spatial extent at any given period and would result in minor impacts, as they would be temporary in nature. Fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to air quality impacts from ongoing and planned activities including offshore wind associated with onshore construction, which would be minor. Emissions from ongoing and planned activities, including the Proposed Action, would be highly variable and limited in spatial extent at any given period. Fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

Air emissions – O&M: During O&M, air quality impacts are anticipated to be smaller in magnitude compared to construction and decommissioning. Offshore O&M activities would consist of WTG operations, planned maintenance, and unplanned emergency maintenance and repairs. The WTGs operating under the Proposed Action would have no pollutant emissions. Emergency generators on the WTGs and the substations would operate only during emergencies or testing, so emissions from these sources would be small and transient. Pollutant emissions from O&M would be mostly the result of operations of ocean vessels and helicopters used for maintenance activities. Crew transfer vessels and helicopters would transport crews to the Wind Farm Area for inspections, routine maintenance, and repairs. Jack-up vessels, multipurpose offshore support vessels, and rock-dumping vessels would travel infrequently to the Wind Farm Area for significant maintenance and repairs. The proposed Project's contribution would be additive with the impact(s) of any and all other operational activities, including offshore wind activities, that occur within the air quality geographic analysis area. COP Volume I, Sections 6.1.3 and 6.2.3 (Ocean Wind 2022), provide a more detailed description of offshore and onshore O&M activities, and COP Volume II, Table 2.1.3-4, summarizes emissions during O&M. The annual estimated emissions for O&M are summarized in Table 3.4-5.

Table 3.4-5 Ocean Wind 1 Operations and Maintenance Emissions (U.S. tons)

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
Annual	40	159	5.6	5.4	0.9	4.1	11,912
Lifetime (35 years)	1,411	5,576	196	191	31	144	416,907

Source: COP Volume II, Table 2.1.3-4 (Ocean Wind 2022)

Table 3.4-6 presents an initial summary of the Project's estimated offshore O&M emissions in the OCS permit area and a comparison of the total OCS permit area emissions in relation to the total emission inventories of the potentially affected counties. The estimated O&M emissions are currently under review through the OCS air permitting process and the refined estimates will be presented in the Final EIS. This summary is a conservative analysis because it assumes all emissions would directly affect the nearest county's air; however, depending on the wind conditions at the time of emissions, it is likely that not all emissions generated offshore would reach land.

Table 3.4-6 Estimated Ocean Wind 1 O&M Emissions (U.S. tons) in OCS Permit Area

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2e
OCS Permit Area Annual	**40.0**	**158.8**	**5.6**	**5.4**	**0.8**	**3.9**	**11,744**
Atlantic County, New Jersey 2017 Inventory	29,820.4	4,492.6	1,828.1	839	267	15,084.2	1,598,849.4
Percentage of Atlantic County, New Jersey 2017 Inventory	0.1	3.5	0.3	0.6	0.3	0.0	0.7
Cape May County, New Jersey 2017 Inventory	18,830.5	2,883.3	958.9	475.2	63.5	9,015.3	833,591.8
Percentage of Cape May County, New Jersey 2017 Inventory	0.2	5.5	0.6	1.1	1.3	0.0	1.4
Ocean County, New Jersey 2017 Inventory	63,398.4	7,737.8	3,237.8	2,064.3	187.1	20,865.9	3,702,977.4
Percentage of Ocean County, New Jersey 2017 Inventory	0.1	2.1	0.2	0.3	0.4	0.0	0.3

CO_2e = carbon dioxide equivalent

BOEM anticipates that air quality impacts from O&M of the Proposed Action would be minor, occurring for short periods of time several times per year during the proposed 35 years.

Emissions from onshore O&M activities would be limited to periodic use of construction vehicles and equipment. Onshore O&M activities would include occasional inspections and repairs to the onshore substation and splice vaults, which would require minimal use of worker vehicles and construction equipment. Ocean Wind intends to use port facilities at Atlantic City, New Jersey to support O&M activities. BOEM anticipates that air quality impacts due to onshore O&M from the Proposed Action alone would be minor, intermittent, and occurring for short periods.

Increases in renewable energy could lead to reductions in emissions from fossil-fueled power plants. BOEM used its Wind Tool (BOEM 2017) to estimate the emissions avoided as a result of the Proposed Action. Once operational, the Proposed Action would result in annual avoided emissions of 2,362 tons of NO_X, 114 tons of $PM_{2.5}$, 5,705 tons of SO_2, and 2,989,161 tons of CO_2 (COP Volume II, Table 2.1.3-5). The avoided CO_2 emissions are equivalent to the emissions generated by about 590,000 passenger vehicles in a year (USEPA 2020c). Accounting for construction emissions and assuming decommissioning emissions would be the same, and including emissions from future operations, operation of the Proposed Action would offset emissions related to its construction and eventual decommissioning within different time periods of operation depending on the pollutant: NO_X would be offset in approximately 10 years of operation, $PM_{2.5}$ in 6 years, SO_2 in 1 month, and CO_2 in 5 months. If emissions from future operations and decommissioning were not included, the times required for emissions to “break even” would be shorter. From that point, the Project would be offsetting emissions that would otherwise be generated from another source.

The potential health benefits of avoided emissions can be evaluated using USEPA’s COBRA health impacts screening and mapping tool as discussed in Section 3.4.3.2. COBRA was used to analyze the avoided emissions that were calculated for the Proposed Action (COP Volume II, Table 2.1.3-5; Ocean Wind 2022). Table 3.4-7 presents the results.

Table 3.4-7 COBRA Estimate of Annual Avoided Health Effects with Proposed Action

Discount Rate[1] (2023)	Monetized Total Health Benefits (U.S. dollars/year)		Avoided Mortality (cases/year)	
	Low Estimate[2]	High Estimate[2]	Low Estimate[2]	High Estimate[2]
3%	239,354,740	539,958,646	21.511	48.694
7%	213,599,259	481,487,641	21.511	48.694

[1] The discount rate is used to express future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis. Therefore, COBRA accounts for the “time value of money” preference (i.e., a general preference for receiving economic benefits now rather than later) by discounting benefits received later (USEPA 2020b).
[2] The low and high estimates are derived using two sets of assumptions about the sensitivity of adult mortality and non-fatal heart attacks to changes in ambient $PM_{2.5}$ levels. Specifically, the high estimates are based on studies that estimated a larger effect of changes in ambient $PM_{2.5}$ levels on the incidence of these health effects (USEPA 2020b).

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts of ongoing and planned activities including offshore wind, which would be moderate. O&M emissions from ongoing and planned activities, including the Proposed Action, could begin in 2024. Emissions would largely be due to the same source types as for the Proposed Action, including commercial vessel traffic, air traffic such as helicopters, and operation of emergency diesel generators. Such activity would result in short-term, intermittent, and widely dispersed emissions. Planned activities, including the Proposed Action, are estimated to emit 302 tons per year of CO, 1,265 tons per year of NO_X, 42 tons per year of PM_{10}, 40 tons per year of $PM_{2.5}$, 4 tons per year of SO_2, 24 tons per year of VOCs, and 84,978 tons per year of CO_2 when all projects are operating (Table F2-4). Anticipated impacts on air quality from O&M emissions would be transient, small in magnitude, and localized. Additionally, some emissions associated with O&M activities could overlap with other projects’ construction-related emissions. Comparison of the combined emissions from all offshore wind projects as noted above to the emissions contributions from the Proposed Action alone shown in Table 3.4-3 and Table 3.4-5 shows that the increases in air quality impacts from the Proposed Action could be greater or lesser than the impacts of any other single project depending on project size, but would be small relative to those of the combined total of the other planned offshore wind projects. In summary, the largest magnitude air quality impacts and largest spatial extent would result from the overlapping operations activities from the multiple offshore wind projects within the air quality geographic analysis area. A net improvement in air quality is expected on a regional scale as wind projects begin operation and offset emissions from fossil-fueled sources.

The Proposed Action would produce GHG emissions that contribute to climate change; however, its contribution would be less than the emissions reductions from fossil-fueled sources during operation of the Project. Because GHG emissions disperse and mix within the troposphere, the climatic impact of GHG emissions does not depend upon the source location. Therefore, regional climate impacts are largely a function of global emissions. Nevertheless, the Proposed Action per se would have negligible impacts on climate change during these activities and an overall net beneficial impact on criteria pollutant and ozone precursor emissions as well as GHGs, compared to a similarly sized fossil-fueled power plant or to the generation of the same amount of energy by the existing grid.

Overall, it is anticipated that there would be a net reduction in GHG emissions, and no collective adverse impact on climate change as a result of offshore wind projects. Additional offshore wind projects would likely contribute a relatively small emissions increase of CO_2. Development of offshore wind projects including the Proposed Action and construction, O&M, and eventual decommissioning activities would cause some GHG emissions to increase, primarily through emissions of CO_2. The additional GHG emissions anticipated from the planned activities including the Proposed Action over the next 35-year period would have a negligible incremental contribution to existing GHG emissions. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined GHG impacts on air quality from ongoing and planned activities including offshore wind, which would be beneficial from the net decrease in GHG emissions to the extent that fossil-fueled generating facilities would reduce operations as a result of increased energy generation from offshore wind projects.

Air emissions – decommissioning: At the end of the operational lifetime of the Project, Ocean Wind would decommission the Project. Ocean Wind anticipates that all structures above the seabed level or aboveground would be completely removed. The decommissioning sequence would generally be the reverse of the construction sequence, involve similar types and numbers of vessels, and use similar equipment.

The dismantling and removal of the turbine components (blades, nacelle, and tower) and other offshore components would largely be a “reverse installation” process subject to the same constraints as the original construction phase. Onshore decommissioning activities would include removal of facilities and equipment and restoration of the sites to pre-Project conditions where warranted. Emissions from Project decommissioning were not quantified but are expected to be less than for construction. The Project anticipates pursuing a separate OCS Air Permit for those activities because it is assumed that marine vessels, equipment, and construction technology will change substantially in the next 35 years and in the future will have lower emissions than current vessels and equipment. Ocean Wind anticipates minor and temporary air quality impacts from the Proposed Action due to decommissioning.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined air quality impacts from ongoing and planned activities including offshore wind, which would represent a moderate impact. The decommissioning process for all offshore wind projects is expected to be similar to that for Ocean Wind 1, and impacts would be similar to those of Ocean Wind 1 decommissioning. Because the emissions related to onshore activities would be widely dispersed and transient, BOEM expects all air quality impacts to occur close to the emitting sources. If decommissioning activities for projects overlap in time, then impacts could be greater for the duration of the overlap.

Accidental releases: The proposed Project could release VOCs or HAPs because of accidental chemical spills. Based on Table F2-3, the Proposed Action would have up to about 39,690 gallons (150,243 liters) of coolants, 426,671 gallons (1.6 million liters) of oils and lubricants, and 236,216 gallons (894,174 liters) of diesel fuel in its 101 wind turbine and substation structures. Accidental releases including spills from vessel collisions and allisions may lead to short-term periods of VOC and HAP emissions through evaporation. VOC emissions also would be a precursor to ozone formation. Air quality impacts would be short term and limited to the local area at and around the accidental release location. BOEM anticipates that a major spill is very unlikely due to vessel and offshore wind energy industry safety measures, as discussed in Section 3.21.3.2, as well as the distributed nature of the material. BOEM anticipates that these activities would have a negligible air quality impact as a result of the Proposed Action alone.

Collectively, based on Table F2-3, there would be up to about 1,566,883 gallons (5.9 million liters) of coolants, 2,548,448 gallons (9.6 million liters) of oils and lubricants, and 707,708 gallons (2.7 million liters) of diesel fuel contained in the 583 structures among the Proposed Action and planned activities in the air quality geographic analysis area. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined accidental release impacts on air quality from ongoing and planned including offshore wind, which would be negligible due to the short-term nature and localized potential effects. Accidental spills would occur infrequently over the 35-year period with a higher probability of spills during construction of projects, but they would not be expected to contribute appreciably to overall impacts on air quality, as the total storage capacity within the air quality geographic analysis area is considerably less than the existing volumes of hazardous liquids being transported by ongoing activities and is distributed among many different locations and containers.

3.4.5.1. Conclusions

The Proposed Action would result in a net decrease in overall emissions over the region compared to the installation of a traditional fossil-fueled power plant. Although there would be some short-term air quality impacts due to various activities associated with construction, maintenance, and eventual decommissioning, these emissions would be relatively small and limited in duration. The Proposed Action would result in air quality–related health effects avoided in the region due to the reduction in emissions associated with fossil-fueled energy generation (Table 3.4-2). As described above, the impact from air pollutant emissions is anticipated to be minor, and the impact from accidental releases would be negligible. Considering all IPFs together, **minor** air quality impacts would be anticipated for a limited time during construction, maintenance, and decommissioning, but there would be a **minor beneficial** impact on air quality near the Wind Farm Area and the surrounding region overall to the extent that energy produced by the Project would displace energy produced by fossil-fueled power plants. Ocean Wind has committed to APMs that would reduce potential impacts through complying with applicable emissions and fuel standards (AQ-01, AQ-02, and AQ-04), limiting engine idling time (AQ-03), and requiring dust control plans for onshore construction areas (AQ-05). Because of the amounts of emissions, the fact that emissions would be spread out in time (2 years for construction and then lesser emissions annually during operation), and the large geographic area over which they would be dispersed (throughout the 75,525-acre Lease Area and the vessel routes from the onshore facilities), air pollutant concentrations associated with the Proposed Action are not expected to exceed the NAAQS and New Jersey AAQS.

In context of other reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on air quality would range from undetectable to noticeable, with noticeable beneficial impacts. BOEM anticipates that the overall impacts associated with the

Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would result in **moderate** adverse impacts and **moderate beneficial** impacts. The main driver for this impact rating is emissions related to construction activities increasing commercial vessel traffic, air traffic, and truck and worker vehicle traffic. Combustion emissions from construction equipment, and fugitive emissions, would be higher during overlapping construction activities but short term in nature, as the overlap would be limited in time. Therefore, the adverse impact on air quality would likely be **moderate** because while emissions would incrementally increase ambient pollutant concentrations, they are not expected to exceed the NAAQS and New Jersey AAQS. The Proposed Action and other offshore wind projects would benefit air quality in the region surrounding the projects to the extent that energy produced by the projects would displace energy produced by fossil-fueled power plants. While the benefit is regional, BOEM anticipates a **moderate beneficial** impact because the magnitude of the potential reduction in emissions from displacing fossil-fueled generated power would be small relative to total energy generation emissions in the area.

3.4.6 Impacts of Alternatives B, C, D, and E on Air Quality

Air quality and climate impacts associated with all action alternatives would be similar to those of the Proposed Action. Alternatives B-1, B-2, and D could have slightly lower emissions from offshore construction and operation compared to the Proposed Action, to the extent that these alternatives would reduce the number of WTGs. To the extent that total annual MW-hours generated were diminished due to differing wind cut-in speeds of higher-capacity turbine generators, benefits would be diminished. Alternatives C-1 and C-2 would have the same number of WTGs as the Proposed Action and, therefore, the same anticipated emissions. Although under Alternative E, the offshore and onshore cable lengths would be slightly (2,000 feet) longer, the anticipated emissions from offshore and onshore cable construction and installation would not be discernably different from those of the Proposed Action. Overall, the differences in emissions among the action alternatives and the Proposed Action would be small, and the air quality and climate impacts from all action alternatives would be substantively the same as described for the Proposed Action. Similarly, the quantities of coolants, oils and lubricants, and diesel fuel under the other action alternatives would be similar to those of the Proposed Action and therefore the impacts on air quality from accidental releases are expected to be about the same as those of the Proposed Action.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the action alternatives to the overall impacts on air quality would be similar to those of the Proposed Action.

3.4.6.1. Conclusions

Expected **minor** impacts associated with the Proposed Action alone would not change under the other action alternatives. The same construction, O&M, and decommissioning activities would still occur, albeit at slightly differing scales as identified. Alternatives B-1, B-2, and D could have slightly less, but not materially different, **minor** impacts on air quality compared to the Proposed Action due to a reduced number of WTGs. Alternatives C-1 and C-2 would have the same number of WTGs and therefore the same **minor** impacts on air quality as the Proposed Action. Alternative E would have similar **minor** impacts on air quality compared to the Proposed Action. As under the Proposed Action, the action alternatives would result in **minor beneficial** impacts on air quality and climate overall due to reduced emissions from fossil-fueled power plants.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the action alternatives to the overall impacts on air quality would be the same as those of the Proposed Action, ranging from undetectable to noticeable with noticeable beneficial impacts. Considering all the IPFs together, BOEM anticipates that the impacts on air quality associated with each of the action alternatives when combined with the impacts from ongoing and planned activities including offshore wind would likely be **moderate** adverse and **moderate beneficial** overall due to reduced emissions from fossil-fueled power plants.

3.4.7 Proposed Mitigation Measures

No measures to mitigate impacts on air quality have been proposed for analysis.

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3.5. Bats

This section discusses potential impacts on bat populations from the proposed Project, alternatives, and ongoing and planned activities in the bat geographic analysis area. The bat geographic analysis area, as shown on Figure 3.5-1, includes the United States coastline from Maine to Florida, and extends 100 miles (161 kilometers) offshore and 5 miles (8 kilometers) inland to capture the movement range for species in this group. The geographic analysis area for bats was established to capture most of the movement range for migratory species. The offshore limit was established to capture the migratory movements of most species in this group, while the onshore limits cover onshore habitats used by species that may be affected by onshore and offshore components of the proposed Project.

3.5.1 Description of the Affected Environment for Bats

The number of bat species in the geographic analysis area varies by state, ranging from eight species (Rhode Island, New Hampshire, and Maine) to 17 (Virginia and North Carolina) (Rhode Island Department of Environmental Management n.d.; Maine Department of Inland Fisheries and Wildlife 2021; New Hampshire Fish and Game n.d.; Virginia Department of Wildlife Resources 2021; North Carolina Wildlife Resources Commission 2017).

There are nine species of bats present in the state of New Jersey, eight of which may be present in the Project area and six that are year-round residents (Table 3.5-1).

Table 3.5-1 Bats Present in New Jersey and their Conservation Status

Common Name	Scientific Name	State Status	Federal Status
Cave-Hibernating Bats			
Eastern small-footed bat[1]	*Myotis leibii*	-	-
Little brown bat[1]	*Myotis lucifugus*	-	Under Review[2]
Northern long-eared bat[1,3]	*Myotis septentrionalis*	-	Threatened
Indiana bat[4]	*Myotis sodalist*	Endangered	Endangered
Tri-colored bat[1]	*Perimyotis subflavus*	-	Under Review[5]
Big brown bat[6]	*Eptesicus fuscus*	-	-
Migratory Tree Bats			
Eastern red bat[6]	*Lasiurus borealis*	-	-
Hoary bat[6]	*Lasiurus cinereus*	-	-
Silver-haired bat[6]	*Lasionycteris noctivagans*	-	-

Source: Ocean Wind 2022; USFWS 2021a, 2021b.
[1] Currently a candidate for state listing as endangered pending rule promulgation (NJDEP 2013).
[2] Currently under a USFWS discretionary status review. Results of the review may be to propose listing, make a species a candidate for listing, provide notice of a not warranted candidate assessment, or other action as appropriate. USFWS anticipates a decision in Fiscal Year 2022.
[3] On March 23, 2022, USFWS published a proposal to reclassify the northern long-eared bat as endangered. The U.S. District Court for the District of Columbia has order USFWS to complete a new final listing determination by November 2022 (Case 1:15-cv-00477, March 1, 2021).
[4] Range does not indicate species presence in Project area.
[5] Currently under 12-month finding review on a petition to list the species. If listing is warranted, USFWS would generally proceed with a concurrent proposed listing rule and proposed critical habitat. USFWS anticipates a decision in Fiscal Year 2022.
[6] Currently a candidate for state listing as special concern pending rule promulgation (NJDEP 2013).

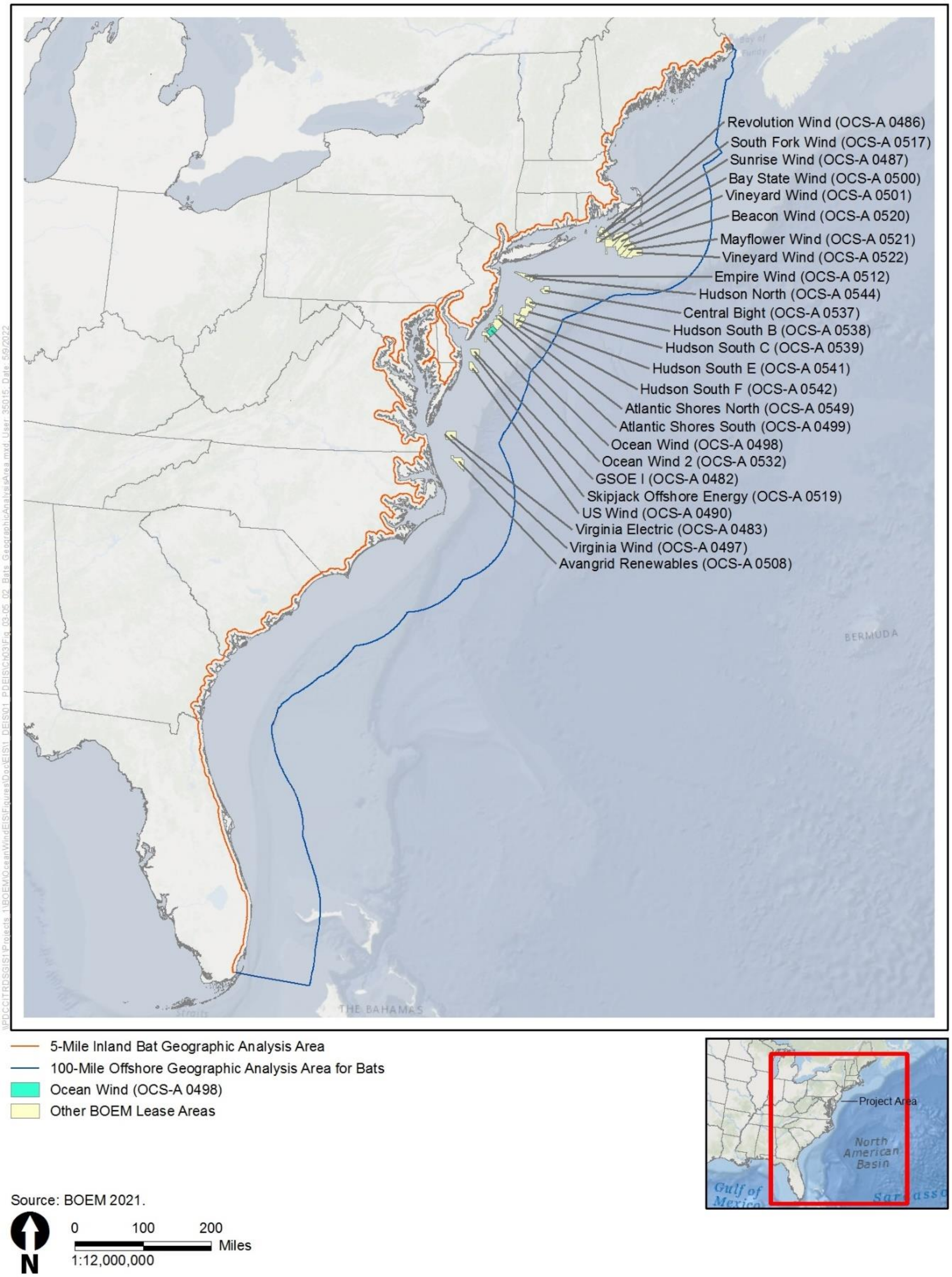


Figure 3.5-1 Bats Geographic Analysis Area

These species can be broken down into cave-hibernating bats and migratory tree bats based on their wintering strategy. Bats are terrestrial species that spend almost their entire lives on or over land. On occasion, tree bats may potentially occur offshore during spring and fall migration and under very specific conditions like low wind and high temperatures. Recent studies, combined with historical anecdotal accounts, indicate that migratory tree bats sporadically travel offshore during spring and fall migration, with 80 percent of acoustic detections occurring in August and September (Dowling et al. 2017; Hatch et al. 2013; Pelletier et al. 2013; Stantec 2016). However, unlike tree bats, the likelihood of detecting a Myotis species or other cave bat is substantially less in offshore areas (Pelletier et al. 2013).

The presence of bats has been documented in the offshore marine environment in the United States (Cryan and Brown 2007; Dowling et al. 2017; Hatch et al. 2013; Pelletier et al. 2013; Ocean Wind 2022). Bats have been documented temporarily roosting on structures (i.e., lighthouses) on nearshore islands and there is evidence of eastern red bats migrating offshore in the Atlantic. In a mid-Atlantic bat acoustic study conducted during the spring and fall of 2009 and 2010, the maximum distance that bats were detected from shore was 13.6 miles (21.9 kilometers) and the mean distance was 5.2 miles (8.4 kilometers). In Maine, bats were detected on islands up to 25.8 miles (41.6 kilometers) from the mainland. In the mid-Atlantic acoustic study, eastern red bat represented 78 percent of all bat detections offshore and bat activity decreased as wind increased. In addition, eastern red bats were detected in the mid-Atlantic up to 27.3 miles (44 kilometers) offshore by high-definition video aerial surveys (Ocean Wind 2022). At this time, there is some uncertainty regarding the level of bat use of the OCS. However, available data indicates that bat activity levels are generally lower offshore compared to onshore (Hein et al. 2021). A bat migration study in the North Sea off Belgium found that the number of bat detections was up to 24 times higher at onshore locations compared to the offshore locations (Brabant et al. 2021).

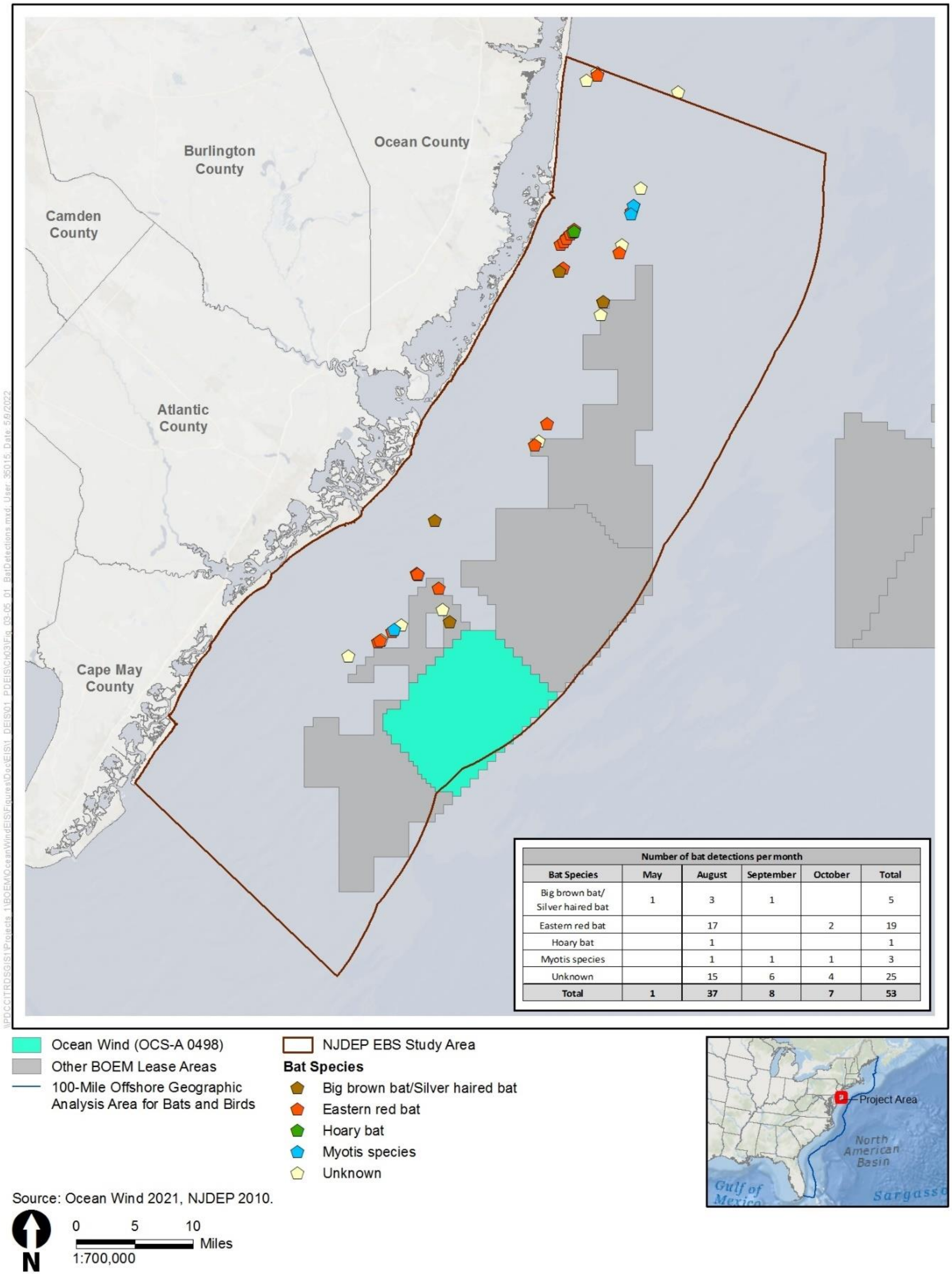
Cave-hibernating bats hibernate regionally in caves, mines, and other structures (e.g., buildings) and feed primarily on insects in terrestrial and fresh-water habitats. These species generally exhibit lower activity in the offshore environment than the migratory tree bats (Ocean Wind 2022), with movements primarily during the fall. In the mid-Atlantic, the maximum distance *Myotis* bats were detected offshore was 7.2 miles (11.5 kilometers). A recent nano-tracking study on Martha's Vineyard recorded little brown bat movements off the island in late August and early September, with one individual flying from Martha's Vineyard to Cape Cod. Big brown bats were also detected migrating from the island later in the year (October–November). These findings are supported by an acoustic study conducted on islands and buoys off the Gulf of Maine that indicated the greatest percentage of activity in July–October. Given that the use of the coastline as a migratory pathway by cave-hibernating bats is likely limited to their fall migration period, that acoustic studies indicate lower use of the offshore environment by cave-hibernating bats, and that cave-hibernating bats do not regularly feed on insects over the ocean, exposure to the Wind Farm Area is unlikely for this group (Ocean Wind 2022).

Tree bats migrate south to overwinter and have been documented in the offshore environment (Ocean Wind 2022). Eastern red bats have been detected migrating from Martha's Vineyard late in the fall, with one bat tracked as far south as Maryland. These results are supported by historical observations of eastern red bats offshore and recent acoustic and survey results (Ocean Wind 2022). While little local data are available for the Project area, the NJDEP EBS surveys recorded several observations of bats flying over the ocean, with observations of migratory tree bats in the near-shore portion of the Wind Farm Area. Given that tree-bats were detected in the offshore environment, they may pass through the Project area during the migration period (Figure 3.5-2).

Onshore coastal areas throughout the geographic analysis area provide a variety of habitats that support a diversity of bat species. The onshore export cable route corridors to BL England and Oyster Creek contain a diverse set of habitats including coastal wetlands, forested wetlands, forested uplands, forested lowlands, barrier beaches, and bay island habitats that support a diversity of bat species. Forested habitats, such as the area adjacent to the proposed onshore export cables at BL England and Oyster Creek, can provide roosting areas for both migratory and non-migratory species. All bat species present in New Jersey (migratory and non-migratory) are known to utilize forested areas (of varying types) during summer for roosting and foraging. Some of these species roost solely in the foliage of trees, while others select dead and dying trees where they roost in peeling bark or inside crevices. Some species may select forest interior sites, while others prefer edge habitats (Ocean Wind 2022). Although there are no bat data available specific to the Onshore Project area, Biodiversity Research Institute completed field work in 2011 in the area at Edwin B. Forsythe National Wildlife Refuge (6 miles [10 kilometers] south of Oyster Creek and 30 miles [48 kilometers] north of BL England) where northern long-eared bat, eastern red bat, big brown bat, and little brown bat were captured. No telemetry was conducted, so it is unknown if they used the refuge or surrounding areas for roosting. Caves and mines provide key habitat for non-migratory bats. These locations serve as winter hibernacula, fall swarm locations (areas where mating takes place in the fall months), and summer roosting locations for some individuals. Hibernacula are documented in New Jersey, but the numbers of individuals at the sites have declined dramatically because of the fungal disease white-nose syndrome (WNS) (Ocean Wind 2022). Overall, while both cave-hibernating and migratory tree bats may occur in the area around BL England and Oyster Creek, the onshore export cable route corridors are not likely to provide suitable habitat because they are anticipated to be mostly co-located with existing disturbed areas (e.g., roads, transmission lines). In addition, there are generally fewer bats along the coast of New Jersey (see Figure 2-4 in COP Volume III, Appendix H, Ocean Wind 2022).

One bat species protected under the ESA may occur in the Project area: the northern long-eared bat (USFWS 2021a; Ocean Wind 2022). It is not expected that northern long-eared bats will be exposed to the offshore Wind Farm Area. A recent tracking study on Martha's Vineyard (July–October 2016) did not record any offshore movements (Ocean Wind 2022). If northern long-eared bat were to migrate over water, movements would likely be in close proximity to the mainland. The related little brown bat has been documented to migrate from Martha's Vineyard to Cape Cod, and northern long-eared bat may likewise migrate to mainland hibernacula from these islands in August–September (Ocean Wind 2022). Given that there is little evidence of use of the offshore environment by northern long-eared bat, exposure to the proposed Wind Farm Area, if it occurs, is anticipated to be minimal. As mentioned above, the northern long-eared bat was captured during 2011 surveys in the area at Edwin B. Forsythe National Wildlife Refuge north and south of the Onshore Project areas. The Ocean Wind BA provides a detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2022).

Cave bat species, including the northern long-eared bat, are experiencing drastic declines due to WNS. WNS has been confirmed present in every state in the geographic analysis area, except Florida (Whitenosesyndrome.org 2021). WNS was confirmed present in New Jersey in 2009 and has killed large numbers of cave bats during hibernation—more than 90 percent at many sites (Whitenosesyndrome.org 2021; New Jersey Division of Fish and Wildlife 2019). However, New Jersey's bat population appears to be stabilizing (New Jersey Division of Fish and Wildlife 2019). Proposed Project-related impacts have the potential to affect cave bat populations already affected by WNS. The unprecedented mortality of more than 5.5 million bats in northeastern North America as of 2015 reduces the likelihood of many individuals being present within the onshore portions of the proposed Project area (USFWS 2015). However, given the drastic reduction in cave bat populations in the region, the biological significance of mortality resulting from the proposed Project, if any, may be increased.



Number of bat detections per month					
Bat Species	May	August	September	October	Total
Big brown bat/ Silver haired bat	1	3	1		5
Eastern red bat		17		2	19
Hoary bat		1			1
Myotis species		1	1	1	3
Unknown		15	6	4	25
Total	**1**	**37**	**8**	**7**	**53**

Figure 3.5-2 Bat Occurrences in the New Jersey Department of Environmental Protection Ecological Baseline Studies

3.5.2 Environmental Consequences

3.5.2.1. Impact Level Definitions for Bats

Definitions of impact levels are provided in Table 3.5-2. There are no beneficial impacts on bats.

Table 3.5-2 Impact Level Definitions for Bats

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Most impacts would be avoided; if impacts occur, the loss of one or few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
Moderate	Adverse	Impacts are unavoidable but would not result in population-level effects or threaten overall habitat function.
Major	Adverse	Impacts would result in severe, long-term habitat or population-level effects on species.

3.5.3 Impacts of the No Action Alternative on Bats

When analyzing the impacts of the No Action Alternative on bats, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

3.5.3.1. Ongoing and Planned Non-offshore Wind Activities

Under the No Action Alternative, baseline conditions for bats would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities within the geographic analysis area that contribute to impacts on bats are generally associated with onshore impacts, including onshore construction and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect bat species through temporary and permanent habitat removal and temporary noise impacts related to construction activities, which could cause avoidance behavior and displacement. Mortality of individual bats could occur, but population-level effects would not be anticipated. Impacts associated with climate change have the potential to reduce reproductive output and increase individual mortality and disease occurrence.

Other planned non-offshore wind activities that may affect bats include new submarine cables and pipelines, oil and gas activities, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Section F.2 in Appendix F for a complete description of ongoing and planned activities). These activities may result in temporary and permanent onshore habitat impacts and temporary or permanent displacement and injury of or mortality to individual bats, but population-level effects would not be expected. See Table F1-2 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for bats.

3.5.3.2. Offshore Wind Activities (without Proposed Action)

The sections below summarize the potential impacts of the other offshore wind activities on bats during the various phases of the projects. The federally listed northern long-eared bat is the only bat species listed under the ESA that may be affected by other offshore wind activities. Impacts on the northern long-eared bat would most likely be limited to onshore impacts, and generally during onshore facility construction.

Offshore wind activities may affect bats through the following primary IPFs.

Noise: Anthropogenic noise associated with offshore wind development, including noise from pile-driving and construction activities, has the potential to affect bats on the OCS. Additionally, onshore construction noise has the potential to affect bats. BOEM anticipates that these impacts would be temporary and highly localized.

In the planned activities scenario (Appendix F, *Planned Activities Scenario*), the construction of 3,109 offshore structures (other than the Proposed Action) would create noise and may temporarily affect some migrating tree bats, if conducted at night during spring or fall migration. The greatest impact of noise is likely to be caused by pile-driving activities during construction. Noise from pile driving would occur during installation of foundations for offshore structures at a frequency of 4 to 6 hours at a time over an 8-year period. Construction activity would be temporary and highly localized. Auditory impacts are not expected to occur, as recent research has shown that bats may be less sensitive to TTS than other terrestrial mammals (Simmons et al. 2016). Habitat-related impacts (i.e., displacement from potentially suitable habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior by individual migrating tree bats (Schaub et al. 2008). These impacts would likely be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016). However, these impacts are highly unlikely to occur, as little use of the OCS is expected, and only during spring and fall migration.

Potential for temporary and localized habitat impacts arising from onshore construction noise exists; however, no auditory impacts on bats would be expected to occur. Recent literature suggests that bats are less susceptible to temporary or permanent hearing loss from exposure to intense sounds (Simmons et al. 2016). Nighttime work may be required on an as-needed basis. Some temporary displacement or avoidance of potentially suitable foraging habitat could occur, but these impacts would not be expected to be biologically significant. Some bats roosting in the vicinity of construction activities may be disturbed during construction but would be expected to move to a different roost farther from construction noise. This would not be expected to result in any impacts, as frequent roost switching is common among bats (Hann et al. 2017; Whitaker 1998).

Non-routine activities associated with the offshore wind facilities would generally require intense, temporary activity to address emergency conditions. The noise made by onshore construction equipment or offshore repair vessels could temporarily deter bats from approaching the site of a given non-routine event. Impacts on bats, if any, would be temporary and last only as long as repair or remediation activities were necessary to address these non-routine events.

Given the temporary and localized nature of potential impacts and the expected biologically insignificant response to those impacts, no individual fitness or population-level impacts would be expected to occur as a result of onshore or offshore noise associated with offshore wind development, so impacts would be negligible.

Presence of structures: Offshore wind-related activities would add up to 3,109 WTGs and OSS on the OCS that could result in potential impacts on bats. Cave bats (including the federally listed as threatened northern long-eared bat) do not tend to fly offshore (even during fall migration) and, therefore, exposure to construction vessels during construction or maintenance activities, or the rotor-swept zone (RSZ) of operating WTGs in the wind lease areas, is expected to be negligible, if exposure occurs at all (BOEM 2015; Pelletier et al. 2013).

Tree bats, however, may pass through the offshore wind lease areas during the fall migration, with limited potential for migrating bats to encounter vessels during construction and decommissioning of WTGs, OSS, and offshore export cable corridors, although structure and vessel lights may attract bats due to increased prey abundance. As discussed above, while bats have been documented on offshore islands, relatively little bat activity has been documented over open water habitat similar to the conditions in the Project Wind Farm Area. Several authors, such as Cryan and Barclay (Barclay 2009), Cryan et al. (Cryan et al. 2014), and Kunz et al. (Kunz et al. 2007), discuss several hypotheses as to why bats may be attracted to WTGs. Many of these, including the creation of linear corridors, altered habitat conditions, or thermal inversions, would not apply to WTGs on the Atlantic OCS (Cryan and Barclay 2009; Cryan et al. 2014; Kunz et al. 2007). Other hypotheses associated with the Atlantic OCS regarding bat attraction to WTGs include bats perceiving the WTGs as potential roosts, potentially increased prey base, visual attraction, disorientation due to EMFs or decompression, or attraction due to mating strategies (Arnett et al. 2008; Cryan 2007; Kunz et al. 2007). However, no definitive answer as to why, if at all, bats are attracted to WTGs has been postulated, despite intensive studies at onshore wind facilities. As such, it is possible that some bats may encounter, or perhaps be attracted to, OSS and non-operational WTG towers to opportunistically roost or forage. However, bats' echolocation abilities and agility make it unlikely that these stationary objects (OSS and non-operational WTGs) or moving vessels would pose a collision risk to migrating individuals; this assumption is supported by the evidence that bat carcasses are rarely found at the bases of onshore turbine towers (Choi et al. 2020).

Tree bat species that may encounter the operating WTGs in the offshore wind lease areas include the eastern red bat, hoary bat, and silver-haired bat. Offshore O&M would present a seasonal risk factor to migratory tree bats that may utilize the offshore habitats during fall migration. While some potential exists for migrating tree bats to encounter operating WTGs during fall migration, the overall occurrence of bats on the OCS is relatively very low (Stantec 2016). Furthermore, unlike with terrestrial migration routes, there are no landscape features that would concentrate bats and thereby increase exposure to the offshore wind lease areas. Given the expected infrequent and limited use of the OCS by migrating tree bats, very few individuals would be expected to encounter operating WTGs or other structures associated with offshore wind development. With the proposed up to 1-nm (1.9-kilometer) spacing between structures associated with offshore wind development and the distribution of anticipated projects, individual bats migrating over the OCS within the RSZ of project WTGs would likely pass through projects with only slight course corrections, if any, to avoid operating WTGs because, unlike with terrestrial migration routes, there are no landscape features that would concentrate migrating tree bats and increase exposure to offshore wind lease areas on the OCS (Baerwald and Barclay 2009; Cryan and Barclay 2009; Fiedler 2004; Hamilton 2012; Smith and McWilliams 2016). Additionally, the potential collision risk to migrating tree bats varies with climatic conditions; for example, bat activity is associated with relatively low wind speeds and warm temperatures (Arnett et al. 2008; Cryan and Brown 2007; Fiedler 2004; Kerns et al. 2005). Given the relatively low numbers of tree bats in the offshore environment, the WTGs being widely spaced, and the patchiness of projects, the likelihood of collisions is expected to be low, so impacts on bats would be negligible. Additionally, the likelihood of a migrating individual encountering one or more operating WTGs during adverse weather conditions is extremely low, as bats have been shown to suppress activity during periods of strong winds, low temperatures, and rain (Arnett et al. 2008; Erickson et al. 2002).

Land disturbance: A small amount of infrequent construction impacts associated with onshore power infrastructure would be required over the next 8 years to tie offshore wind energy projects to the electrical grid. Typically, this would require only small amounts of habitat removal, if any, and would occur in previously disturbed areas. Short-term, negligible impacts associated with habitat loss or avoidance during construction may occur, but no injury or mortality of individuals would be expected. As such, onshore construction activities associated with offshore wind development would not be expected to appreciably contribute to overall impacts on bats.

In addition to electrical infrastructure, some amount of habitat conversion may result from port expansion activities required to meet the demands for fabrication, construction, transportation, and installation of wind energy structures. The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly and require some conversion of undeveloped land to meet port demand. This conversion will result in permanent habitat loss for local bat populations. However, the incremental increase from offshore wind development would be a minimal contribution in the port expansion required to meet increased commercial, industrial, and recreational demand (BOEM 2019).

3.5.3.3. Conclusions

Under the No Action Alternative, baseline conditions for bats would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities, including other offshore wind activities. Ongoing and planned non-offshore wind activities and offshore wind activities (excluding the Proposed Action) are expected to have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, and habitat conversion) on bats. These effects are primarily through onshore construction impacts, the presence of structures, and climate change. Ongoing activities, including climate change, would likely result in negligible impacts on bats. Planned activities other than offshore wind development would also contribute to impacts on bats due to habitat loss from increased onshore construction, but that these impacts would likely be negligible. BOEM expects the combination of ongoing and planned activities other than offshore wind development to result in negligible impacts on bats. Offshore wind activities are not expected to materially contribute to the impacts on bats. Given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration, and given that cave bats do not typically occur on the OCS, the presence of additional offshore structures would not appreciably contribute to overall impacts on bats. Temporary disturbance and permanent loss of onshore habitat may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area.

Under the No Action Alternative, existing environmental trends and activities would continue, and bats would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **negligible** impacts on bats. BOEM anticipates that the No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **negligible** impacts because bat presence on the OCS is anticipated to be limited and onshore bat habitat impacts are expected to be minimal.

3.5.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on bats:

- The onshore export cable routes, including routing variants, and extent of ground disturbance for new onshore substations, which could require the removal of trees suitable for roosting and foraging;
- The number, size, and location of WTGs; and
- The time of year during which construction occurs.

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

- WTG number, size, and location: The level of hazard related to WTGs is proportional to the number of WTGs installed; fewer WTGs would present less hazard to bats.
- Onshore export cable routes and substation footprints: The route chosen (including variants within the general route) and substation footprints would determine the amount of habitat affected.
- Season of construction: The active season for bats in this area is from April through October. Construction outside of this window would have a lesser impact on bats than construction during the active season.

Ocean Wind has committed to measures to minimize impacts on bats. Trees would be cleared during winter months to the extent practicable (BAT-01), and if tree clearing is required in areas with trees suitable for bat roosting habitat when northern long-eared bats may be present, avoidance and minimization measures would be developed in coordination with USFWS and NJDEP (BAT-02). Also, Ocean Wind would use lighting technology that minimizes impacts on bat species (BIRD-04) (COP Volume II, Table 1.1-2; Ocean Wind 2022) and has committed to implementing an *Avian and Bat Post-Construction Monitoring Framework* (COP Appendix AB; Ocean Wind 2022) that outlines an approach to post-construction bat monitoring that supports advancement of the understanding of bat interactions with offshore wind farms.

3.5.5 Impacts of the Proposed Action on Bats

The sections below summarize the potential impacts of the Proposed Action on bats during the various phases of the proposed Project. Routine activities would include construction, O&M, and decommissioning of the proposed Project, as described in Chapter 2, *Alternatives*. BOEM prepared a BA for the potential effects on USFWS federally listed species, which found that the Proposed Action was *not likely to adversely affect*, or had *no effect*, on listed species (BOEM 2022). BOEM requested concurrence on its conclusion that the impacts of the proposed activities are expected to be discountable and insignificant, and thus *may affect but are not likely to adversely affect* northern long-eared bat. There is no critical habitat designated for this species. The results of consultation with USFWS pursuant to Section 7 of the ESA will be included in the Final EIS.

Noise: Pile-driving noise and onshore and offshore construction noise associated with the Proposed Action alone is expected to result in temporary, highly localized, and negligible impacts. Auditory impacts are not expected to occur, as recent research has shown that bats may be less sensitive to TTS than other terrestrial mammals (Simmons et al. 2016). Impacts, if any, are expected to be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016).

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined noise impacts on bats from ongoing and planned activities including offshore wind, which would likely be negligible.

Presence of Structures: The various types of impacts on bats that could result from the presence of structures, such as migration disturbance and turbine strikes, are described in detail in Section 3.5.3.2. Up to 98 WTGs on the OCS would result from the proposed Project where few currently exist. The structures, and related bat impacts, associated with Proposed Action would remain at least until decommissioning of the proposed Project is complete. At this time, there is some uncertainty regarding the level of bat use of the OCS and the ultimate consequences of mortality, if any, associated with operating WTGs. Three years of post-construction bat monitoring around the Block Island Wind Farm found bats present and at wind speeds at or above the cut-in speeds for Ocean Wind 1’s proposed WTGs (Stantec 2020), which could indicate vulnerability for bats. The cut-in speed for the proposed WTGs is 3.5 m/s and, based on the wind speeds that bats were observed at the Block Island Wind Farm, bats could be exposed to the turbine blades when they are turning. However, as previously mentioned, available data indicate that bat activity levels are generally lower offshore compared to onshore (Hein et al. 2021). A bat migration study in the North Sea off Belgium found that the number of bat detections was up to 24 times higher at onshore locations compared to offshore locations (Brabant et al. 2021). In addition, the proposed WTGs are very large and spin much slower (7.8 rotations per minute) compared to onshore wind turbines.

Existing data from meteorological buoys provide the best opportunity to further define bat use of open-water habitat far from shore where Ocean Wind would site the proposed Project WTGs. Relatively few (372) bat passes were detected at meteorological buoy sites and use was sporadic when compared to sites on offshore islands (Stantec 2016). In addition, the data from 3 years of post-construction monitoring around Block Island Wind Farm found relatively low numbers of bats and only during fall, and no northern long-eared bats (Stantec 2020). While the buoy data and Block Island Wind Farm data were collected outside of the Project's Wind Farm Area, the information is still applicable to the overall use of bats on the OCS. Furthermore, as previously mentioned, surveys conducted offshore New Jersey for the NJDEP EBS that cover the Project's Wind Farm Area recorded several observations of bats flying over the ocean, but not as far as Ocean Wind 1's Wind Farm Area (NJDEP 2010) (Figure 3.5-2). Therefore, because available information indicating bat presence on the OCS is limited, BOEM anticipates the presence of structures to have a negligible impact on bat populations. Ocean Wind has also committed to implementing an *Avian and Bat Post-Construction Monitoring Framework* (COP Appendix AB; Ocean Wind 2022) that outlines an approach to post-construction bat monitoring that supports advancement of the understanding of bat interactions with offshore wind farms. The scope of monitoring is designed to meet federal requirements (30 CFR 585.626(b)(15) and 585.622(b)) and is scaled to the size and risk profile of the Project with a focus on species of conservation concern.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined impacts on bats arising from the presence of structures from ongoing and planned activities including offshore wind, which would likely be negligible given the expected limited use of the OCS by migrating tree bats. A majority (approximately 97 percent) of these impacts would occur as a result of structures associated with other offshore wind development and not the Proposed Action, as the Proposed Action would account for 3 percent (98 of 3,044) of the new WTGs on the Atlantic OCS.

Land disturbance: Impacts associated with construction of onshore elements of the Proposed Action could occur if construction activities occur during the active season (generally April through October), and may result in injury or mortality of individuals, particularly juveniles who are unable to flush from a roost, if occupied by bats at the time of removal. There would be some potential for habitat impacts on bats as a result of the loss of potentially suitable roosting or foraging habitat. However, impacts on bat habitat from onshore construction activities would be limited because, whenever possible, facilities (including overhead transmission lines) would be co-located with existing developed areas (i.e., roads and existing transmission lines) to limit disturbance. Where necessary, construction of onshore facilities may require clearing and some permanent removal of some trees along the edge of the construction corridor. The existing habitat at the proposed onshore substation sites at BL England and Oyster Creek is already developed and fragmented. Any remnant habitat within the permanent substation site would be converted to developed land with landscaping for the duration of the Project's operational lifetime. To avoid and minimize impacts on bats, Ocean Wind is proposing to conduct tree clearing during winter months, to the extent practicable, to develop avoidance and minimization measures with USFWS and NJDEP specific to the northern long-eared bat and to conduct pre-construction habitat surveys for northern long-eared bat (BAT-01, BAT-02; see COP Volume II, Table 1.1-2; Ocean Wind 2022). Additional measures proposed by Ocean Wind that are not specific to bats would further avoid and minimize land disturbance impacts on bats (GEN-01, GEN-13, TCHF-01, and TCHF-02; see COP Volume II, Table 1.1-2; Ocean Wind 2022). BOEM anticipates that impacts would be negligible given the limited amount of habitat removal, and that any potential impact would be avoided or significantly reduced due to Ocean Wind's proposed APMs; therefore, impacts would not result in individual fitness or population-level effects.

In context of the reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined land disturbance impacts from ongoing and planned activities including offshore wind, which would likely be negligible, as only a small amount of habitat loss, if any, would be expected.

3.5.5.1. Conclusions

BOEM anticipates construction and installation, O&M, and conceptual decommissioning of the Proposed Action would have overall **negligible** impacts on bats, especially if tree clearing is conducted outside the active season. The primary risks would be from potential onshore removal of habitat and operation of the offshore WTGs, which could lead to negligible long-term impacts in the form of mortality, although BOEM anticipates this to be rare. Noise effects from construction are expected to be limited to temporary and localized behavioral avoidance of pile-driving or construction activity that would cease once construction is complete.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on bats would be undetectable. BOEM anticipates that the overall impacts on bats in the geographic analysis area associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be **negligible**. Because the occurrence of bats offshore is low, the Proposed Action would contribute to the overall impacts primarily through the permanent impacts from onshore habitat loss related to onshore cable installation and substation construction.

3.5.6 Impacts of Alternatives B, C, and D on Bats

The impacts resulting from individual IPFs associated with construction and installation, O&M, and conceptual decommissioning of the Project under Alternatives B, C, and D would be similar to those described under the Proposed Action. BOEM expects the elimination of WTGs under Alternatives B-1 (up to 9 WTGs), B-2 (up to 19 WTGs), and D (up to 15 WTGs) to have a reduced impact on bats given the smaller number of WTGs compared to the Proposed Action. BOEM does not expect relocation of the eight WTGs and compression of the 98 WTGs under Alternatives C-1 and C-2, respectively, to significantly change the potential impacts compared to the Proposed Action because the total number of WTGs would remain the same, the overall footprint would be the same or slightly less, and the Wind Farm Area does not include areas with high bat densities.

Given the infrequent and limited use of the OCS by bats during spring and fall migration and the similar or smaller footprints under Alternatives B-1, B-2, C-1, C-2, and D, BOEM does not anticipate impacts to be materially different than those described under the Proposed Action.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, C, and D to the overall impacts on bats would be similar to those described under the Proposed Action.

3.5.6.1. Conclusions

As discussed in the above sections, the anticipated negligible impacts associated with the Proposed Action would not change substantially under Alternatives B, C, and D. While Alternatives B, C, and D could slightly change the impacts on bats within the Offshore and Onshore Project areas, ultimately the same construction, O&M, and decommissioning impacts would still occur. Alternatives B-1, B-2, and D may result in slightly less, but not materially different, negligible impacts on bats than those described under the Proposed Action. Alternative C-1 would have the same WTG number and overall Wind Farm Area footprint as the Proposed Action and, therefore, would have similar negligible impacts on bats. Alternative C-2 would have the same number of WTGs as the Proposed Action, but compressed in a smaller footprint, and, therefore, would have similar negligible impacts on bats. Therefore, the overall **negligible** impacts would be very similar among the Proposed Action and Alternatives B, C, and D.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, C, and D to the overall impacts on bats would be undetectable. However, the differences in impacts among Alternatives B, C, and D should still be considered alongside the impacts of other factors. Therefore, impacts on bats would be slightly less, but not materially different, under Alternatives B-1, B-2, and D and similar, but not materially different, under Alternatives C-1 and C-2. BOEM anticipates the that the overall impacts of Alternatives B, C, and D when combined with impacts from ongoing and planned activities including offshore wind would likely be **negligible**. This impact rating is driven primarily by ongoing activities as well as limited disturbance and habitat removal associated with onshore construction of the alternatives.

3.5.7 Impacts of Alternative E on Bats

The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Project under Alternative E would be similar to those described under the Proposed Action. In contrast to the Proposed Action, which includes two Oyster Creek cable route options as part of Ocean Wind's PDE to cross Island Beach State Park, Alternative E would cross Island Beach State Park on the more northerly route where SAV impacts would be avoided (refer to Section 2.1.6). BOEM expects that the modifications to the Oyster Creek export cable route to avoid impacts on SAV in Barnegat Bay under Alternative E would not significantly change the potential impact compared to the Proposed Action. Alternative E would affect an additional 0.9 acre of undisturbed scrub/shrub and wetland habitat, which can support bats, compared to the southern cable route under the Proposed Action. This habitat impact would occur in the vicinity of an existing maintenance/storage yard across from the Park Office on Central Avenue/Shore Road and would be a primarily temporary impact to support HDD staging and workspace, but some permanent cable easements would be required after the staging and workspaces are restored. Alternative E would also slightly increase the length of the onshore cable route compared to the Proposed Action, but the cable would be placed along the parking area and Central Avenue/Shore Road where vegetation impacts are anticipated to be minimal. While the construction duration under Alternatives E could be longer than under the Proposed Action if the southern cable route option is constructed due to the slightly increased cable length, non-habitat impacts (e.g., noise) would be temporary, lasting only the duration of construction. Any timing restrictions for construction to avoid impacts on bats (e.g., not clearing trees during winter) would be the same as under the Proposed Action. Impacts on bat habitat from onshore construction activities under Alternative E would increase slightly compared to the Proposed Action due to HDD staging and workspace and permanent impacts from widening existing rights-of-way, but would still remain relatively limited because facilities would be co-located with existing developed areas (i.e., roads, parking areas, and maintenance yards) to limit disturbance and affected habitats would be mostly restored or would be minimal in the context of the surrounding available habitat.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the overall impacts on bats would be similar to those described under the Proposed Action.

3.5.7.1. Conclusions

The anticipated negligible impacts associated with the Proposed Action alone would not change substantially under Alternative E. While Alternative E could slightly change the impacts on bats within the Onshore Project area, ultimately the same construction, O&M, and decommissioning impacts would still occur. Alternative E would have a slightly different onshore cable route that could result in negligible impacts for onshore ground disturbance due to potential temporary and permanent impacts, but impacts on bat habitat from onshore construction activities would not be materially different than those of the Proposed Action and would still remain limited. Therefore, Alternative E would have overall **negligible** impacts on bats.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the overall impacts on bats would be undetectable. Considering all the IPFs together, BOEM anticipates that the overall impacts on bats associated with Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **negligible**. This impact rating is driven primarily by ongoing activities as well as limited disturbance and habitat removal associated with onshore construction of Alternative E.

3.5.8 Proposed Mitigation Measures

If the reported post-construction bat monitoring results (generated as part of Ocean Wind's *Avian and Bat Post-Construction Monitoring Framework* [COP Appendix AB, Ocean Wind 2022]) indicate bat impacts deviate substantially from the impact analysis included in this EIS, then Ocean Wind must make recommendations for new mitigation measures or monitoring methods (refer to Appendix H, Table H-2).

3.7. Birds

This section discusses potential impacts on bird resources from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area for birds. The geographic analysis area for birds, as shown on Figure 3.7-1, includes the United States coastline from Maine to Florida; the offshore limit is 100 miles (161 kilometers) from the Atlantic shore and the onshore limit is 0.5 mile (0.8 kilometer) inland. The geographic analysis area was established to capture resident species and migratory species that winter as far south as South America and the Caribbean, and those that breed in the Arctic or along the Atlantic Coast that travel through the area. The offshore limit was established to cover the migratory movement of most species in this group. The onshore limit was established to cover onshore habitats used by the species that may be affected by onshore and offshore components of the proposed Project.

3.7.1 Description of the Affected Environment for Birds

This section discusses bird species that use onshore and offshore habitats, including both resident bird species that use the proposed Project area during all (or portions of) the year and migrating bird species with the potential to pass through the proposed Project area during fall migration, spring migration, or both. Detailed information regarding habitats and bird species potentially present can be found in the COP Volume II, Section 2.2.3, and Appendix H (Ocean Wind 2022). Given the differences in life history characteristics and habitat use between offshore and onshore bird species, the sections below provide a separate discussion of each group. This section also discusses bald and golden eagles. In addition, this section addresses federally listed threatened and endangered birds, which are further addressed in the Ocean Wind 1 BA prepared for USFWS (BOEM 2022).

The mid-Atlantic Coast plays an important role in the ecology of many bird species. The Atlantic Flyway is a major route for migratory birds, which are protected under the Migratory Bird Treaty Act of 1918. Chapter 4.2.4 of the Atlantic OCS Proposed Geological and Geophysical Activities Programmatic EIS (BOEM 2014a) discusses the use of Atlantic Coast habitats by migratory birds. Birds in the geographic analysis area are subject to pressure from ongoing activities, such as onshore construction, marine minerals extraction, port expansions, and installation of new structures in the OCS, but particularly from accidental releases; new cable, transmission line, and pipeline emplacement; interactions with fisheries and fishing gear; and climate change. More than one-third of bird species that occur in North America (37 percent, 432 species) are at risk of extinction unless significant conservation actions are taken (NABCI 2016). This is likely representative of the conditions of birds within the geographic analysis area. Species that live or migrate through the Atlantic Flyway have historically been, and will continue to be, subject to a variety of ongoing anthropogenic stressors, including hunting pressure (approximately 86,000 seaducks are harvested annually [Roberts 2019]), commercial fisheries by-catch (approximately 2,600 seabirds are killed annually on the Atlantic [Hatch 2017; Sigourney et al. 2019]), and climate change, which have the potential to have adverse impacts on bird species.

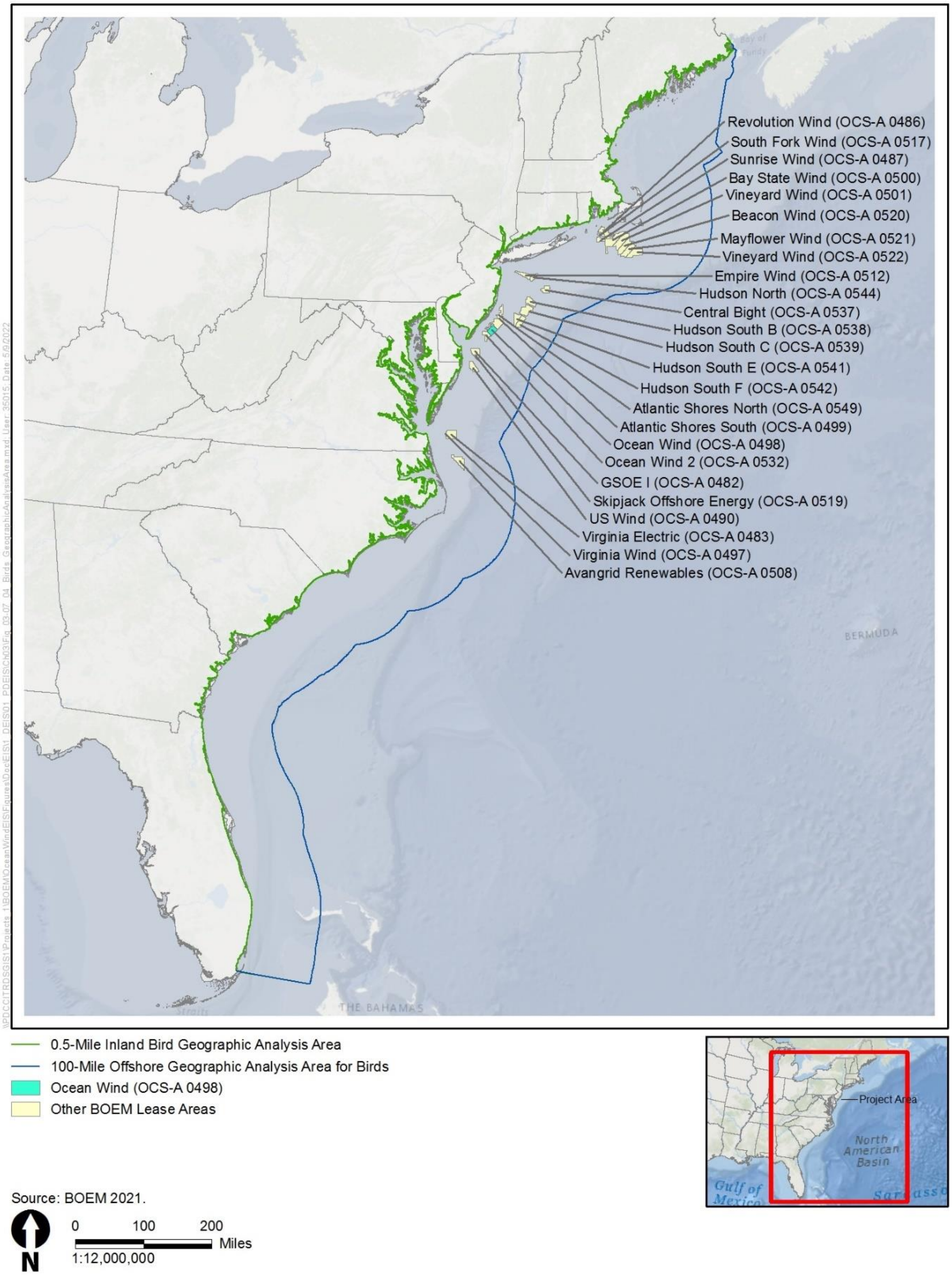


Figure 3.7-1 Birds Geographic Analysis Area

According to the North American Bird Conservation Initiative (NABCI), more than half of the offshore bird species (57 percent, 31 species) have been placed on the NABCI watch list as a result of small ranges, small and declining populations, and threats to required habitats. This watch list identified species of high conservation concern based upon high vulnerability to a variety of factors, including population size, breeding distribution, non-breeding distribution, threats to breeding, threats to non-breeding, and population trend (NABCI 2016). Globally, monitored offshore bird populations have declined by nearly 70 percent from 1950 to 2010, which may be representative of the overall population trend of seabirds (Paleczny et al. 2015) including those that forage, breed, and migrate over the Atlantic OCS. Overall, offshore bird populations are decreasing; however, considerable differences in population trajectories of offshore bird families have been documented.

Coastal birds, especially those that nest in coastal marshes and other low-elevation habitats, are vulnerable to sea-level rise and the increasing frequency of strong storms as a result of global climate change. According to NABCI, nearly 40 percent of the more than 100 bird species that rely on coastal habitats for breeding or for migration are on the NABCI watch list. Many of these coastal species have small population size or restricted distributions, making them especially vulnerable to habitat loss or degradation and other stressors (NABCI 2016). Models of vulnerability to climate change estimate that, throughout New Jersey, 20 percent of New Jersey's 248 bird species are vulnerable to climate change across all seasons (Audubon 2019), some of which occur in the geographic analysis area. These ongoing impacts on birds would continue regardless of the offshore wind industry.

A broad group of avian species may pass through the Offshore Project area, including migrants (such as raptors and songbirds), coastal birds (such as shorebirds, waterfowl, and waders), and marine birds (such as seabirds and seaducks). Approximately 159 bird species have been identified as potentially occurring in the Offshore Project area through public databases and baseline studies (see Table 3-1 in COP Volume III Appendix H; Ocean Wind 2022). Of these 159 species, nine are state-listed as endangered for at least one life stage (i.e., breeding or non-breeding), four are state-listed as threatened for at least one life stage, 19 are state-listed as special concern species for at least one life stage, two are federally listed as threatened, and one is federally listed as endangered. There is high diversity of marine birds that may use the Wind Farm Area because it is in the Mid-Atlantic Bight, which overlaps with the ranges of both northern and southern species and falls within the Atlantic Flyway (a major migratory pathway for birds in the eastern United States and Canada). Migrant terrestrial species may follow the coastline on their annual trips or choose more direct flight routes over expanses of open water. Many marine birds also make annual migrations up and down the eastern seaboard (e.g., gannets, loons, and seaducks), taking them directly through the mid-Atlantic region in spring and fall. This results in a complex ecosystem where the community composition shifts regularly and temporal and geographic patterns are highly variable. The mid-Atlantic supports large populations of birds in summer, some of which breed in the area, such as coastal gulls and terns. Other summer residents, such as shearwaters and storm-petrels, visit from the Southern Hemisphere (where they breed during the austral summer). In the fall, many of the summer residents leave the area and migrate south to warmer climates, and are replaced by species that breed farther north and winter in the mid-Atlantic. Table 3.7-1 summarizes the bird presence in the Offshore Project area by bird type.

Table 3.7-1 Bird Presence in the Offshore Project Area by Bird Type

Bird Type	Potential Bird Presence in Offshore Project Area
Non-Marine Migratory Birds	
Shorebirds	Shorebirds are coastal breeders and foragers and generally avoid straying out over deep waters during breeding. Of the shorebirds, only red phalarope and red-necked phalarope are generally considered marine species. Overall, exposure of shorebirds to the offshore infrastructure will be limited to migration, and, with the exception of phalaropes, the offshore marine environment does not provide habitat for shorebirds.
Wading Birds	Most long-legged wading birds breed and migrate in coastal and inland areas. Like the smaller shorebirds, wading birds are coastal breeders and foragers and generally avoid straying out over deep waters, but may traverse the Wind Farm Area during spring and fall migration periods. The USFWS IPaC database did not indicate any wading birds in the Wind Farm Area or adjacent waters that are identified as vulnerable or Birds of Conservation Concern, and the NJDEP EBS surveys detected few herons and egrets offshore (see COP Volume III, Appendix H).
Raptors	Except for falcons, most raptors do not fly in the offshore marine environment due to their wing morphology, which requires thermal column formation to support their gliding flight. Falcons are encountered offshore because they can make large water crossings. Merlins and peregrine falcons are commonly observed offshore, fly offshore during migration, and have been observed on offshore oil platforms. Therefore, falcons may pass through the Wind Farm Area during migration. Ospreys fly over open water crossings; however, satellite telemetry data from ospreys in New England and the mid-Atlantic suggest these birds generally follow coastal or inland migration routes.
Songbirds	Songbirds almost exclusively use terrestrial, freshwater, and coastal habitats and do not use the offshore marine system except during migration. Songbirds regularly cross large bodies of water, and there is some evidence that species migrate over the northern Atlantic. Some birds may briefly fly over the water while others, like the blackpoll warbler, can migrate over vast expanses of ocean. Evidence for a variety of species suggests that overwater migration in the Atlantic is much more common in fall (than in spring), when the frequency of overwater flights increases perhaps due to consistent tailwinds from the northwest. Overall, the exposure of songbirds to the Wind Farm Area will be limited to migration.
Coastal Waterbirds	Coastal waterbirds (including waterfowl) use terrestrial or coastal wetland habitats and rarely use the marine offshore environment. The species in this group are generally restricted to freshwater or use saltmarshes, beaches, and other strictly coastal habitats and are unlikely to pass through the Wind Farm Area. Seaducks are discussed below in the marine bird section.
Marine Birds	
Loons	Common loons and red-throated loons use the Atlantic OCS in winter. Analysis of satellite-tracked red-throated loons, captured and tagged in the mid-Atlantic area, found their winter distributions to be largely inshore of the mid-Atlantic WEAs, although they did overlap with the Wind Farm Area during spring migration. However, large aggregations of common loons intersect the western boundary of the Wind Farm Area in fall, winter, and spring as detected by the AMAPPS and other offshore survey programs. The NJDEP EBS surveys and MDAT models show higher use of the Wind Farm Area by loons in the spring than other seasons.

Bird Type	Potential Bird Presence in Offshore Project Area
Seaducks	The seaducks use the Atlantic OCS heavily in winter. Most seaducks forage on mussels and other benthic invertebrates, and generally winter in shallower inshore waters or out over large offshore shoals, where they can access benthic prey. Surf scoters tracked with satellite transmitters remained largely inshore of the Wind Farm Area. Exposure to the Wind Farm Area will be primarily limited to migration or travel between wintering sites.
Petrel Group	This group consists mostly of shearwaters and storm-petrels that breed in the southern hemisphere and visit the northern hemisphere during the austral winter (boreal summer) and may pass through the Wind Farm Area. These species use the Atlantic OCS region heavily, but mostly concentrate offshore and in the Gulf of Maine.
Gannets, Cormorants, and Pelicans	Northern gannets use the Atlantic OCS primarily during winter. They breed in southeastern Canada and winter along the mid-Atlantic region and in the Gulf of Mexico. They are opportunistic foragers, capable of long-distance oceanic movements, and large aggregations intersect the western boundaries of the Wind Farm Area regularly during the non-breeding period as detected on surveys conducted by the AMAPPS and other offshore survey programs. The double-crested cormorant is the most likely species of cormorant exposed to the Wind Farm Area, but regional MDAT abundance models show that cormorants are concentrated closer to shore and not commonly encountered well offshore. Brown pelicans are rare in the area and unlikely to pass through the Wind Farm Area in any numbers.
Gulls, Skuas, and Jaegers	Nine species in this group were observed in the NJDEP EBS surveys and could potentially pass through the Wind Farm Area. The regional MDAT abundance models show that these birds have wide distributions, ranging from near shore (gulls) to offshore (jaegers). The herring gull and great black-backed gull reside in the region year-round, and are found farther offshore outside of the breeding season. The parasitic jaeger is often observed closer to shore during migration than the other species and great skuas may pass along the Atlantic OCS outside the breeding season.
Terns	Seven species of tern are present in New Jersey during the spring, summer, and fall. Of these, there are breeding records in New Jersey of Caspian tern, common tern, Forster's tern, gull-billed tern, least tern, and royal tern. Terns generally restrict themselves to coastal waters during breeding, although they may pass through the Wind Farm Area infrequently to forage and during migration. Roseate terns are federally listed.
Auks	Auk species present in New Jersey offshore waters are generally northern or Arctic breeders that winter along the Atlantic OCS. The annual abundance and distribution of auks along the eastern seaboard in winter is erratic, however, depending upon broad climatic conditions and the availability of prey. In winters with prolonged harsh weather, which may prevent foraging for extended periods, these generally pelagic species often move inshore or are driven considerably farther south than usual. The MDAT abundance models show that auks are generally concentrated offshore and south of Nova Scotia, but some individuals may pass through the Wind Farm Area during winter.

Source: COP Appendix H; Ocean Wind 2022; USFWS 2021a.
IPaC = Information for Planning and Consultation; MDAT = Marine-life Data and Analysis Team

The Onshore Project area includes multiple potential onshore export cable routes that contain a diverse set of habitats, including coastal wetlands, forested wetlands, forested uplands, forested lowlands, barrier beaches, and bay island habitats. A broad group of avian species utilize these onshore habitats during breeding, wintering, and migration periods, and avian groups found in these habitats include songbirds, shorebirds, raptors, waterfowl, waders, and seabirds. See Tables 4-5 and 4-6 in COP Volume III, Appendix H (Ocean Wind 2022) for a list of bird species with potential to occur in proximity to the BL England and Oyster Creek substations and onshore export cable routes. These birds include 59 species that are federally listed as threatened and endangered, USFWS-designated Birds of Conservation Concern, state-listed threatened and endangered birds, and state Special Concern birds (see Table 2.2.3-1 in COP Volume II; Ocean Wind 2022). The BL England Onshore Project area is within the Delaware Bay and Atlantic Coastal landscape regions, where the Focal Species of Greatest Conservation Need (SGCN)[1] include American oystercatcher, American woodcock, black rail, black skimmer, bluewinged warbler, common tern, Forster's tern, least tern, little blue heron, northern harrier, peregrine falcon, pied-billed grebe, piping plover, red knot, red-headed woodpecker, ruddy turnstone, scarlet tanager, snowy egret, tricolored heron, bobolink, eastern meadowlark, grasshopper sparrow, Kentucky warbler, northern bobwhite, prothonotary warbler, vesper sparrow, and wood thrush. The nearest recorded peregrine falcon nesting activity in 2019 was in the vicinity of the BL England landfall site in Ocean City on a nesting platform in a marsh, as well as on the Ocean City-Longport Bridge. COP Appendix H, Figure 3-11, shows documented locations of peregrine falcons in the Onshore Project area. The Oyster Creek Onshore Project area is within the Pinelands and Atlantic Coastal landscape regions, where the Focal SGCN are the same as in the BL England Onshore Project area but with one additional species: cerulean warbler. The nearest recorded peregrine falcon nesting activity in 2019 was reported along the barrier beaches at Sedge Island approximately 4.4 miles to the east and southeast of the Oyster Creek landfall site (Ocean Wind 2022).

There are multiple onshore export cable system route options to the BL England and Oyster Creek substations. The onshore export cable system route options would be co-located with existing developed areas (e.g., roads, existing transmission lines, rail) to the extent practicable. Habitat along the route options varies, but includes high-density urban residential areas (edge habitat), commercial areas, salt marsh, shrubs, grasses, mixed forest (predominantly deciduous forest with scattered cedars and pines), and deciduous forest. The cable landfall locations are in the Atlantic Coastal Landscape Region, which includes barrier islands, beaches, tidal salt marshes, rivers, shallow bays, and lagoons. The BL England substation parcel consists of a preexisting substation bordered by Great Egg Harbor Bay, salt marsh, and mowed lawn with scattered deciduous tree habitat. The grid interconnection would be in an existing highly disturbed and industrialized area adjacent to a golf course; the area is primarily covered with existing impervious surfaces that effectively do not provide viable bird habitat. The parcels for the Oyster Creek substation are in areas of pineland forest and shrubland. The grid interconnection would be in an existing and highly disturbed and industrialized area that is primarily covered with existing impervious surfaces and sparse vegetation, which does not provide viable bird habitat. A short section of overhead transmission line, extending up to 0.5 mile (0.8 kilometer), would potentially be installed in this area.

Bald eagles (*Haliaeetus leucocephalus*), which are listed as endangered (breeding) and threatened (non-breeding) in New Jersey, are federally protected by the Bald and Golden Eagle Protection Act, 16 USC § 668 et seq., as are golden eagles (*Aquila chrysaetos*). Bald eagles are broadly distributed across North America and generally nest and perch in areas associated with water (lakes, rivers, bays) in both freshwater and marine habitats, often remaining largely within roughly 1,640 feet of the shoreline. Bald eagles are present year-round in New Jersey and nesting is concentrated on the edge of Delaware Bay. In a study evaluating the space use of bald eagles captured in Chesapeake Bay, the coast of New Jersey was associated with moderate levels of use. The general morphology of bald eagles dissuades long-distance

[1] SGCN are wildlife species with low, declining, or vulnerable populations, and for whom conservation actions are needed to prevent or reverse declines over the next 10 years (NJDEP 2018). Focal SGCN are considered "upper tier" SGCN that include a discrete set of wildlife that are both in need of immediate protection and perceived to be responsive to known and feasible conservation actions (NJDEP 2018). Implementing targeted efforts toward their conservation will benefit many other species (NJDEP 2018).

movements in offshore settings, as the species generally relies upon thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, bald eagles are unlikely to fly through the Wind Farm Area. In 2019, bald eagle nesting activity was recorded at Beesley's Point, within a few kilometers of the BL England landfall site and proposed substation location and in Waretown, within a few kilometers of the Oyster Creek landfall site and proposed substation location. This nest fledged two young (Ocean Wind 2022).

Golden eagles are found throughout the United States, but mostly in the western half of the United States and are rare in the eastern states (Cornell University 2019). In New Jersey, golden eagles are associated with forest habitats in the Delaware Bay, Piedmont Intercoastal Plain, Pinelands, and Skylands landscape regions (NJDEP 2018). The Onshore Project area is primarily within the Atlantic Coastal Landscape region, which is not associated with golden eagles; however, portions of the Onshore Project areas are within the Pinelands and Delaware Bay landscape region and include some forested areas (New Jersey Bureau of GIS 2018). Like with bald eagle, the general morphology of golden eagle dissuades long-distance movements in offshore settings (Kerlinger 1985), as the species generally relies upon thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, golden eagles are unlikely to fly through the Wind Farm Area.

Four species of birds listed as threatened or endangered under the ESA may occur in the Onshore and Offshore Project areas: the threatened piping plover (*Charadrius m. melodus*), endangered roseate tern (*Sterna d. dougallii*), threatened eastern black rail (*Laterallus jamaicensis* ssp. *jamaicensis*), and threatened *Rufa* subspecies of the red knot (*Calidris canutus rufa*) (USFWS 2021a; Ocean Wind 2021). The Ocean Wind 1 BA provides a detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2022).

Impacts from reasonably foreseeable offshore wind activities on ESA-listed species will be discussed in detail in subsequent project-specific analysis documents. As is the case with the proposed Ocean Wind 1 Project, each proposed project will be required to address ESA-listed species at the individual project scale and cumulatively. Additionally, BOEM is currently working on a programmatic framework for ESA consultation with USFWS to address the potential impacts of the anticipated development of Atlantic offshore wind energy facilities on ESA-listed species.

3.7.2 Environmental Consequences

3.7.2.1. Impact Level Definitions for Birds

Definitions of impact levels are provided in Table 3.7-2.

Table 3.7-2 Impact Level Definitions for Birds

Impact Level	Impact Level	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
	Beneficial	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Most impacts would be avoided; if impacts occur, the loss of one or few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
	Beneficial	Impacts would be localized to a small area but with some measurable effect on one or a few individuals or habitat.

Impact Level	Impact Level	Definition
Moderate	Adverse	Impacts would be unavoidable but would not result in population-level effects or threaten overall habitat function.
	Beneficial	Impacts would affect more than a few individuals in a broad area but not regionally, and would not result in population-level effects.
Major	Adverse	Impacts would result in severe, long-term habitat or population-level effects on species.
	Beneficial	Long-term beneficial population-level effects would occur.

3.7.3 Impacts of the No Action Alternative on Birds

When analyzing the impacts of the No Action Alternative on birds, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

3.7.3.1. Ongoing and Planned Non-offshore Wind Activities

Under the No Action Alternative, baseline conditions for birds would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities within the geographic analysis area that contribute to impacts on birds are generally associated with onshore impacts (including onshore construction and coastal lighting), activities in the offshore environment (e.g., vessel traffic, commercial fisheries), and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect bird species through temporary and permanent habitat removal or conversion, temporary noise impacts related to construction, collisions (e.g., presence of structures), and lighting effects, which could cause avoidance behavior and displacement as well as injury to or mortality of individual birds. However, population-level effects would not be anticipated. Activities in the offshore environment could result in bird avoidance behavior and displacement, but population-level effects would not be anticipated. Increased storm severity and frequency, ocean acidification, altered migration patterns, increased disease frequency, protective measures, and increased erosion and sediment deposition have the potential to result in long-term, potentially high-consequence risks to birds and could lead to changes in prey abundance and distribution, changes in nesting and foraging habitat abundance and distribution, and changes to migration patterns and timing.

Other planned non-offshore wind activities that may affect birds include installation of new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Section F.2 in Appendix F for a complete description of ongoing and planned activities). Similar to ongoing activities, other planned non-offshore wind activities may result in temporary and permanent impacts on birds including disturbance, displacement, injury, mortality, habitat degradation, and habitat conversion. See Table F1-4 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for birds.

3.7.3.2. Offshore Wind Activities (without Proposed Action)

BOEM expects other offshore wind development activities to affect birds through the following primary IPFs.

Accidental releases: Accidental releases of fuel/fluids, other contaminants, and trash and debris could occur as a result of offshore wind activities. The risk of any type of accidental release would be increased primarily during construction, but also during operations and decommissioning of offshore wind facilities. Ingestion of fuel and other hazardous contaminants has the potential to result in lethal and sublethal impacts on birds, including decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997; Haney et al. 2017; Paruk et al. 2016). Additionally, even small exposures that result in oiling of feathers can lead to sublethal effects that include changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities, including chick provisioning, commuting, courtship, foraging, long-distance migration, predator evasion, and territory defense (Maggini et al. 2017). Based on the volumes potentially involved (refer to Table F-3 in Appendix F, *Planned Activities Scenario*), the likely amount of releases associated with offshore wind development would fall within the range of accidental releases that already occur on an ongoing basis from non-offshore wind activities and would represent a negligible impact on birds.

Vessel compliance with USCG regulations would minimize trash or other debris; therefore, BOEM expects accidental trash releases from offshore wind vessels to be rare and localized in nature. In the unlikely event of a release, lethal and sublethal impacts on individuals could occur as a result of blockages caused by both hard and soft plastic debris (Roman et al. 2019). Given that accidental releases are anticipated to be rare and localized, BOEM expects that accidental releases of trash and debris would not appreciably contribute to overall impacts on birds.

Lighting: Nighttime lighting associated with offshore wind structures and vessels could represent a source of bird attraction. Under the No Action Alternative, up to 2,946 WTGs and 163 OSS would have hazard and aviation lighting that would be incrementally added beginning in 2023 and continuing through 2030. Construction vessels are also a source of artificial lighting. Vessel lighting would result in localized and temporary impacts on birds; structure lighting may pose an increased collision or predation risk (Hüppop et al. 2006), although this risk would be localized in extent and minimized through the use of BOEM lighting guidelines (BOEM 2019; Kerlinger et al. 2010). Overall, BOEM anticipates lighting impacts related to offshore wind structures and vessels would be negligible.

Cable emplacement and maintenance: Generally, emplacement of submarine cables would result in increased suspended sediments that may affect diving birds, result in displacement of foraging individuals or decreased foraging success, and have impacts on some prey species (e.g., benthic assemblages) (Cook and Burton 2010). The total area of seafloor disturbed by offshore export and inter-array cables for offshore wind facilities is estimated to be up to 32,346 acres (131 km^2). Impacts associated with cable emplacement would be temporary and localized, and birds would be able to successfully forage in adjacent areas not affected by increased suspended sediments. Any dredging necessary prior to cable installation could contribute to additional impacts. Disturbed seafloor from construction of offshore wind projects may affect some bird prey species; however, assuming future projects use installation procedures similar to those proposed in the Ocean Wind 1 COP, the duration and extent of impacts would be limited and short term, and benthic assemblages would recover from disturbance. Section 3.6, *Benthic Resources*, and Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*, provide more information. Impacts would be negligible because increased suspended sediments would be temporary and generally localized to the emplacement corridor and no individual fitness or population-level effects on birds would be expected.

Noise: Anthropogenic noise on the OCS associated with offshore wind development, including noise from aircraft, pile-driving activities, G&G surveys, offshore construction, and vessel traffic, has the potential to result in impacts on birds on the OCS. Additionally, onshore construction noise has the potential to result in impacts on birds. BOEM anticipates that noise impacts would be negligible because noise would be localized and temporary. Potential impacts could be greater if avoidance and displacement of birds occurs during seasonal migration periods.

Aircraft flying at low altitudes may cause birds to flush, resulting in increased energy expenditure. Disturbance to birds, if any, would be temporary and localized, with impacts dissipating once the aircraft has left the area. No individual or population-level effects would be expected.

Construction of up to 3,109 offshore structures would create noise and may temporarily affect diving birds. The greatest impact of noise is likely to be caused by pile-driving activities during construction. Noise transmitted through water has the potential to result in temporary displacement of diving birds in a limited space around each pile and can cause short-term stress and behavioral changes ranging from mild annoyance to escape behavior (BOEM 2014b, 2016). Additionally, noise impacts on prey species may affect bird foraging success. Similar to pile driving, G&G site characterization surveys for offshore wind facilities would create high-intensity impulsive noise around sites of investigation, leading to similar impacts on birds.

Onshore noise associated with intermittent construction of required offshore wind development infrastructure may also result in localized and temporary impacts, including avoidance and displacement, although no individual fitness or population-level effects would be expected to occur.

Noise associated with project vessels could disturb some individual diving birds, but they would likely acclimate to the noise or move away, potentially resulting in a temporary loss of habitat (BOEM 2012). However, brief, temporary responses, if any, would be expected to dissipate once the vessel has passed or the individual has moved away. No individual fitness or population-level effects would be expected.

Presence of structures: The presence of structures can lead to impacts, both beneficial and adverse, on birds through fish aggregation and associated increase in foraging opportunities, as well as entanglement and gear loss or damage, migration disturbances, and WTG strikes and displacement. These impacts may arise from buoys, meteorological towers, foundations, scour and cable protections, and transmission cable infrastructure.

The primary threat to birds from the presence of structures would be from collision with WTGs. The Atlantic Flyway is an important migratory pathway for as many as 164 species of waterbirds, and a similar number of land birds, with the greatest volume of birds using the Atlantic Flyway during annual migrations between wintering and breeding grounds (Watts 2010). Within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several kilometers out onto the OCS, while land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland (Watts 2010). While both groups may occur over land or water within the flyway and may extend considerable distances from shore, the highest diversity and density are centered on the shoreline. Building on this information, Robinson Wilmott et al. (Robinson Wilmott et al. 2013) evaluated the sensitivity of bird resources to collision and displacement due to offshore wind development on the Atlantic OCS and included the 164 species selected by Watts (Watts 2010) plus an additional 13 species, for a total of 177 species that may occur on the Atlantic OCS from Maine to Florida during all or some portion of the year. As discussed in Robinson Willmott et al. (Robinson Wilmott et al. 2013) and consistent with Garthe and Hüppop (Garthe and Hüppop 2004), Furness and Wade (Furness and Wade 2012), and Furness et al. (Furness et al. 2013), species with high scores for sensitivity for collision include gulls, jaegers, and the northern gannet (*Morus bassanus*). In many cases, high collision sensitivity was driven by high occurrence on the OCS, low avoidance rates with high uncertainty, and time spent in the RSZ. Many of the species addressed in Robinson Willmott et al. (Robinson Wilmott et al. 2013) had low collision sensitivity including passerines that spend very little time on the Atlantic OCS during migration and typically fly above the RSZ. As described by Watts (2010), 55 seabird species occur on the Atlantic OCS at a distance from shore where WTGs could be operating. However, generally the abundance of bird species that overlap with the anticipated development of wind energy facilities on the Atlantic OCS is relatively small (Figure 3.7-2).

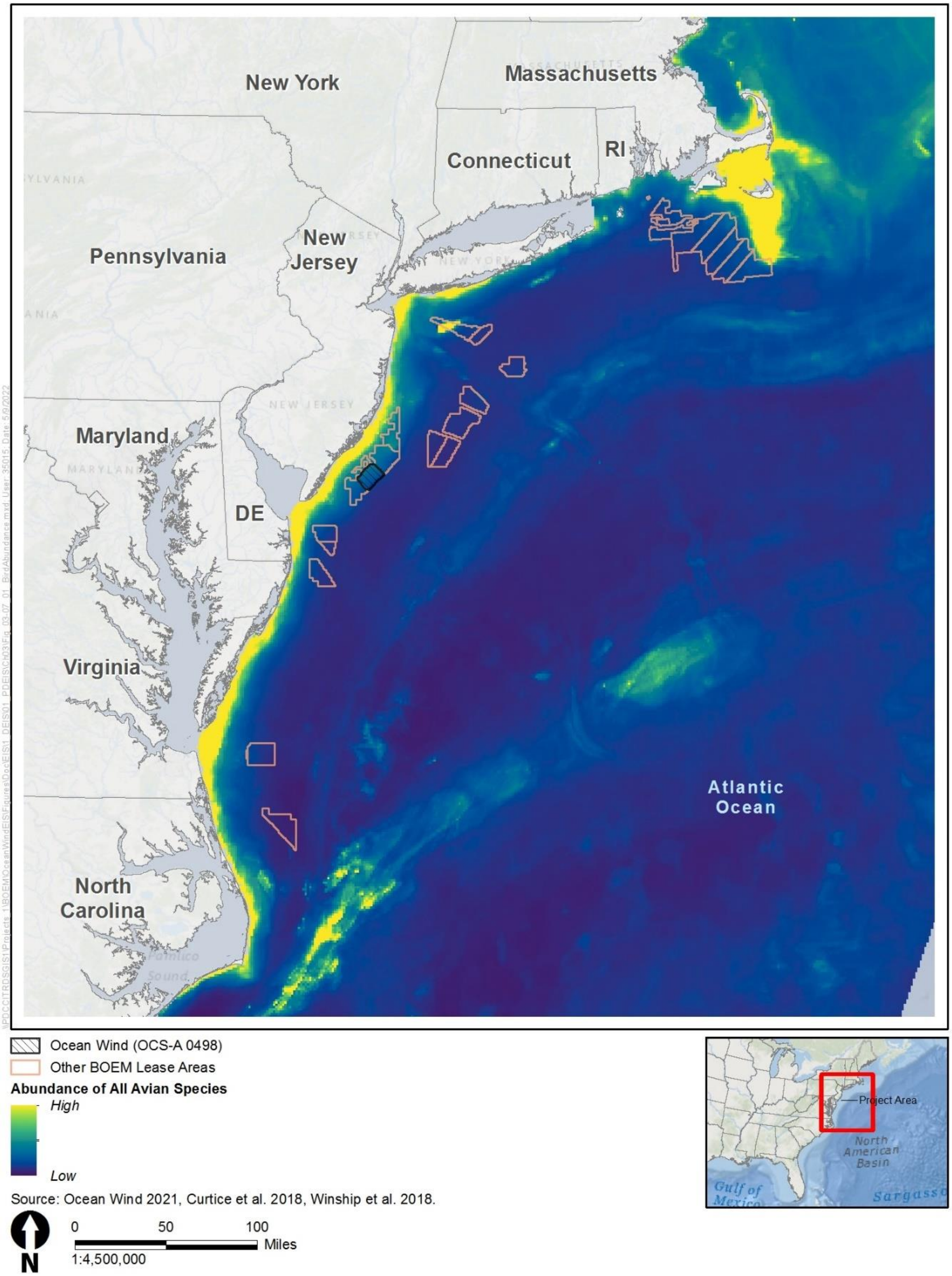


Figure 3.7-2 Total Avian Relative Abundance Distribution Map

Of the 55 seabird species, 47 seabird species have sufficient survey data to calculate the modeled percentage of a species population that would overlap with the anticipated offshore wind development on the Atlantic OCS (Winship et al. 2018); the relative seasonal exposure is generally very low, ranging from 0.0 to 5.2 percent (Table 3.7-3). The estimated percentage of the more sensitive Birds of Conservation Concern populations that overlap offshore wind development areas is 0 percent for three birds and between 0.1 and 0.9 percent for two birds (Table 3.7-3). BOEM assumes that the 47 species (85 percent) with sufficient data to model the relative distribution and abundance on the Atlantic OCS are representative of the 55 species that may overlap with offshore wind development on the Atlantic OCS.

Table 3.7-3 Percentage of Each Atlantic Seabird Population that Overlaps with Anticipated Offshore Wind Energy Development on the Outer Continental Shelf by Season

Species	Spring	Summer	Fall	Winter
Artic Tern (*Sterna paradisaea*)	NA	0.2	NA	NA
Atlantic Puffin (*Fratercula arctica*)[1]	0.2	0.1	0.1	0.2
Audubon Shearwater (*Puffinus lherminieri*)[2]	0.0	0.0	0.0	0.0
Black-capped Petrel (*Pterodroma hasitata*)[2]	0.0	0.0	0.0	0.0
Black Guillemot (*Cepphus grille*)	NA	0.3	NA	NA
Black-legged Kittiwake (*Rissa tridactyla*)[1]	0.7	NA	0.7	0.5
Black Scoter (*Melanitta americana*)	0.2	NA	0.4	0.5
Bonaparte’s Gull (*Chroicocephalus philadelphia*)	0.5	NA	0.4	0.3
Brown Pelican (*Pelecanus occidentalis*)	0.1	0.0	0.0	0.0
Band-rumped Storm-Petrel (*Oceanodroma castro*)[2]	NA	0.0	NA	NA
Bridled Tern (*Onychoprion anaethetus*)	NA	0.1	0.1	NA
Common Eider (*Somateria mollissima*)[1]	0.3	0.1	0.5	0.6
Common Loon (*Gavia immer*)	3.9	1.0	1.3	2.1
Common Murre (*Uria aalge*)	0.4	NA	NA	1.9
Common Tern (*Sterna hirundo*)[1]	2.1	3.0	0.5	NA
Cory’s Shearwater (*Calonectris borealis*)[2]	0.1	0.9	0.3	NA
Double-crested Cormorant (*Phalacrocorax auritus*)	0.7	0.6	0.5	0.4
Dovekie (*Alle alle*)	0.1	0.1	0.3	0.2
Great Black-backed Gull (*Larus marinus*)[1]	1.3	0.5	0.7	0.6
Great Shearwater (*Puffinus gravis*)	0.1	0.3	0.3	0.1
Great Skua (*Stercorarius skua*)	NA	NA	0.1	NA
Herring Gull (*Larus argentatus*)[1]	1.0	1.3	0.9	0.5
Horned Grebe (*Podiceps auritus*)	NA	NA	NA	0.3
Laughing Gull (*Leucophaeus atricilla*)	1.0	3.6	0.9	0.1
Leach’s Storm-Petrel (*Oceanodroma leucorhoa*)	0.1	0.0	0.0	NA
Least Tern (*Sternula antillarum*)	NA	0.3	0.0	NA
Long-tailed Ducks (*Clangula hyemalis*)	0.6	0.0	0.4	0.5
Manx Shearwater (*Puffinus puffinus*)[1, 2]	0.0	0.5	0.1	NA
Northern Fulmar (*Fulmarus glacialis*)[1]	0.1	0.2	0.1	0.2
Northern Gannet (*Morus bassanus*)[1]	1.5	0.4	1.4	1.4
Parasitic Jaeger (*Stercorarius parasiticus*)	0.4	0.5	0.4	NA
Pomarine Jaeger (*Stercorarius pomarinus*)	0.1	0.3	0.2	NA

Species	Spring	Summer	Fall	Winter
Razorbill (*Alca torda*)[1]	5.2	0.2	0.4	2.1
Ring-billed Gull (*Larus delawarensis*)	0.5	0.5	0.9	0.5
Red-breasted Merganser (*Mergus serrator*)	0.5	NA	NA	0.7
Red Phalarope (*Phalaropus fulicarius*)	0.4	0.4	0.2	NA
Red-necked Phalarope (*Phalaropus lobatus*)	0.3	0.3	0.2	NA
Roseate Tern (*Sterna dougallii*)	0.6	0.0	0.5	NA
Royal Tern (*Thalasseus maximus*)	0.0	0.2	0.1	NA
Red-throated Loon (*Gavia stellate*)[1]	1.6	NA	0.5	1.0
Sooty Shearwater (*Ardenna grisea*)	0.3	0.4	0.2	NA
Sooty Tern (*Onychoprion fuscatus*)	0.0	0.0	NA	NA
South Polar Skua (*Stercorarius maccormicki*)	NA	0.2	0.1	NA
Surf Scoter (*Melanitta perspicillata*)	1.2	NA	0.4	0.5
Thick-billed Murre (*Uria lomvia*)	0.1	NA	NA	0.1
Wilson's Storm-Petrel (*Oceanites oceanicus*)	0.2	0.9	0.2	NA
White-winged Scoter (*Melanitta deglandi*)	0.7	NA	0.2	1.3

Source: Winship et al. 2018.
[1] Species used in collision risk modeling.
[2] Species considered Birds of Conservation Concern by USFWS (USFWS 2021b).
NA = not applicable

The greatest risk to birds associated with offshore wind development would be collision with operating WTGs while flying through lease areas or approaching WTGs to perch on the structure. Motion smear, a phenomenon where spinning turbine blades become deceptively transparent to the eye, can also factor into collision risk (Hodos 2013). However, offshore wind turbines are very large and spin much slower (7.8 rotations per minute) than onshore wind turbines. Offshore wind development would add up to 2,946 WTGs in the bird geographic analysis area (Table F-3). In the contiguous United States, bird collisions with operating WTGs are relatively rare events, with an estimated 140,000 to 500,000 (mean = 320,000) birds killed annually from about 49,000 onshore wind turbines in 39 states (USFWS 2018). Bird collisions with turbines in the eastern United States is estimated at 6.86 birds per turbine per year (USFWS 2018). Based on this mortality rate, an estimated 20,210 birds could be killed annually from the 2,946 WTGs that would be added for offshore wind development. This represents a worst-case scenario and does not consider mitigating factors, such as landscape and weather patterns, or bird species that are expected to occur. Given that the relative density of birds in the OCS is low, relatively few birds are likely to encounter WTGs (see Figure 3.7-2). Potential annual bird kills from WTGs would be relatively low compared to other causes of migratory bird deaths in the United States; feral cats are the primary cause of migratory bird deaths in the United States (2.4 billion per year), followed by collisions with building glass (599 million per year), collisions with vehicles (214.5 million per year), poison (72 million per year), collisions with electrical lines (25.5 million per year), collisions with communication towers (6.6 million per year), and electrocutions (5.6 million per year) (USFWS 2021c). Not all individuals that occur or migrate along the Atlantic Coast are expected to encounter the RSZ of one or more operating WTGs associated with offshore wind development. Generally, only a small percentage of a species' seasonal population would potentially encounter operating WTGs (Table 3.7-3). The addition of WTGs to the offshore environment may result in increased functional loss of habitat for those species with higher displacement sensitivity. However, a recent study of long-term data collected in the North Sea found that despite the extensive observed displacement of loons in response to the development of 20 wind farms, there was no decline in the region's loon population (Vilela et al. 2021). Furthermore, substantial foraging habitat for resident birds would remain available outside of the proposed offshore lease areas. Impacts on birds due to the presence of operating WTGs would likely be minor, with no individual fitness or population-level impacts expected to occur.

Because most structures would be spaced 0.6 to 1 nm apart, ample space between WTGs would allow birds that are not flying above WTGs to fly through individual lease areas without changing course or to make minor course corrections to avoid operating WTGs. Adverse impacts of additional energy expenditure due to minor course corrections or complete avoidance of offshore wind lease areas would not be expected to be biologically significant. Any additional flight distances would be miniscule when compared with the overall migratory distances traveled by migratory birds, and no individual fitness or population-level effects would be expected to occur.

In the Northeast and mid-Atlantic waters, there are 2,570 seabird fatalities through interaction with commercial fishing gear each year; of those, 84 percent are with gillnets involving shearwaters/fulmars and loons (Hatch 2017). Abandoned or lost fishing nets from commercial fishing may get tangled with foundations, reducing the chance that abandoned gear would cause additional harm to birds and other wildlife if left to drift until sinking or washing ashore. A reduction in derelict fishing gear (in this case by entanglement with foundations) has a beneficial impact on bird populations (Regular et al. 2013). In contrast, the presence of structures may also increase recreational fishing and thus expose individual birds to harm from fishing line and hooks.

The presence of new structures could result in increased prey items for some marine bird species. Offshore wind foundations could increase the mixing of surface waters and deepen the thermocline, possibly increasing pelagic productivity in local areas (English et al. 2017). Additionally, the new structures may create habitat for structure-oriented and hard-bottom species. This reef effect has been observed around WTGs, leading to local increases in biomass and diversity (Causon and Gill 2018). Recent studies have found increased biomass for benthic fish and invertebrates, and possibly for pelagic fish, marine mammals, and birds as well (Raoux et al. 2017, Pezy et al. 2018, Wang et al. 2019), indicating that offshore wind energy facilities can generate beneficial permanent impacts on local ecosystems, translating to increased foraging opportunities for individuals of some marine bird species. BOEM anticipates that the presence of structures may result in long-term, moderate, beneficial impacts. Conversely, increased foraging opportunities could attract marine birds, potentially exposing those individuals to increased collision risk associated with operating WTGs.

Traffic (aircraft): General aviation traffic accounts for approximately two bird strikes per 100,000 flights (Dolbeer et al. 2019). Because aircraft flights associated with offshore wind development are expected to be minimal in comparison to baseline conditions, aircraft strikes with birds are highly unlikely to occur. As such, aircraft traffic impacts would be negligible and not expected to appreciably contribute to overall impacts on birds.

Land disturbance (onshore construction): Onshore construction of offshore wind development infrastructure has the potential to result in some impacts due to habitat loss or fragmentation. However, onshore construction would be expected to account for only a very small increase in development relative to other ongoing development activities. Furthermore, construction would be expected to generally occur in previously disturbed habitats, and no individual fitness or population-level impacts on birds would be expected to occur. As such, onshore construction impacts associated with offshore wind development would be negligible and not expected to appreciably contribute to overall impacts on birds.

3.7.3.3. Conclusions

Under the No Action Alternative, baseline conditions for birds would continue to follow the current general decreasing trends and respond to IPFs introduced by other ongoing and planned activities. BOEM expects ongoing and planned non-offshore wind activities, and offshore wind development (excluding the

Proposed Action) to have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, habitat degradation, habitat conversion) on birds primarily through accidental releases, anthropogenic noise, presence of structures, and climate change. Ongoing activities would likely result in minor impacts as a result of interactions with commercial fisheries, anthropogenic light in the coastal environment, and climate change. The impacts of planned activities other than offshore wind development would include new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS and would likely be minor. BOEM expects the combination of ongoing and planned activities other than offshore wind to result in minor impacts on birds in the geographic analysis area. BOEM anticipates that the impacts associated with offshore wind activities in the geographic analysis area would result in moderate adverse impacts but could potentially include moderate beneficial impacts because of the presence of structures. The majority of offshore structures in the geographic analysis area would be attributable to the offshore wind development. Migratory birds that use the offshore wind lease areas during all or parts of the year would either be exposed to new collision risk or experience long-term functional habitat loss due to behavioral avoidance and displacement from wind lease areas on the OCS. The offshore wind development would also be responsible for the majority of impacts related to new cable emplacement and pile-driving noise, but effects on birds resulting from these IPFs would be localized and temporary and would not be expected to be biologically significant.

Under the No Action Alternative, existing environmental trends and activities would continue, and birds would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **minor** impacts on birds. BOEM anticipates that the No Action Alternative combined with all planned activities (including offshore wind activities) would have a **moderate** adverse impact on birds but could include **moderate beneficial** impacts because of the presence of offshore structures.

3.7.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on birds:

- The new onshore substations, which could require the removal of trees on the edge of the construction footprint;
- The number, size, and location of the WTGs;
- The routing variants within the selected onshore export cable system, which could require removal of trees on the edge of the construction corridor; and
- The time of year during which construction occurs.

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

- WTG number, size, and location: the level of hazard related to WTGs is proportional to the number of WTGs installed; fewer WTGs would present less hazard to birds.
- Onshore export cable routes and substations footprint: the route chosen (including variants within the general route) and substation footprint would determine the amount of habitat affected.
- Season of construction: The activity and distribution of birds exhibit distinct seasonal changes. For instance, summer and fall months (generally May through October) constitute the most active season for birds in the Project area, and the months on either side coincide with major migration events.

Therefore, construction during months in which birds are not present, not breeding, or less active would have a lesser impact on birds than construction during more active times.

Ocean Wind has committed to measures to minimize impacts on birds. These measures include, but are not limited to, cutting trees and vegetation, where possible, during the winter months when most migratory birds are not present (BIRD-03) and using lighting technology that minimizes impacts on avian species to the extent practicable (BIRD-04) (COP Volume II, Table 1.1-2; Ocean Wind 2022).

3.7.5 Impacts of the Proposed Action on Birds

The sections below summarize the potential impacts of the Proposed Action on birds during the various phases of the proposed Project. Routine activities would include construction, O&M, and decommissioning of the proposed Project, as described in Chapter 2, *Alternatives*. The most impactful IPF is expected to be the presence of structures, which could lead to adverse impacts including injury and mortality or elicit an avoidance response. BOEM prepared a BA for the potential effects on USFWS federally listed species, which found that the Proposed Action was *not likely to adversely affect*, or would have *no effect*, on listed species (BOEM 2022). BOEM requested concurrence on its conclusion that the impacts of the proposed activities are expected to be discountable and insignificant, and thus *may affect but are not likely to adversely affect* piping plovers, roseate terns, eastern black rails, and rufa red knots. There are no critical habitats designated for these species in the action area defined in the BA (BOEM 2022). Consultation with USFWS pursuant to Section 7 of the ESA is ongoing and results of consultation will be presented in the Final EIS.

Accidental releases: Some potential exists for mortality, decreased fitness, and health effects due to the accidental release of fuel, hazardous materials, and trash and debris from vessels associated with the Proposed Action. Vessels associated with the Proposed Action may potentially generate operational waste, including bilge and ballast water, sanitary and domestic wastes, and trash and debris. All vessels associated with the Proposed Action would comply with USCG requirements for the prevention and control of oil and fuel spills. Proper vessel regulations and operating procedures would minimize effects on offshore bird species resulting from the release of debris, fuel, hazardous materials, or waste (BOEM 2012). In addition, Ocean Wind has committed to preparing and implementing waste management plans and hazardous materials plans, which would minimize the potential for spills and identify procedures in the event of a spill (GEN-10). All vessels would be certified to conform to vessel O&M protocols designed to minimize the risk of fuel spills and leaks (WQ-01). These releases, if any, would occur infrequently at discrete locations and vary widely in space and time; as such, BOEM expects localized, temporary, and negligible impacts on birds. Offshore wind activities would contribute to an increased risk of spills and associated impacts due to fuel, fluid, or hazardous materials exposure but, compared to the overall spill risk from ongoing activities, the contribution from offshore wind and the Proposed Action would be low.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined impacts from ongoing and planned activities including offshore wind, which would be expected to be localized, temporary, and negligible due to the likely limited extent and duration of a release.

Lighting: Under the Proposed Action, up to 98 WTGs and three OSS would be lit with navigational and FAA hazard lighting; these lights have some potential to attract birds and result in increased collision risk (Hüppop et al. 2006). In accordance with BOEM lighting guidelines (2021c) and as outlined in the Ocean Wind 1 COP (Volume I, Section 7.4; Ocean Wind 2022), each WTG above 699 feet about ground level would be lit with two FAA model L-864 aviation red flashing obstruction lights on the highest point of the nacelle and up to four FAA model L-810 red flashing lights at mid-mast level, adding up to 588 new red flashing lights to the offshore environment where none currently exist. However, red flashing aviation obstruction lights are commonly used at land-based wind facilities without any observed increase in avian mortality compared with unlit turbine towers (Kerlinger et al. 2010, Orr et al. 2013). Additionally, marine navigation lighting would consist of multiple flashing yellow lights on each WTG and on the corners of each OSS.

The Project is proposing to use an ADLS, which if implemented would only activate WTG lighting when aircraft enter a predefined airspace. The short-duration synchronized flashing of the ADLS would have less impact on birds at night than the standard continuous, medium-intensity red strobe light aircraft warning systems. Based on recent studies associated with South Fork Wind Farm, activation of the ADLS would occur on average from 2 minutes to 46 minutes per month as compared to standard continuous FAA hazard lighting (BOEM 2021b). Similar analyses have not been prepared for other planned offshore wind projects; however, this EIS assumes that activation of ADLS for other projects (if used) would be comparably rare. This would reduce impacts already associated with WTG lighting. To further reduce impacts on birds, Ocean Wind proposes to use lighting technology that minimizes impacts on avian species to the extent practicable (BIRD-04). As such, BOEM expects impacts, if any, to be long term but negligible from lighting. Vessel lights during construction, O&M, and decommissioning would be minimal and likely limited to vessels transiting to and from construction areas.

The impact of the Proposed Action alone would not noticeably increase the impacts of light beyond those described under the No Action Alternative. Under the planned action scenario, up to 3,324 WTGs and 87 OSS would have lights, and these would be incrementally added over time beginning in 2023 and continuing through 2030. Lighting of WTGs and other structures would be minimal (navigation and aviation hazard lights) and in accordance with BOEM (2021c) guidance. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined lighting impacts on birds from ongoing and planned activities including offshore wind, which would be negligible. Ongoing and planned non-offshore wind activities are expected to cause permanent impacts, primarily driven by light from offshore structures and short-term and localized impacts from vessel lights.

Cable emplacement and maintenance: The Proposed Action would disturb up to 3,785 acres (15 km^2) of seafloor associated with the installation of array cable and offshore cable, which would result in turbidity effects that have the potential to reduce marine bird foraging success or have temporary and localized impacts on marine bird prey species. These impacts are expected to be temporary, with sediments settling quickly to the seabed and potential plumes limited to right above the seabed and not within the water column; turbidity concentrations greater than 10 mg/L would be short in duration—up to 6 hours—and limited to within approximately 50 to 200 meters of the trench in offshore areas. Dredging, which may also occur along the proposed cable route in locations where sand waves (naturally mobile slopes on the seabed) are encountered or when crossing federal and state navigation channels, would produce similar effects, but with plumes likely to last longer and extend farther out. As BOEM (2018) notes, while turbidity would likely be high in the areas affected by dredging, the sediment would not affect water quality after it settles, and the period of sediment suspension would be very short term and localized. Individual birds would be expected to successfully forage in nearby areas not affected by increased sedimentation during cable emplacement, and only non-measurable impacts, if any, on individuals or populations would be expected given the localized and temporary nature of the potential impacts. Given the localized nature of these impacts, impacts associated with the emplacement of cables for other offshore wind projects in the geographic analysis area are not anticipated to overlap spatially with the Proposed Action, and impacts would be negligible.

The Proposed Action combined with ongoing and planned activities including offshore wind would disturb up to 36,131 acres (146 km^2) of seafloor from the offshore export cable and inter-array cables. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined cable emplacement impacts from ongoing and planned activities including offshore wind, which could occur if impacts are in close temporal and spatial proximity. However, these impacts from cable emplacement would be expected to be negligible and not biologically significant.

Noise: The expected impacts of aircraft, G&G survey, and pile-driving noise associated with Proposed Action alone would not increase the impacts of noise beyond those described under the No Action Alternative. Effects on offshore bird species could occur during the construction phase of the Proposed Action because of equipment noise (including pile-driving noise). The pile-driving noise impacts would be short term (4 hours per pile). Vessel and construction noise could disturb offshore bird species, but they would likely acclimate to the noise or move away, potentially resulting in a temporary loss of habitat (BOEM 2012). BOEM anticipates the temporary impacts, if any, related to construction and installation of the offshore components would be negligible.

Normal operation of the substations would generate continuous noise, but BOEM expects negligible long-term impacts when considered in the context of the other commercial and industrial noises near the proposed substations.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined noise impacts on birds from ongoing and planned activities including offshore wind, which would likely be negligible.

Presence of structures: The various types of impacts on birds that could result from the presence of structures, such as fish aggregation and associated increase in foraging opportunities, entanglement and fishing gear loss or damage, migration disturbances, and WTG strikes and displacement, are described in detail in Section 3.7.3.2, *Offshore Wind Activities (without Proposed Action)*. The impacts of the Proposed Action alone as a result of presence of structures would be long term but minor, and may include some minor beneficial impacts. Due to the anticipated use of flashing red tower lights, restricted time period of exposure during migration, and small number of migrants that could cross the Wind Farm Area, BOEM and USFWS conclude that the Proposed Action would not likely adversely affect roseate terns, piping plovers, eastern black rail, and red knots. See the Ocean Wind 1 BA (BOEM 2022) for a complete discussion of the potential collision risk to ESA-listed species as a result of operation of the proposed Project.

As previously described and depicted for the offshore wind lease areas on Figure 3.7-3 and Figure 3.7-4, the locations of the OCS offshore wind lease areas were selected to minimize impacts on all resources, including birds. Within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several kilometers out onto the OCS, while land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland (Watts 2010). However, operation of the Proposed Action would result in impacts on some individuals of offshore bird species and possibly some individuals of coastal and inland bird species during spring and fall migration. These impacts could arise through direct mortality from collisions with WTGs or through behavioral avoidance and habitat loss (Drewitt and Langston 2006, Fox et al. 2006, Goodale and Millman 2016). The predicted activity of bird populations that have a higher sensitivity to collision (as defined by Robinson Willmott et al. [2013]) is relatively low in the OCS during all seasons of the year (Figure 3.7-3), suggesting that bird fatalities due to collision are likely to be low. When WTGs are present, many birds would avoid the WTG site altogether, especially the species that ranked “high” in vulnerability to displacement by offshore wind energy development (Robinson Willmott et al. 2013). In addition, many birds would likely adjust their flight paths to avoid WTGs by flying above, below, or between them (e.g., Desholm and Kahlert 2005, Plonczkier and Simms 2012, Skov et al. 2018) and others may take extra precautions to avoid WTGs when the WTGs are moving (Johnston et al. 2014). Several species have very high avoidance rates; for example, the northern gannet, black-legged kittiwake, herring gull, and great black-backed gull have measured avoidance rates of at least 99.6 percent (Skov et al. 2018).

Ocean Wind performed an exposure assessment to estimate the risk of various offshore bird species encountering the Wind Farm Area (COP Volume III, Appendix H; Ocean Wind 2022). Most species were identified as having “minimal” to “low” overall exposure risk. Of the approximately 40 species of marine birds that use the mid-Atlantic marine environment, the northern gannet and loons had the highest potential exposure, both considered “low-medium” exposure risk. In addition, two raptors—peregrine falcon and merlin—were found to have “low-medium” exposure risk; non-falcon raptors were found to have limited use of the offshore environment. While some non-marine birds have the potential to be exposed to the Wind Farm Area, the Wind Farm Area is far enough offshore as to be beyond the range of most breeding terrestrial or coastal bird species. Of the species considered to have a higher overall exposure risk (i.e., loons, northern gannet, peregrine falcon, and merlin), two have a special status designation: red-throated loon is a Bird of Conservation Concern and peregrine falcon is state-listed as endangered (breeding) and special concern (non-breeding).

During migration, many bird species, including song birds, likely fly at heights well above or below the RSZ (70.8 feet to 906 feet [22 to 276 meters] above MLLW) (COP Volume III, Appendix H; Ocean Wind 2022 and references in COP Volume III, Appendix H; Ocean Wind 2022). As shown in Robinson Willmott et al. (Robinson Willmott et al. 2013), species with low sensitivity scores include many passerines that only cross the Atlantic OCS briefly during migration and typically fly well above the RSZ.

It is generally assumed that inclement weather and reduced visibility cause changes to migration altitudes (Ainley et al. 2015) and could potentially lead to large-scale mortality events. However, this has not been shown to be the case in studies of offshore wind facilities in Europe, with oversea migration completely, or nearly so, ceasing during inclement weather (Fox et al. 2006, Pettersson 2005, Hüppop et al. 2006), and with migrating birds avoiding flying through fog and low clouds (Panuccio et al. 2019). Furthermore, many of these passerine species, while detected on the OCS during migration as part of BOEM’s Acoustic/Thermographic Offshore Monitoring project (Robinson Willmott and Forcey 2014), they were documented in relatively low numbers. While several studies documenting bird flight and wind speeds over terrestrial environments have shown birds to fly at variable wind speeds, including above the typical cut-in speeds of wind turbines (Abdulle and Fraser 2018; Bloch and Bruderer 1982; Bruderer and Boldt 2001; Chapman et al. 2016), Robinson Willmott and Forcey (2014) found that most of the bird activity (including blackpoll warblers) in the offshore environment on the OCS occurred during windspeeds less than 10 kilometers per hour (2.8 m/s) (see Figure 109 in Robinson Willmott and Forcey 2014). The cut-in speed for the Ocean Wind 1 WTGs is 3.5 m/s; therefore, based on the Robinson Willmott and Forcey (2014) offshore study, passerines would likely be migrating when the turbine blades are idle (Ørsted 2022). Furthermore, most carcasses of small migratory songbirds found at land-based wind energy facilities in the Northeast were within 2 meters of the turbine towers, suggesting that they are colliding with towers rather than moving turbine blades (Choi et al. 2020). Although it is possible that migrating passerines could collide with offshore structures, migrating passerines are also occasionally found dead on boats, presumably from exhaustion (e.g., Stabile et al. 2017).

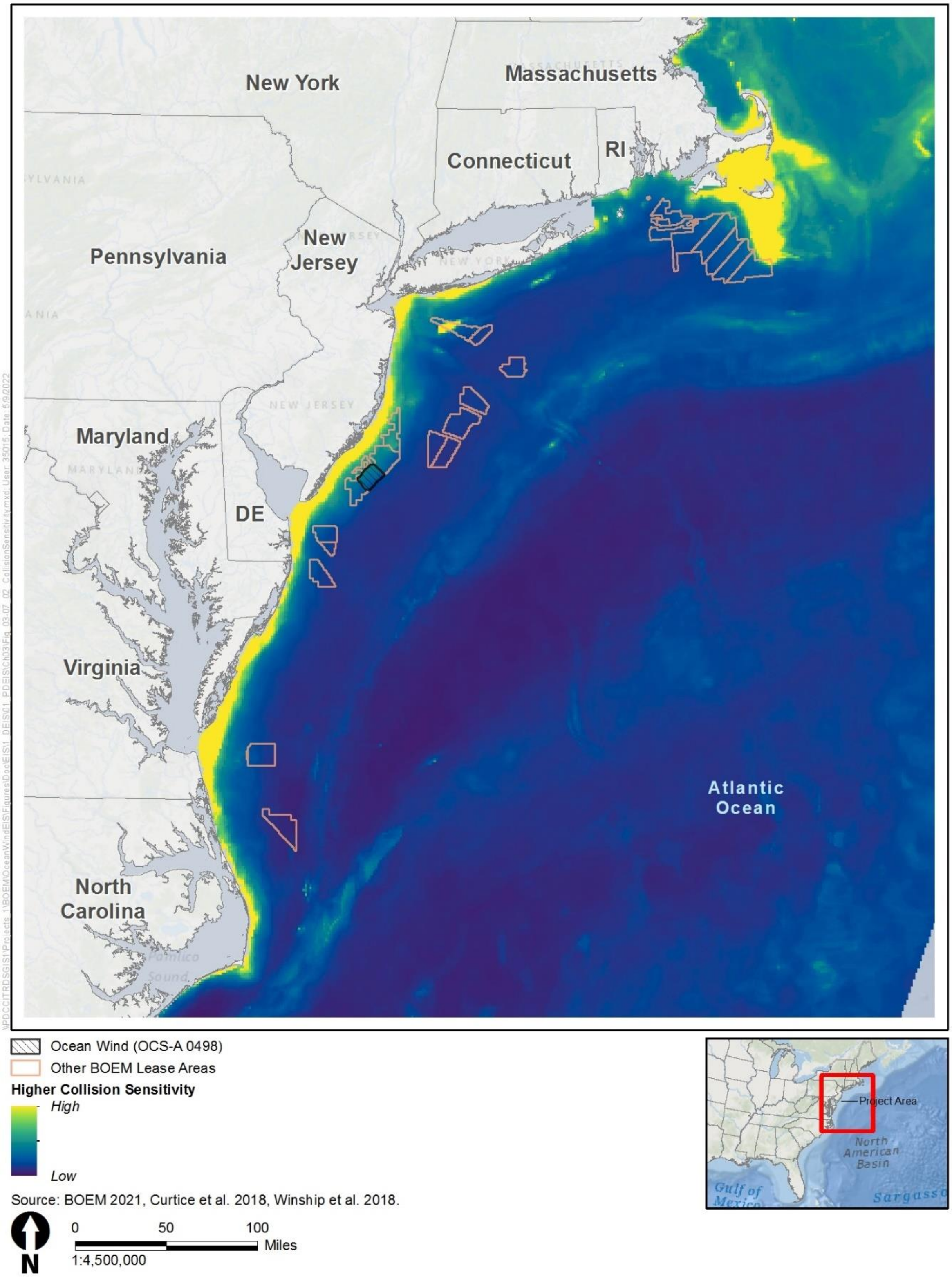


Figure 3.7-3 Total Avian Relative Abundance Distribution Map for the Higher Collision Sensitivity Species Group

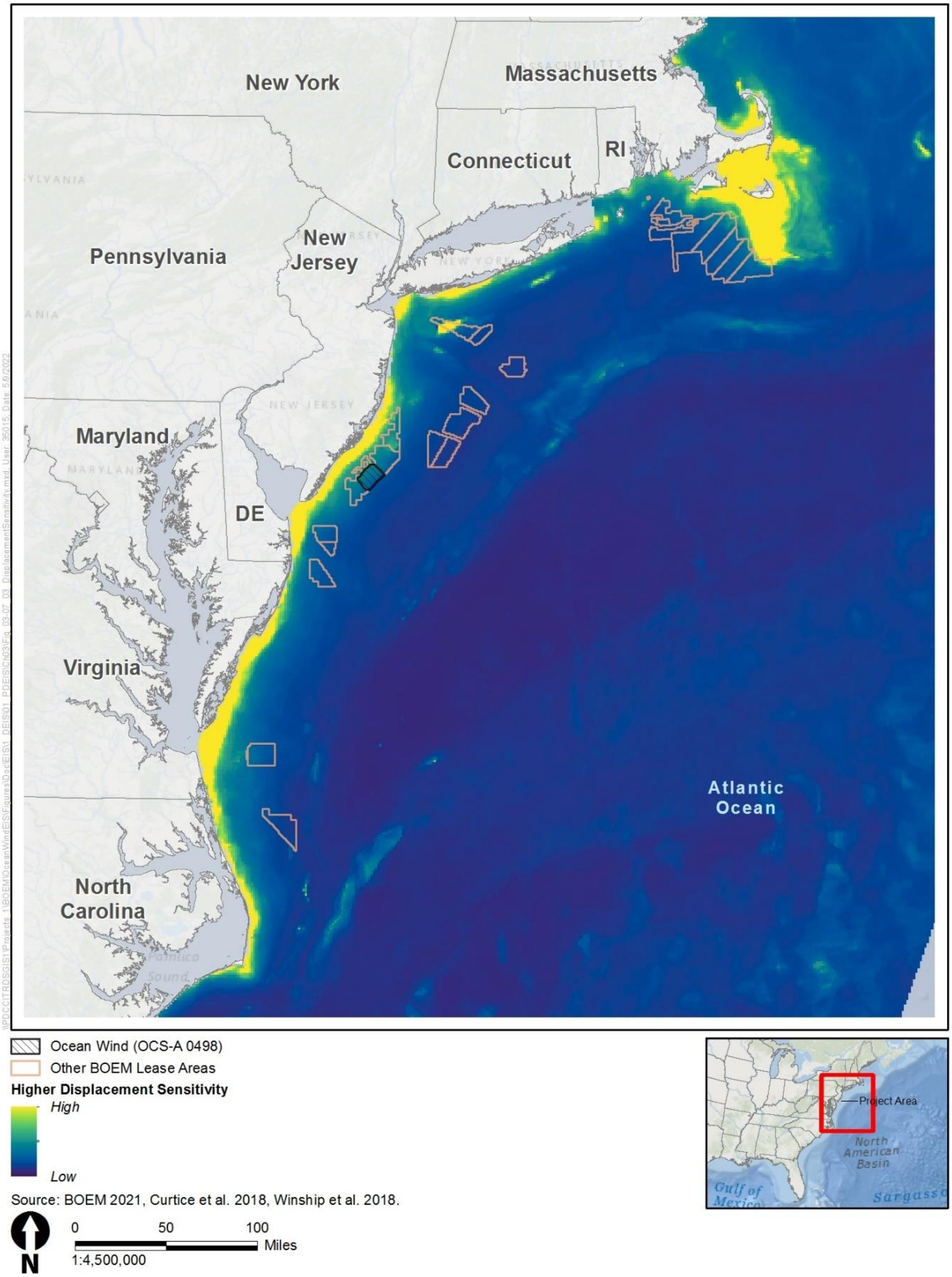


Figure 3.7-4 Total Avian Relative Abundance Distribution Map for the Higher Displacement Sensitivity Species Group

Some marine bird species might avoid the Wind Farm Area during its operation, leading to an effective loss of habitat. For example, loons (Dierschke et al. 2016, Drewitt and Langston 2006, Lindeboom et al. 2011, Percival 2010, Petersen et al. 2006), grebes (Dierschke et al. 2016, Leopold et al. 2011, Leopold et al. 2013), seaducks (Drewitt and Langston 2006, Petersen et al. 2006), and northern gannets (Drewitt and Langston 2006, Lindeboom et al. 2011, Petersen et al. 2006) typically avoid offshore wind developments. The proposed Project would no longer provide foraging opportunities to those species with high displacement sensitivity, but suitable foraging habitat exists in the immediate vicinity of the proposed Project and throughout the region. However, as depicted on Figure 3.7-4, modeled use of the Wind Farm Area by bird species with high displacement sensitivity is low. A complete list of species included in the higher displacement sensitivity group can be found in Robinson Willmott et al. (Robinson Willmott et al. 2013). Because the Wind Farm Area is not likely to contain important foraging habitat for the species susceptible to displacement, BOEM expects this loss of habitat to be insignificant. Population-level, long-term impacts resulting from habitat loss would likely be negligible.

Using the assumptions in Table F-3, there could be up to approximately 3,044 WTGs within the geographic analysis area. Of these, a maximum of 98 WTGs would result from the proposed Project. The structures associated with the Proposed Action and the consequential impacts would remain at least until decommissioning of the proposed Project is complete. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined impacts arising from the presence of structures from ongoing and planned activities including offshore wind, which would be minor adverse and minor beneficial due to the large number of structures. A majority (approximately 97 percent) of these impacts would occur as a result of structures associated with other offshore wind development. The Proposed Action would account for 3 percent (98 of 3,044) of the new WTGs on the Atlantic OCS. In addition, Ocean Wind has committed to implementing an *Avian and Bat Post-Construction Monitoring Framework* (COP Appendix AB; Ocean Wind 2022) that outlines an approach to post-construction bird monitoring that supports advancement of the understanding of bird interactions with offshore wind farms. The scope of monitoring is designed to meet federal requirements (30 CFR 585.626(b)(15) and 585.622(b)) and is scaled to the size and risk profile of the Project with a focus on species of conservation concern.

Generally, onshore operation is not expected to pose any significant IPFs (i.e., hazards) to birds because activities would disturb little if any habitat, and the transmission lines would be primarily below ground. Overhead transmission lines are unlikely to be a significant IPF because they are short (less than 0.5 mile [0.8 kilometer]); they are in existing, highly disturbed, industrial areas that are unlikely to provide important bird habitat; and best practices, such as implementing Avian Power Line Interaction Committee (2012) standard design guidance to the extent practicable, would be used to minimize potential impacts from collision and electrocution.

Traffic (aircraft): The expected impacts of aircraft traffic associated with the Proposed Action would be negligible, similar to those of the No Action Alternative. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined aircraft traffic impacts from ongoing and planned activities including offshore wind, which would be negligible.

Land disturbance (onshore construction): The expected impacts of onshore construction associated with the Proposed Action would not increase the impacts of this IPF beyond those described under the No Action Alternative. Ocean Wind proposes to use trenchless technology (e.g., HDD) to go under barrier beaches, which would avoid beach habitat for nesting shorebirds; as such, temporary impact on birds, particularly nesting shorebirds, resulting from the landfall location would be negligible.

Collisions between birds and vehicles or construction equipment have some limited potential to cause mortality. However, these temporary impacts, if any, would be negligible, as most individuals would avoid noisy construction areas (Bayne et al. 2008, Goodwin and Shriver 2010, McLaughlin and Kunc 2013).

Overall, impacts on bird habitat from onshore construction activities would be limited because, whenever possible, facilities (including overhead transmission lines) would be co-located with existing developed areas (i.e., roads and existing transmission lines) to limit disturbance. The maximum design for the Oyster Creek cable corridor would require an approximate construction disturbance up to 5.3 miles long and 50 feet wide and a permanent easement up to 30 feet wide, equating to approximately 32 acres of total disturbance and 19 acres of permanent disturbance. The maximum design for the BL England cable corridor would require an approximate construction disturbance up to 8 miles long and 50 feet wide and a permanent easement up to 30 feet wide, equating to approximately 48 acres of total disturbance and 29 acres of permanent disturbance. While most of this disturbance would occur in already disturbed areas that would provide little, if any, bird habitat, construction of onshore facilities may require clearing and some permanent removal of some trees and shrubs (COP Volume II, Sections 2.2.1.2.1 and 2.2.3.2.1; Ocean Wind 2022).

Clearing and grading during construction within temporary workspaces would result in temporary loss of forage and cover for birds within the area. Construction of the onshore substations would result in temporary and permanent impacts on habitat from construction of the permanent substation facilities and use of temporary construction workspace. However, the existing habitat at the proposed onshore substation sites at BL England and Oyster Creek is already developed and fragmented. The BL England and Oyster Creek substation sites would require approximately 13 and 31.5 acres, respectively. Any remnant habitat within the permanent substation site would be converted to developed land with landscaping for the duration of the Project's operational lifetime (COP Volume 2, page 126; Ocean Wind 2022). Landscaped areas would provide some habitat for species acclimated to human activity. However, the work would not affect habitat outside the construction area.

Impacts on nesting bald eagles are not anticipated because, as described in Section 3.7.1, no bald eagle nest activity has been identified along or adjacent to any of the onshore Project components. Peregrine falcons have been documented throughout the Onshore Project area (see COP Appendix H, Figure 3-11; Ocean Wind 2022), with nesting documented in the vicinity of the landfall sites (see Section 3.7.1) but none in the location of an onshore Project component. Due to the short duration of the activities and the APMs (see COP Volume II, Table 1.1-2; Ocean Wind 2022) that Ocean Wind has committed to implementing to reduce impacts, population-level impacts on birds from habitat modification and impacts are unlikely. Given the nature of the existing habitat, its abundance on the landscape, and the temporary nature of construction, the impacts on birds are expected to be negligible.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined impacts associated with onshore construction from ongoing and planned activities including offshore wind, which would be expected to be negligible. Onshore land disturbance would not be expected to result in noticeable change to the condition of birds in the geographic analysis area.

3.7.5.1. Conclusions

Overall, the Proposed Action would have **negligible** to **minor** impacts on birds, depending on the location, timing, and species affected by an activity. The primary factors of the Proposed Action affecting birds are habitat loss and collision-induced mortality from rotating WTGs and permanent habitat loss and conversion from onshore construction. The Proposed Action would also result in potential **minor beneficial** impacts associated with foraging opportunities for marine birds.

In context of other reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on birds would be undetectable. BOEM anticipates that the overall impacts on birds in the geographic analysis area associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be **moderate** adverse and **moderate beneficial**. Climate change and the presence of operating WTGs may result in habitat loss and mortality. The Proposed Action would contribute to the overall impacts primarily through the permanent impacts from the presence of structures.

3.7.6 Impacts of Alternatives B, C, and D on Birds

The impacts resulting from Alternatives B, C, and D would be less than or similar to those described under the Proposed Action. BOEM expects the elimination of WTGs under Alternatives B-1 (up to 9 WTGs), B-2 (up to 19 WTGs), and D (up to 15 WTGs) to have a reduced impact on birds given the smaller number of WTGs compared to the Proposed Action. BOEM does not expect relocation of the eight WTGs and compression of the 98 WTGs under Alternatives C-1 and C-2, respectively, to significantly change the potential impacts compared to the Proposed Action because the total number of WTGs would remain the same, the overall footprint would be the same or slightly less, and the Wind Farm Area does not include areas with high bird densities.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, C, and D to the overall impacts on birds would be similar to those described under the Proposed Action. However, the differences in impacts among Alternatives B, C, and D would still apply when considered alongside the impacts of other ongoing and planned activities. Therefore, impacts on birds would be similar under Alternatives C-1 and C-2 and slightly lower but not materially different under Alternatives B-1, B-2, and D.

3.7.6.1. Conclusions

As discussed in the above sections, the expected **negligible** to **minor** impacts and potential **minor beneficial** impacts associated with the Proposed Action alone would not change substantially under Alternatives B, C, and D. While Alternatives B, C, and D have some potential to result in slightly different impacts on birds, the same construction, O&M, and decommissioning activities would still occur, albeit at differing scales in some cases. Alternatives B-1, B-2, and D may result in slightly less, but not materially different, negligible to minor impacts and minor beneficial impacts on species with high collision sensitivity and high displacement sensitivity due to a reduced number of WTGs and Project area. Alternative C-1 would have the same WTG number and overall Wind Farm Area footprint as the Proposed Action and, therefore, would have similar negligible to minor impacts and minor beneficial impacts on species with higher collision sensitivity and higher displacement sensitivity. Alternative C-2 would have the same number of WTGs as the Proposed Action, but compressed into a smaller footprint, and, therefore, would have similar negligible to minor impacts and minor beneficial impacts on species with higher collision sensitivity and higher displacement sensitivity.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, C, and D to the overall impacts on birds would be undetectable. BOEM anticipates that the overall impacts of Alternatives B, C, and D when each combined with the impacts from ongoing and planned activities including offshore wind would be **moderate** adverse due to behavioral avoidance and temporary or permanent displacement, injury, and mortality, and may include **moderate beneficial** impacts due to the presence of structures, which may provide increased foraging opportunities for bird species within the geographic analysis area.

3.7.7 Impacts of Alternative E on Birds

The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Project under Alternative E would be similar to those described under the Proposed Action because Alternative E would differ only with respect to a short distance of onshore export cable at the landing site for Oyster Creek (see Figure 2-11). The only IPFs that would be meaningfully different under Alternative E compared to the Proposed Action are land disturbance and new cable emplacement/maintenance. All other offshore and onshore Project components of Alternative E would be the same as those of the Proposed Action and the other IPFs are not anticipated to differ.

In contrast to the Proposed Action, which includes two Oyster Creek cable route options as part of Ocean Wind's PDE to cross Island Beach State Park, Alternative E would cross Island Beach State Park on the more northerly route where SAV impacts would be avoided (refer to Section 2.1.6). BOEM expects that the modifications to the Oyster Creek export cable route to avoid impacts on SAV in Barnegat Bay under Alternative E would not significantly change the overall potential impact compared to the Proposed Action. While minimization of SAV impacts under Alternative E would benefit bird species that could use this habitat, Alternative E would affect an additional 0.9 acre of undisturbed scrub/shrub dune and wetland habitat compared to the southern cable route under the Proposed Action. The impact on this habitat, which can support federally and state-listed bird foraging and nesting habitat, would occur in the vicinity of an existing maintenance/storage yard across from the Park Office on Central Avenue/Shore Road and would be a primarily temporary impact to support HDD staging and workspace, but some permanent cable easements would be required after the staging and workspaces are restored.

Alternative E would place the export cable route along the parking area and Central Avenue/Shore Road, where vegetation impacts are anticipated to be minimal. While the construction duration under Alternative E could be longer than under the Proposed Action if the southern cable route option is constructed due to the slightly increased cable length, non-habitat impacts (e.g., noise) would be temporary and short term, lasting only the duration of construction. Any timing restrictions for construction to avoid impacts on birds would be the same as under the Proposed Action for potential habitats for sensitive species or as required by federal and state agency requirements.

In the aquatic environment, cable emplacement would still result in short-term and localized sediment suspension and individual birds would be expected to successfully forage in nearby areas. Impacts on bird habitat from onshore construction activities under Alternative E would remain relatively limited because facilities would be co-located with existing developed areas (i.e., roads, parking areas, and existing maintenance yards) to limit disturbance and affected habitats would be mostly restored. The impacts of Alternative E would not be materially different than those described under the Proposed Action.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the overall impacts on birds would be similar to those described under the Proposed Action.

3.7.7.1. Conclusions

The expected **negligible** to **minor** impacts and potential **minor beneficial** impacts associated with the Proposed Action alone would not change substantially under Alternative E. While Alternative E has some potential to result in slightly different impacts on birds, the same construction and installation, O&M, and decommissioning activities would still occur. Alternative E would result in similar negligible impacts on birds in relation to sediment disturbance and turbidity, and minor impacts for onshore ground disturbance due to the potential temporary and permanent impacts on bird habitat.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the overall impacts on birds would be undetectable. BOEM anticipates that the overall impacts on birds associated with Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **moderate** adverse and may include **moderate beneficial** impacts. This impact rating is driven primarily by ongoing activities as well as the presence of operating WTGs on the OCS.

3.7.8 Proposed Mitigation Measures

If the reported post-construction bat monitoring results (generated as part of Ocean Wind's *Avian and Bat Post-Construction Monitoring Framework* [COP Appendix AB, Ocean Wind 2022]) indicate bird impacts deviate substantially from the impact analysis included in this EIS, then Ocean Wind must make recommendations for new mitigation measures or monitoring methods (refer to Appendix H, Table H-2). In addition, while the significance level of impacts would remain the same, BOEM could further reduce bird impacts by requiring, as conditioned as part of the COP approval, installation of bird deterrent devices to minimize bird attraction to operating WTGs and on the OSS, where and if appropriate (refer to Appendix H, Table H-2).

3.8. Coastal Habitat and Fauna

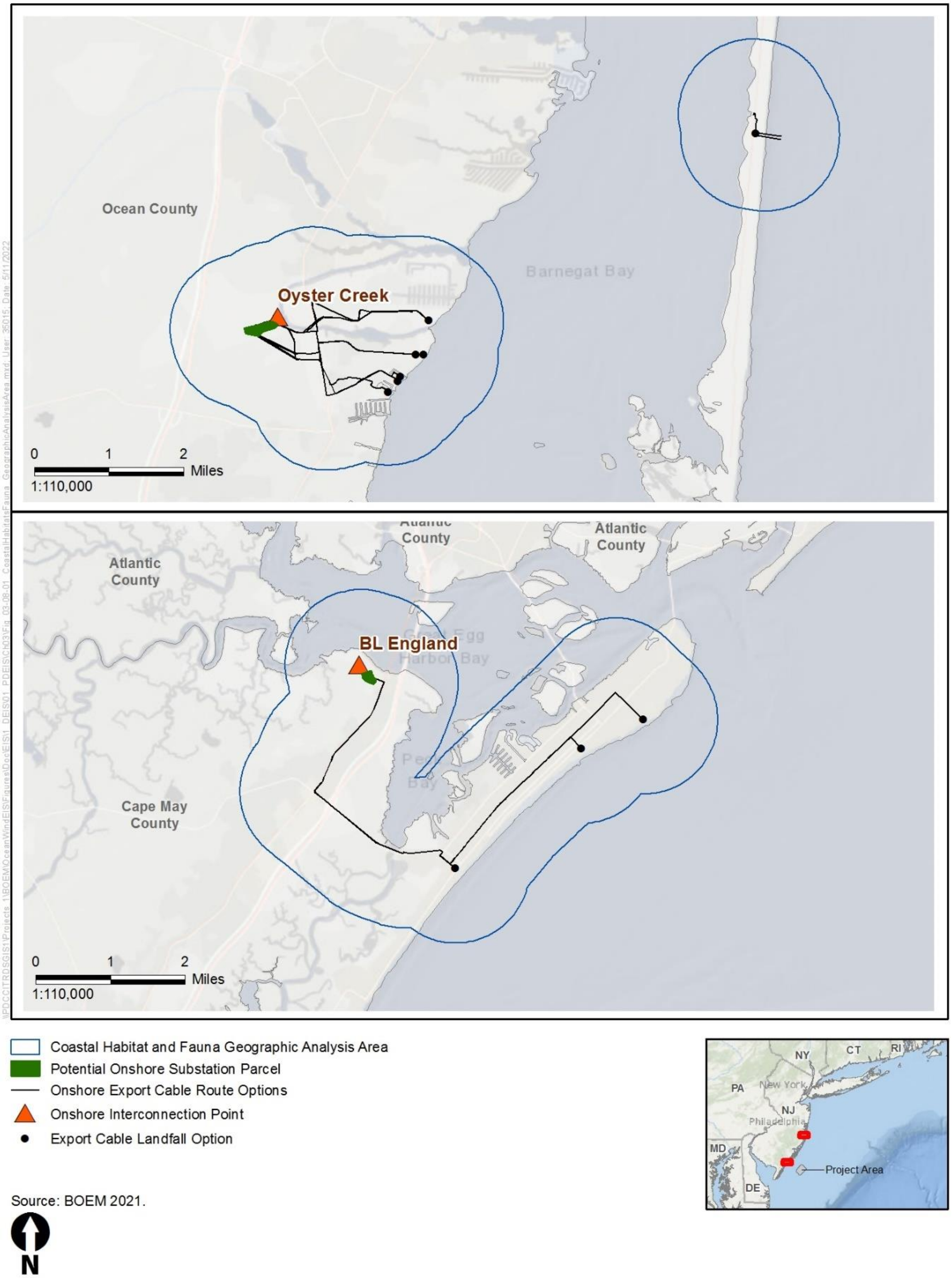
This section discusses potential impacts on coastal habitat and fauna resources from the Proposed Action, alternatives, and ongoing and planned activities in the coastal habitat and fauna geographic analysis area. Coastal habitat includes flora and fauna within state waters (which extend 3 nm from the shoreline) inland to the mainland, including the foreshore, backshore, dunes, and interdunal areas. The coastal habitat and fauna geographic analysis area, as shown on Figure 3.8-1, includes the area within a 1.0-mile (1.6-kilometer) buffer of the Onshore Project area that includes the export cable landfalls, onshore export cable routes, the onshore substation, and the connection from the onshore substation to the points of interconnection at Oyster Creek and BL England. BOEM expects the resources in this area to have small home ranges. These resources are unlikely to be affected by impacts outside their home ranges.

This section analyzes the affected environment and environmental consequences of the Proposed Action and alternatives on coastal flora and fauna, including special-status species. The affected environment and environmental consequences of Project activities that are within the geographic analysis area and extend into state waters (i.e., HDD for cable landfalls and cable laying within 1 mile [1.6 kilometers] of cable landfalls) are presented in Sections 3.6, *Benthic Resources*; 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*; 3.15, *Marine Mammals*; 3.19, *Sea Turtles*; and 3.21, *Water Quality*. Additional information on birds, bats, and wetlands is presented in Section 3.7, *Birds*; Section 3.5, *Bats*; and Section 3.22, *Wetlands*, respectively.

3.8.1 Description of the Affected Environment for Coastal Habitat and Fauna

This section describes vegetation communities under existing conditions in upland portions of the geographic analysis area and includes information about special-status species and habitats within the Onshore Project area. Vegetation communities occurring in wetlands are described in Section 3.22, *Wetlands*. Benthic resources, including SAV, are described in Section 3.6, *Benthic Resources*.

The Project is within the Atlantic and Gulf Coast Lowland Forest and Crop Region. This land resource region is composed of coastal lowlands, coastal plains, drowned estuaries, tidal marshes, islands, and beaches along the Atlantic Coast. Native vegetation in most of the region is a mixture of pines and hardwoods (USDA NRCS 2006). This section also describes fauna occurring in upland portions of the geographic analysis area. Bats and birds are described in Sections 3.5 and 3.7, respectively.



Source: BOEM 2021.

Figure 3.8-1 Coastal Habitat and Fauna Geographic Analysis Area

Coastal Flora Special-Status Species and Habitats

The USFWS Information for Planning, and Consultation system was used to determine the potential presence of special-status floral species under the jurisdiction of USFWS within the geographic analysis area (USFWS 2021a). USFWS indicates that five threatened or endangered plant species may occur within the geographic analysis area: American chaffseed (*Schwalbea americana*—endangered), Knieskern's beaked-rush (*Rhynchospora knieskernii*—threatened), seabeach amaranth (*Amaranthus pumilus*—threatened), sensitive joint-vetch (*Aeschynomene virginica*—threatened), and swamp pink (*Helonias bullata*—threatened). USFWS has not designated or proposed critical habitat for any of these listed species. The habitat requirements for these five species are summarized below, taken from federally listed species descriptions provided by the New Jersey Field Office of USFWS (USFWS 2021b).

- **American chaffseed** occurs in highly diverse communities consisting of grasses, sedges, and savanna dicots. It is mainly found in early successional habitats described as open, moist pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and dry sandy soils, bog borders, and other open grass-sedge systems. This species is dependent on fire, mowing, or fluctuating water tables to maintain the open to partly open conditions it requires.

- **Knieskern's beaked-rush** is an obligate wetland species that is endemic to New Jersey. It occurs in early successional wetland habitats, often on bog-iron substrates adjacent to slow-moving streams in the Pinelands region. This species is also found in abandoned borrow pits, clay pits, ditches, rights-of-way, and unimproved roads that exhibit similar early successional stages due to water fluctuation or periodic disturbance from vehicles, mowing, or fire. It is intolerant of shade and competition, especially from woody species, and is sometimes found on relatively bare substrates.

- **Seabeach amaranth** is an annual plant that is endemic to Atlantic Coast beaches and barrier islands. The primary habitat of seabeach amaranth consists of overwash flats at accreting ends of islands, lower foredunes, and upper strands of non-eroding beaches (landward of the wrack line). The plant grows on a nearly pure sand substrate, occasionally with shell fragments mixed in, above the high tide line and is intolerant of even occasional flooding during its growing season.

- **Sensitive joint-vetch** is an annual member of the pea family that inhabits the intertidal zone of fresh to brackish tidal river segments, typically in areas where sediments accumulate and extensive marshes are formed. It requires bare or sparsely vegetated substrate and usually grows on river banks within 6 feet of the low water mark. It can also occur on accreting point bars and in sparsely vegetated microhabitats of tidal marsh interiors.

- **Swamp pink** is an obligate wetland species that occurs in a variety of palustrine forested wetlands, including swampy forested wetlands bordering meandering streamlets, headwater wetlands, sphagnous Atlantic white-cedar swamps, and spring seepages. Specific hydrologic requirements limit its occurrence within these wetlands to areas that are perennially saturated, but not inundated. Swamp pink is shade tolerant and is often found growing on hummocks formed by trees, shrubs, and sphagnum moss (*Sphagnum* spp.).

The New Jersey Natural Heritage Database has documented several rare plants in the Oyster Creek Onshore Project area in addition to those described above, including smooth orange milkweed (*Asclepias lanceolata*), seabeach sedge (*Carex silicea*), large-fruit fireweed (*Erechtites hieraciifolia* var. *megalocarpa*), swamp-pink (*Helonias bullata*), seabeach sandwort (*Honckenya peploides* var. *robusta*), bog asphodel (*Narthecium americanum*) (three records), sea-beach knotweed (*Polygonum glaucum*), pale beaked-rush (*Rhynchospora pallida*), curly grass fern (*Schizaea pusilla*) (two records), saltmarsh bulrush (*Schoenoplectus maritimus*), and pine barren bellwort (*Uvularia puberula* var. *nitida*). The BL England Onshore Project area contains one record of a New Jersey state rare plant: sea-beach evening-primrose (*Oenothera humifusa*). The New Jersey Natural Heritage Database also identified one rare ecological community in the Oyster Creek Onshore Project area: coastal dune woodland. Ocean Wind would coordinate with NJDEP and 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 (APM TCHF-01; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2022). In addition, Island Beach State Park and Ocean City have Beach Management Plans that provide a framework for protecting federally and state-listed plant species that occur along the beach habitats (Island Beach State Park 2017; City of Ocean City 2016). Ocean Wind would need to coordinate with the local beach management entity and comply with any requirements of the beach management plans.

Coastal Fauna Special-Status Species

The geographic analysis area contains protected species habitat based on NJDEP's Landscape Project 3.3 data. Areas with Rank 3, 4, or 5 designations are considered most critical because they represent habitat areas utilized by species on the State Threatened, State Endangered, and Federal Threatened and Endangered Species lists (NJDFW 2017a, 2017b). As depicted on Figure 2.2.1-1 of the COP (Ocean Wind 2022), most of the BL England area contains Rank 4 habitat, indicating documented occurrences of state-listed endangered species or habitats. Portions of the coastline are designated as Rank 5 habitat, indicating documented occurrences of federally listed endangered species or habitats. All Rank 5 habitat is classified based on the potential occurrence of federally listed birds, which are addressed in Section 3.7. As depicted on Figure 2.2.1-2 of the COP, the Oyster Creek area contains a mix of Rank 3 and Rank 4 habitat, indicating documented occurrences of state-listed threatened and endangered species or habitat, respectively (Ocean Wind 2022). Fragmented Rank 1 habitat, indicating habitat patches meeting habitat-specific suitability requirements but no confirmed occurrences of special-status species, is mapped throughout, and Rank 5 habitat is designated within Oyster Creek for federally listed sea turtles, which are addressed in Section 3.19. Additionally, the proposed HDD exit pits and export cable routes on Island Beach State Park are adjacent to habitats designated as Rank 5 for federally listed birds (see Section 3.7).

The USFWS Information for Planning, and Consultation system was accessed to determine the potential presence of special-status faunal species under the jurisdiction of USFWS within the geographic analysis area (USFWS 2021a). Six faunal species under the jurisdiction of USFWS may occur: northern long-eared bat (*Myotis septentrionalis*—threatened), eastern black rail (*Laterallus jamaicensis* ssp. jamaicensis—threatened), piping plover (*Charadrius melodus*—threatened), red knot (*Calidris canutus rufa*—threatened), roseate tern (*Sterna dougallii*—endangered), and bog turtle (*Clemmys muhlenbergii*—threatened). The monarch butterfly (*Danaus plexippus*) is currently a candidate for federal listing and could occur in the geographic analysis area. Candidate species are provided no statutory protection under the ESA. USFWS has either not designated or proposed critical habitat for these species or designated or proposed critical habitat is not within the geographic analysis area. In addition to the federally listed species, the following state-listed species may occur, according to the NJDEP Landscape Project: bobcat (*Lynx rufus*—state-listed as endangered), corn snake (*Elaphe guttata*—state-listed as endangered), northern pine snake (*Pituophis melanoleucus*—state-listed as threatened), timber rattlesnake (*Crotalus horridus*—state-listed as endangered), wood turtle (*Glyptemys insculpta*—state-listed as threatened), Pine Barrens treefrog (*Hyla andersonii*—state-listed as threatened), and Cope's gray treefrog (*Hyla chrysoscelis*—state-listed as endangered). Northern long-eared bats are discussed in Section 3.5, and eastern black rail, piping plover, red knot, and roseate tern are discussed in Section 3.7. The remaining species' habitat requirements are summarized below, taken from the New Jersey Endangered and Threatened Species Field Guide (Conserve Wildlife Foundation of New Jersey 2021) and USFWS species reports (USFWS 2021b).

- **Bog turtle** habitat includes well-drained, calcareous fens, sphagnum bogs, and wet, grassy pastures with soft, thick, mucky substrates and tussock-forming herbaceous vegetation. Open areas are required for basking and nesting. Emergent wetland areas recently or currently used as pastures are common places to find bog turtles, as grazing maintains open areas and keeps the ground soft.

- **Monarch butterfly** caterpillars feed almost exclusively on milkweed (*Asclepias* spp.) and as adults feed on nectar from a wide range of flowers. In the spring, summer, and early fall, they can be found in New Jersey wherever there is milkweed and other native nectar plants.
- **Bobcat** habitat typically consists of large areas of contiguous forest and fragmented forests interspersed with agricultural areas or early successional vegetation. Bobcats often utilize rock outcrops, caves, and ledges for shelter and cover for hunting, resting, and rearing young. When rocky areas are unavailable, swamps, bogs, conifer stands, and rhododendron and mountain laurel thickets can provide cover and hunting grounds.
- **Corn snake** habitat is primarily mature upland pine forests with stump holes, uprooted trees, rotten logs, and sandy or loamy soils. These features allow corn snakes to burrow. Abandoned buildings or foundations provide nesting and hibernation habitat. They require a nearby water source such as a stream or pond and utilize open fields and forest edges for foraging.
- **Northern pine snakes** live in dry pine and oak forests with sandy soils. Disturbances, both natural and human, create openings used for nesting, basking, and burrowing, and sandy soils allow them to dig out burrows for hibernating and summer denning.
- **Timber rattlesnakes** are typically found in pinelands habitats in southern New Jersey that consist primarily of pitch pine, shortleaf pine, scrub oak, blackjack oak, and blueberry (*Vaccinium* spp.). Dens are usually found in cedar swamps and along streambanks.
- **Wood turtles** reside in both aquatic and terrestrial environments. Aquatic habitats are required for mating, feeding, and hibernation, while terrestrial habitats are used for foraging and egg laying. Freshwater streams, brooks, creeks, or rivers that are relatively remote provide the habitat needed by these turtles. These tributaries are characteristically clean, free of litter and pollutants, and located within undisturbed uplands such as fields, meadows, or forests. Wood turtle habitats typically contain few roads and are often over 0.5 mile away from developed or populated areas.
- **Pine Barrens treefrog** habitat consists of acidic Atlantic white cedar swamps and pitch pine lowlands associated with dense sphagnum moss. The species requires an open-canopy, dense shrub layer, and heavy ground cover in sandy and mucky soils. Breeding areas include vernal pools, bogs, and seepage areas with approximately 12 to 24 inches (30 to 61 centimeters) of acidic water. More-disturbed areas such as roadside ditches, vehicle ruts, and borrow pits may also serve as breeding areas, provided enough associated vegetation is present.
- **Cope’s gray treefrogs** utilize both aquatic and terrestrial habitats. They spend most of their time high in the trees, except during breeding season when they are at the water’s edge. Breeding pools include vernal pools, gravel pits, retention basins, floodplain corridors, bogs, weedy lakes, cattail or sedge marshes, and farm ponds, typically within or near deciduous or mixed forest, with bare horizontal branches over water near preferred calling sites.

Other state special concern species that could potentially occur in the geographic analysis area include the spotted turtle (*Clemmys guttata*), northern diamondback terrapin (*Malaclemys terrapin terrapin*), and eastern box turtle (*Terrapene carolina carolina*) (Ocean Wind 2022). Ocean Wind would coordinate with NJDEP and 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 (APM TCHF-01; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2022). In addition, Island Beach State Park and Ocean City have Beach Management Plans that provide a framework for protecting federally and state-listed animal species that occur along the beach habitats (Island Beach State Park 2017; City of Ocean City 2016). Ocean Wind would need to coordinate with the local beach management entity and comply with any requirements of the beach management plans.

BL England

BL England Flora

The proposed landfall sites are along the coastline of the barrier island, within Ocean City, New Jersey. The landfall locations would be primarily in developed areas. However, unvegetated beaches and vegetated dunes occur along the coastline. American beachgrass (*Ammophila breviligulata*) is the primary plant species found on foredunes in New Jersey (New Jersey Sea Grant Consortium n.d.). Multiple species of plants colonize areas landward of the foredunes; in New Jersey, these species typically include rugosa rose (*Rugosa rosa*), bayberry (*Morella pensylvanica*), and goldenrod (*Solidago* sp.) (New Jersey Sea Grant Consortium n.d.).

From the coastline, the onshore export cable route(s) would traverse heavily developed sections of Ocean City, New Jersey. This area is largely devoid of vegetation except for some landscape plants and maintained lawns. Farther inland, the onshore export cable route(s) would traverse areas of mixed forested communities interspersed with suburban development. The upland forests are characterized by pines, especially pitch pine (*Pinus rigida*) and shortleaf pine (*P. echinata*). Pitch pine is the most abundant, and its associations include shortleaf pine and oaks. Communities within the upland association include pine-black oak (*Quercus velutina*), pine-black oak-scrub oak (*Q. berberidifolia*), and oak-pine (Ocean Wind 2022 citing Atlantic County 1973). The location proposed for the onshore substation was once a golf course and is now dominated by herbaceous vegetation and interspersed trees. The vegetation communities at the substation site are similar to those along the onshore export cable route(s). Table 2.2.1-1 of the COP provides a list of common plant species occurring in the BL England area (COP Volume II, Section 2.2.1.1.1; Ocean Wind 2022).

Suitable habitat for seabeach amaranth is present along the Ocean City coastline within the upper beach zone, above the high tide line. These areas are generally depicted as “barren land” along the coastline on Figure 2.3.5-1 of the COP (Ocean Wind 2022). Open meadows that would provide suitable habitat for American chaffseed are present within the BL England area, although it is unlikely that any areas provide the appropriate disturbance regime required for the plant to germinate and grow. Wetland habitats that would provide suitable habitat for Knieskern’s beaked-rush, sensitive joint-vetch, and swamp pink do not occur within the BL England area.

BL England Fauna

Ghost or sand crabs (Ocypodidae) are likely to occur on the upper beach and edge of the dunes (Wootton et al. 2016). Due to the fragmentation and urbanization of the upland forest along the export cable route, animal species commonly found in these habitats in New Jersey would be most likely to occur. Common mammal species would likely include the gray squirrel (*Sciurus carolinensis*), eastern cottontail (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), red fox (*Vulpes vulpes*), and house mouse (*Mus musculus*). Common reptiles would likely include the black rat snake (*Pantherophis obsoletus*) and eastern garter snake (*Thamnophis sirtalis*). Common amphibians may include the spring peeper (*Pseudacris crucifer*) and gray treefrog (*Hyla versicolor*). The open fields at the proposed onshore substation site likely contain small mammals such as the deer mouse (*Peromyscus maniculatus*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), eastern mole (*Scalopus aquaticus*), and short-tailed shrew (*Blarina brevicauda*). As the location of the proposed onshore substation site is less developed, additional species such as the white-tailed deer (*Odocoileus virginianus*) and gray fox (*Urocyon cinereoargenteus*) may inhabit the area. Table 2.2.2-1 of the COP provides a list of animal species potentially occurring in the BL England area (Ocean Wind 2022).

In coordination with USFWS and NJDEP, Ocean Wind commissioned species surveys within portions of the Onshore Project area that contained potentially suitable habitat for listed species. Based on this coordination, a bog turtle Phase 1 Habitat Assessment Survey was conducted on the BL England onshore substation parcel. The surveys found that suitable bog turtle habitat does not occur on the substation parcel. Surveys were not conducted along the BL England landfall site or export cable route(s) because potentially suitable habitat does not occur. As depicted on Figure 2.3.5-1 of the COP (Ocean Wind 2022), the proposed landfall sites and cable route corridors are highly developed, and the wetland crossing along Roosevelt Boulevard contains brackish water, whereas bog turtles are freshwater species. The federal candidate species, monarch butterfly, is likely to utilize the open fields and other undeveloped land where milkweed and other native nectar plants are present. The preferred remote, undisturbed habitats for wood turtle are not present. Corn snake, timber rattlesnake, and northern pine snake may occur in forested uplands, particularly in less developed areas near the substation site. Breeding and non-breeding habitats for Pine Barrens and Cope’s gray treefrog could also occur.

Oyster Creek

Oyster Creek Flora

This EIS evaluates six landfall sites for the Oyster Creek area. All export cable routes would landfall and cross Island Beach State Park prior to traversing Barnegat Bay to the mainland landfall. The mainland landfall site options include landfall locations in Waretown (Ocean Township) and Forked River (Lacey Township). These landfall sites are described in further detail below. From the selected landfall site, the onshore export cable would extend to the proposed onshore substation next to the Oyster Creek Generating Station, which consists of previously disturbed herbaceous vegetation.

Island Beach State Park. The proposed onshore export cable route at Oyster Creek would first make landfall in a parking lot in Island Beach State Park on the Barnegat Peninsula before crossing Barnegat Bay to landfall sites on the mainland. Upland vegetation communities at Island Beach State Park include primary dune, secondary dune, road edge, thicket, bayshore, and maritime forest. The primary dunes are dominated by American beachgrass, with beach pea (*Lathyrus maritimus*), Japanese sedge (*Carex kobomugi*), seaside goldenrod (*Solidago sempervirens*), and sea rocket (*Cakile edentula*) also occurring. The secondary dune community is more diverse than the primary dune community, with representative species including beach plum (*Prunus maritima*), bayberry (*Myrica pensylvanica*), beach heather (*Hudsonia tomentosa*), pineweed (*Hypericum gentianoides*), and salt spray rose (*Rosa rugosa*). Within the thicket, edge, and bayshore communities, 73, 140, and 22 plant species have been identified, respectively. The maritime forest community is dominated by American holly (*Ilex opaca forma sabintegra*), Atlantic white cedar (*Chamaecyparis thyoides*), white oak, and pitch pine (Kennish n.d.; Save Barnegat Bay 2019).

Island Beach State Park is designated as a Natural Heritage Priority Site (i.e., Island Beach Macrosite) and supports populations of state-listed endangered plant species and species of concern plant species such as the seaside sandplant (*Honckenya peploides* var. robusta), seabeach knotweed (*Polygonum glaucum*), seabeach sedge (*Carex silicea*), and sickle-leaf golden-aster (*Pityopsis falcate*) (Ocean Wind 2022).

Waretown and Forked River Landfalls. Six mainland landfall site options and onshore export cable routes would be in Waretown (Ocean Township) and Forked River (Lacey Township), New Jersey. The Lighthouse Drive option is in a developed area devoid of vegetation. Holtec Property and Bay Parkway occur in wetland areas (see Section 3.22 for a description of vegetative communities in wetlands). Other options would landfall within the Lighthouse Marina or Nautilus Drive and predominantly follow public right-of-way and previously disturbed areas or traverse private land. Upland communities farther west from the landfall site options along the onshore export cable route options include coniferous and mixed forests. These communities are typically dominated by oaks and pines. Table 2.2.1-2 of the COP provides a list of common plant species occurring in the Waretown and Forked River portions of the Oyster Creek area (COP Volume II, Section 2.2.1.1.1; Ocean Wind 2022).

Suitable habitat for seabeach amaranth is present within all of the Oyster Creek landfall and export cable route options, including on Island Beach State Park. Suitable locations are present along the coastline within the upper beach zone, above the high tide line. In 2019, 1,591 seabeach amaranth plants were counted at Island Beach State Park, a more than 500-percent increase from the 2018 total of 307 plants (Conserve Wildlife Foundation of New Jersey 2019). Open meadows that would provide suitable habitat for American chaffseed are not present. Wetlands within the Holtec Property and Bay Parkway landfall sites may provide suitable habitat for Knieskern's beaked-rush, sensitive joint-vetch, and swamp pink; wetland habitats are discussed in detail in Section 3.22. In coordination with USFWS, Ocean Wind commissioned species surveys within portions of the Onshore Project area that contained potentially suitable habitat for listed species. Based on this coordination, surveys were conducted for swamp pink and Knieskern's beaked-rush within the forested wetlands and ditch areas of the Holtec Property of Lacey Township. These surveys were conducted by a Professional Wetland Scientist with rare plant survey experience and were timed to coincide with the fruiting/blooming period for the species. No individuals of either species were observed during these surveys.

Oyster Creek Fauna

Long Beach Island would be expected to support wildlife species adapted to suburban and urban environments such as the Virginia opossum, eastern cottontail, Norway rat (*Rattus norvegicus*), house mouse, red fox, and raccoon. Reptile and amphibian species may include the American bullfrog (*Lithobates catesbeianus*), green frog (*Lithobates clamitans*), common snapping turtle (*Chelydra serpentina*), northern water snake (*Nerodia sipedon*), eastern garter snake, and rough green snake (*Opheodrys aestivus*) (Ocean County Planning Department 1976).

More than 30 species of land mammals occur in the Barnegat Bay watershed, which encompasses the remaining landfall sites and onshore export cable routes in the Oyster Creek area. Forest-dwelling species include the red fox, gray fox, raccoon, long-tailed weasel (*Mustela frenata*), short-tailed weasel (*Mustela erminea*), striped skunk, Virginia opossum, gray squirrel, red squirrel (*Tamiasciurus hudsonicus*), chipmunk (*Tamias striatus*), southern flying squirrel (*Glaucomys volans*), white-footed mouse, and pine vole (*Microtus pinetorum*). Species such as the red fox and raccoon occur on both the mainland and barrier islands, while white-tailed deer is found only on the mainland. Shrubland and grassland mammals include the meadow vole, meadow jumping mouse (*Zapus hudsonius*), woodchuck (*Marmota monax*), and eastern cottontail, as well as several of the species also found in forested areas (Kennish n.d.).

Three species of lizards occur in the Barnegat Bay region: the fence lizard (*Sceloporus undulatus hyacinthinus*), ground skink (*Scincella lateralis*), and five-lined skink (*Eumeces fasciatus*). Upland snake species include the black racer (*Coluber constrictor*), northern pine snake, corn snake, worm snake (*Carphophis punctatus*), and eastern hognose snake (*Heterodon platirhinos*). The box turtle (*Terrapene carolina*) is the only upland turtle species occurring in the area. Common salamander species include the red-backed salamander (*Plethodon cinereus*), northern two-lined salamander (*Eurycea bislineata*), four-toed salamander (*Hemidactylium scutatum*), and northern red salamander (*Pseudotriton ruber*). Widespread frog and toad species include the northern spring peeper (*Pseudacris crucifer*), northern gray treefrog (*Hyla versicolor*), New Jersey chorus frog (*Pseudacris triseriata kalmi*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans melanota*), wood frog (*Rana sylvatica*), southern leopard frog (*Rana utricularia*), pickerel frog (*Rana palustris*), and Fowler's toad (*Bufo woodhousii fowleri*) (Kennish n.d.). Table 2.2.2-2 of the COP provides a list of animal species potentially occurring in the Waretown and Forked River portions of the Oyster Creek area (COP Volume II, Section 2.2.2; Ocean Wind 2022).

Suitable habitat for the federally listed threatened bog turtle does not occur in the Oyster Creek area. Suitable habitat for bog turtle is only present where open-canopy freshwater wetlands with mucky substrates and tussock-forming vegetation are present. The state-listed threatened bobcat is unlikely to frequent the area due to the urban environment and proximity to roads and other human disturbance. Monarch butterfly is likely to occur throughout the Oyster Creek area in undeveloped lands or gardens where milkweed and other native nectar plants are present. Suitable habitat for the northern pine snake, timber rattlesnake, Pine Barrens treefrog, and Cope's gray treefrog is likely present in the less developed portions of the landfall sites, onshore export cable route, and substation area.

3.8.2 Environmental Consequences

3.8.2.1. Impact Level Definitions for Coastal Habitat and Fauna

Definitions of impact levels are provided in Table 3.8-1. There are no beneficial impacts on coastal habitat and fauna.

Table 3.8-1 Impact Level Definitions for Coastal Habitat and Fauna

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on species or habitat would be so small as to be unmeasurable.
Minor	Adverse	Most impacts on species would be avoided; if impacts occur, they may result in the loss of a few individuals. Impacts on sensitive habitats would be avoided; impacts that do occur are temporary or short term in nature.
Moderate	Adverse	Impacts on species would be unavoidable but would not result in population-level effects. Impacts on habitat may be short term, long term, or permanent and may include impacts on sensitive habitats but would not result in population-level effects on species that rely on them.
Major	Adverse	Impacts would affect the viability of the population and would not be fully recoverable. Impacts on habitats would result in population-level impacts on species that rely on them.

3.8.3 Impacts of the No Action Alternative on Coastal Habitat and Fauna

3.8.3.1. Ongoing and Planned Non-offshore Wind Activities

Under the No Action Alternative, baseline conditions for coastal habitat and fauna would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities. Ongoing activities within the geographic analysis area that contribute to impacts on coastal habitat and fauna are generally associated with onshore impacts, including onshore residential, commercial, and industrial development, and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect coastal flora and fauna through temporary and permanent habitat removal or conversion, temporary noise impacts during construction, and lighting, which could cause avoidance behavior and displacement of animals, as well as injury or mortality to individual animals or loss and alteration of vegetation and individual plants. However, population-level effects would not be anticipated. Climate change and associated sea level rise results in dieback of coastal habitats caused by rising groundwater tables and increased saltwater inundation from storm surges and exceptionally high tides (Sacatelli et al. 2020). Climate change may also affect coastal habitats through increases in instances and severity of droughts and range expansion of invasive species. Warmer temperatures will cause plants to flower earlier, will not provide needed periods of cold weather, and will likely result in declines in reproductive success of plant and pollinator species. Reptile and amphibian populations may experience shifts in distribution, range, reproductive ecology, and habitat availability. Increased temperatures could lead to changes in mating, nesting, reproductive, and foraging behaviors of species, including a change in the sex ratios in reptiles with temperature-dependent sex determination. The effects of climate change on animals will likely include loss of habitat, population declines, increased risk of extinction, decreased reproductive productivity, and changes in species distribution (NJDEP 2020).

Other planned non-offshore wind activities that may affect coastal habitat and fauna primarily include increasing onshore development activities (see Section F.2 in Appendix F for a description of ongoing and planned activities). Similar to ongoing activities, other planned non-offshore wind activities may result in temporary and permanent impacts on animals and vegetation, including disturbance, displacement, injury, mortality, habitat and plant degradation and loss, and habitat conversion. See Table F1-6 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for coastal habitat and fauna.

3.8.3.2. Offshore Wind Activities (without Proposed Action)

BOEM reviewed available information regarding the potential for other offshore wind activities to occur within the geographic analysis area for coastal habitat and fauna. Atlantic Shores South proposes points of interconnection at the Cardiff Substation and Larrabee Substation (Atlantic Shores 2021). Transmission lines rated at 138 kV and higher have sufficient thermal capability to deliver power from an offshore wind project to the utility’s load center. The *New Jersey Offshore Wind Energy: Feasibility Study* identified existing transmission lines and substations rated at 138 kV and above. These substations would be likely potential points of interconnection for future offshore wind activities; however, the substations and likely onshore routes to reach the substations are outside of the geographic analysis area.

Because cable landfalls and onshore infrastructure for other offshore wind projects would not be in the geographic analysis area for coastal habitat and fauna, BOEM does not expect other offshore wind activities to affect coastal habitat and fauna through the primary IPFs. Noise and lighting from other offshore wind construction activities are not expected to reach the geographic analysis area for Ocean Wind 1, which includes onshore and nearshore areas within 1.0 mile (1.6 kilometers) of landfalls and proposed onshore infrastructure. Therefore, increased noise and lighting resulting from other offshore wind activities would not affect coastal habitat and fauna, resulting in a negligible impact.

3.8.3.3. Conclusions

Under the No Action Alternative, baseline conditions for coastal habitat and fauna would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities would have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, and habitat conversion) on coastal habitat and fauna, primarily through onshore construction and climate change. Impacts of ongoing activities on coastal habitat and fauna due to ongoing construction activities would likely be minor, but impacts from climate change could be moderate to major. The impacts of planned activities other than offshore wind would likely be minor. Currently, there are no other offshore wind activities proposed in the geographic analysis area.

Under the No Action Alternative, existing environmental trends and activities would continue, and coastal habitat and fauna would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **moderate** impacts on coastal habitat and fauna, primarily driven by ongoing construction activities and climate change.

3.8.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on coastal habitat and fauna:

- The onshore export cable routes, including routing variants, and extent of land disturbance for new onshore substations, which could require the removal of vegetation.

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

- Onshore export cable routes and substation footprints: The route chosen (including variations of the general route) and substation footprints would determine the amount of habitat affected.

Ocean Wind has committed to measures to minimize impacts on coastal habitat and fauna, including avoiding areas of unique or protected habitat or known habitat for threatened or endangered and candidate species to the extent practicable (TCHF-01) and conducting maintenance and repair activities in a manner to avoid or minimize impacts on sensitive species and habitat such as beaches, dunes, and the near-shore zone (TCHF-02) (COP Volume II, Table 1.1-2; Ocean Wind 2022).

3.8.5 Impacts of the Proposed Action on Coastal Habitat and Fauna

The sections below summarize the potential impacts of the Proposed Action on coastal habitat and fauna and special-status species during the various phases of the Project. Routine activities would include construction, O&M, and decommissioning of the Project, as described in Chapter 2, *Alternatives*. BOEM prepared a BA for the potential effects on USFWS federally listed species, which found that the Proposed Action was *not likely to adversely affect*, or had *no effect*, on listed species (BOEM 2022). BOEM requested concurrence on its conclusion that the impacts of the proposed activities are expected to be discountable and insignificant, and thus *may affect but are not likely to adversely affec*t Knieskern's beaked-rush, sensitive joint-vetch, and swamp pink. The BA concluded that the Proposed Action would have *no effect* on bog turtle, American chaffseed, and seabeach amaranth. Results of consultation with USFWS pursuant to Section 7 of the ESA will be presented in the Final EIS.

Noise: Onshore construction noise associated with the Proposed Action alone is expected to result in short-term, temporary, highly localized, and negligible impacts. Impacts, if any, are expected to be limited to behavioral avoidance of construction activity and noise. The state-listed bobcat, although unlikely to be present within the Onshore Project area due to existing development, could experience stress and negative physiological effects that could affect individuals; however, the species can habituate to human presence (Carroll 2019). Construction would predominantly occur in already developed areas where wildlife is habituated to human activity and noise. Displaced wildlife could use adjacent habitat and would repopulate these areas once construction ceases.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined noise impacts on coastal fauna from ongoing and planned activities including offshore wind, which would likely be minor.

Land disturbance: Impacts from the export cable landfall would vary based on the export cable route option chosen. Landfall would require up to 2 acres of workspace to accommodate two HDD exit pits and workspace, and additional workspace would be required for storage and staging. Most landfall options occur in developed areas; however, some clearing of vegetation may be required. Impacts on unvegetated beaches and vegetated dunes would be avoided for all options by using HDD to transition from offshore to onshore. Construction of the onshore export cable may require clearing and permanent removal of some trees along the edge of the construction corridor. Impacts on herbaceous communities would result from excavation, rutting, compaction, mixing of topsoil and subsoil, and potential alteration of habitat. The maximum design for the Oyster Creek cable corridor would require an approximate construction disturbance up to 5.3 miles long and 50 feet wide and a permanent easement up to 30 feet wide, equating to approximately 32 acres of total disturbance and 19 acres of permanent disturbance. The maximum design for the BL England cable corridor would require an approximate construction disturbance up to 8 miles long and 50 feet wide, and a permanent easement up to 30 feet wide, equating to approximately 48 acres of total disturbance and 29 acres of permanent disturbance. Installation of onshore cable is expected to take up to 30 months. The BL England and Oyster Creek substation sites would require approximately 13 and 31.5 acres, respectively. During construction, up to 3 acres would be required for temporary workspace. Construction of each onshore substation is expected to take up to a maximum of 36 months. The planned improvements to the onshore O&M facility would require permanently filling 0.15 acre of open water habitat, and Ocean Wind has already submitted a permit application to the USACE Philadelphia District for authorization of this impact.

To minimize impacts on sensitive habitat from land disturbance during construction, Ocean Wind proposes to use appropriate installation technology designed to minimize disturbance to sensitive habitat (such as beaches and dunes, wetlands and associated buffers, streams, hard-bottom habitats, seagrass beds, and the near-shore zone) (APM GEN-08; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2022). Areas that would require extensive onshore alterations would be avoided to the extent practicable (APM GEN-03; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2022). Ocean Wind proposes to 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 GEN-13; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2022). Temporarily affected upland and wetland communities would be expected to become reestablished within 1 to 3 years following construction. Permanent loss of wetland habitat could occur if placement of fill is required in wetlands. NJDEP-regulated adjacent transition areas may also be affected by clearing and soil disturbance. Ocean Wind proposes to avoid or minimize wetland impacts by implementing a site-specific monitoring program to ensure compliance with permit conditions during the construction, operation, and decommissioning phases (APM GEN-06; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2022). A detailed discussion of impacts on wetland communities is provided in Section 3.22. See Section 3.6 for information on potential impacts on SAV.

Impacts on habitat from onshore construction activities would be limited because, whenever possible, facilities (including overhead transmission lines) would be co-located with existing developed areas (i.e., roads and existing transmission rights-of-way) to limit disturbance (APM GEN-01; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2022). The existing habitat at the proposed onshore substation sites at BL England and Oyster Creek is already developed and fragmented. Any remnant habitat within the substation sites would be converted to developed land with landscaping for the duration of the Project's operational lifetime. Impacts on special-status plants species could occur due to the degradation of habitat and direct loss of individuals during construction. However, BOEM anticipates that any habitat impacts would not result in population-level effects, given the limited amount of habitat removal. Ocean Wind would coordinate with NJDEP and 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 (APM TCHF-01; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2022). Project implementation would be conditioned upon issuance of applicable federal and state permits and conducted in accordance with federal and state permit conditions. It is anticipated that permit conditions may include BMPs such as implementing seasonal work restrictions to avoid and minimize potential adverse effects on wetlands and protected species, clearly demarcating sensitive areas to avoid disturbance during construction, and controlling runoff and stabilizing soils to minimize the potential for soil erosion and sedimentation in wetlands during construction. Impacts on coastal habitat and fauna from land disturbance would be temporary, localized, and negligible.

For temporary impacts, including the effects of onshore construction, it is likely that a portion, possibly a majority, of such impacts from other planned activities would not overlap temporally or spatially with the Proposed Action. However, temporary impacts can also result in long-term to permanent impacts that would likely be negligible. Ocean Wind would likely abandon the onshore cables in place and relocate components of the onshore electrical infrastructure that may still have substantial life expectancies after 35 years (Chapter 2). Land disturbance during decommissioning would be limited to soil compaction and vegetation trampling, and minimal excavation to bury the ends of abandoned cables and remove certain electrical infrastructure. Therefore, onshore temporary impacts of decommissioning would be negligible.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined land disturbance from ongoing and planned activities including offshore wind, which would likely be minor, as only a small amount of habitat loss would be expected.

Traffic: Collisions between wildlife and vehicles or construction equipment would be rare because most individuals are expected to avoid construction areas or have the mobility to avoid construction equipment. However, individuals of burrowing species (e.g., moles, voles) or those with limited mobility, especially herpetofauna, could be more vulnerable to this impact, particularly during land clearing and ground excavation. Impacts would be short term, temporary during the construction period, and negligible.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined vehicle collision impacts from other ongoing and planned activities including offshore wind, which would likely be negligible.

3.8.5.1. Conclusions

Overall, construction and installation, O&M, and conceptual decommissioning of the Proposed Action would have **minor** impacts on coastal habitat and fauna because habitat impacts would be limited and construction would predominantly occur in already developed areas where wildlife is habituated to human activity and noise.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on coastal habitat and fauna would be undetectable. BOEM anticipates that the overall impacts on coastal habitat and fauna in the geographic analysis area associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be **minor**.

3.8.6 Impacts of Alternatives B, C, and D on Coastal Habitat and Fauna

Because Alternatives B, C, and D involve modifications only to offshore components, impacts on coastal habitat and fauna from those alternatives would be the same as those under the Proposed Action.

3.8.6.1. Conclusions

As discussed above, the anticipated **minor** impacts associated with the Proposed Action would not change under Alternatives B, C, and D.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, C, and D to the overall impacts on coastal habitat and fauna would be undetectable.

BOEM anticipates that the overall impacts of Alternatives B, C, and D when combined with the impacts from ongoing and planned activities including offshore wind would be **minor**.

3.8.7 Impacts of Alternative E on Coastal Habitat and Fauna

The types of impacts under Alternative E would be the same as those described for the Proposed Action. The onshore export cable route on Island Beach State Park under Alternative E would be limited to the slightly longer (about 2,000 feet [600 meters]) northern option. The construction of temporary workspace and installation of the export cable along the parking lot and across Central Avenue/Shore Road would result in 0.9 acre of vegetation clearing. Affected vegetation communities include roadside edges, forested wetlands, and scrub/shrub wetlands which are/are not are designated by NJDFW (2017a) as Rank 4 and 5 habitat due to documented occurrences of state- and federally listed endangered species or habitats; however, these special-status species are all birds and there is no suitable habitat for any non-avian special-status species. Impacts from noise and vehicle collisions would be similar to those of the Proposed Action. Alternative E would traverse Barnegat Bay and use the same landfall sites within the Oyster Creek area.

3.8.7.1. Conclusions

Alternative E could affect slightly more habitat at Island Beach State Park than under the Proposed Action and Alternatives B, C, and D (see Figure 3.22-2 in Section 3.22, *Wetlands*), but impacts on coastal habitat and fauna from onshore construction activities would still remain limited overall. Therefore, the overall **minor** impacts would be similar across all action alternatives.

As with the Proposed Action, if Alternative E is selected, Ocean Wind would conduct site-specific habitat surveys and surveys for individuals in suitable habitat to determine the location and extent of special-status species in the geographic analysis area so they can be avoided during construction, O&M, and decommissioning (TCHF-01).

In the context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the overall impacts on coastal habitat and fauna would be undetectable. BOEM anticipates that the overall impacts on coastal habitat and fauna of Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **minor**.

3.8.8 Proposed Mitigation Measures

No measures to mitigate impacts on coastal habitat and fauna have been proposed for analysis.

3.11. Demographics, Employment, and Economics

This section discusses potential impacts on demographics, employment, and economics from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area, as shown on Figure 3.11-1, includes the counties where proposed onshore infrastructure and potential port cities are located, as well as the counties in closest proximity to the Wind Farm Area: Atlantic, Cape May, Cumberland, Gloucester, Ocean, and Salem Counties, New Jersey; Norfolk County, Virginia; and Charleston County, South Carolina. These counties are the most likely to experience beneficial or adverse economic impacts from the proposed Project.

3.11.1 Description of the Affected Environment for Demographics, Employment, and Economics

Atlantic, Cape May, and Ocean Counties

Atlantic, Cape May, and Ocean Counties are some of the most densely populated coastal communities in the U.S. These counties are notable for coastal activities such as swimming, fishing, surfing, and sailing over the 127 miles of ocean beaches along the Jersey Shore from Sandy Hook to Cape May. Coastal communities provide hospitality, entertainment, and recreation for hundreds of thousands of visitors each year and benefit from high tourism employment. Many coastal amenities such as beaches do not directly generate employment, as they are accessible to the public for free but stimulate the recreation and tourism businesses (COP Volume II, Section 2.3.1.1.1; Ocean Wind 2022).

Data on population, demographics, income, and employment for the state of New Jersey and for Atlantic, Cape May, and Ocean Counties are provided in Table 3.11-1 and Table 3.11-2. The population of Atlantic and Cape May Counties declined between 2010 and 2019 while the population of New Jersey and Ocean County increased. The U.S. Census Bureau estimated the 2019 population of Atlantic County at about 270,000 residents. Atlantic County has the lowest percentage of residents over age 65. The population of Ocean County grew by 4.7 percent from 2010 to 2019, while the population of Atlantic and Cape May Counties declined by 2.6 percent and 4.7 percent, respectively. The population of these counties are all older, on average, than New Jersey as a whole, with a higher percentage of residents aged 65 or older. Atlantic, Cape May, and Ocean Counties compose 10.8 percent of New Jersey’s population (U.S. Census Bureau 2021a). In 2020, unemployment was 9.5 percent in Ocean County, 17.8 percent in Atlantic County, and 13.8 percent in Cape May County, compared to 9.8 percent in New Jersey (U.S. Bureau of Labor Statistics 2021). The average labor force participation rate, that is the proportion of the total population 16 years and older that are in the labor force, was 59 percent in Ocean County, 65 percent in Atlantic County, and 58 percent in Cape May County for the period from 2015 to 2019 (U.S. Census Bureau 2022a).

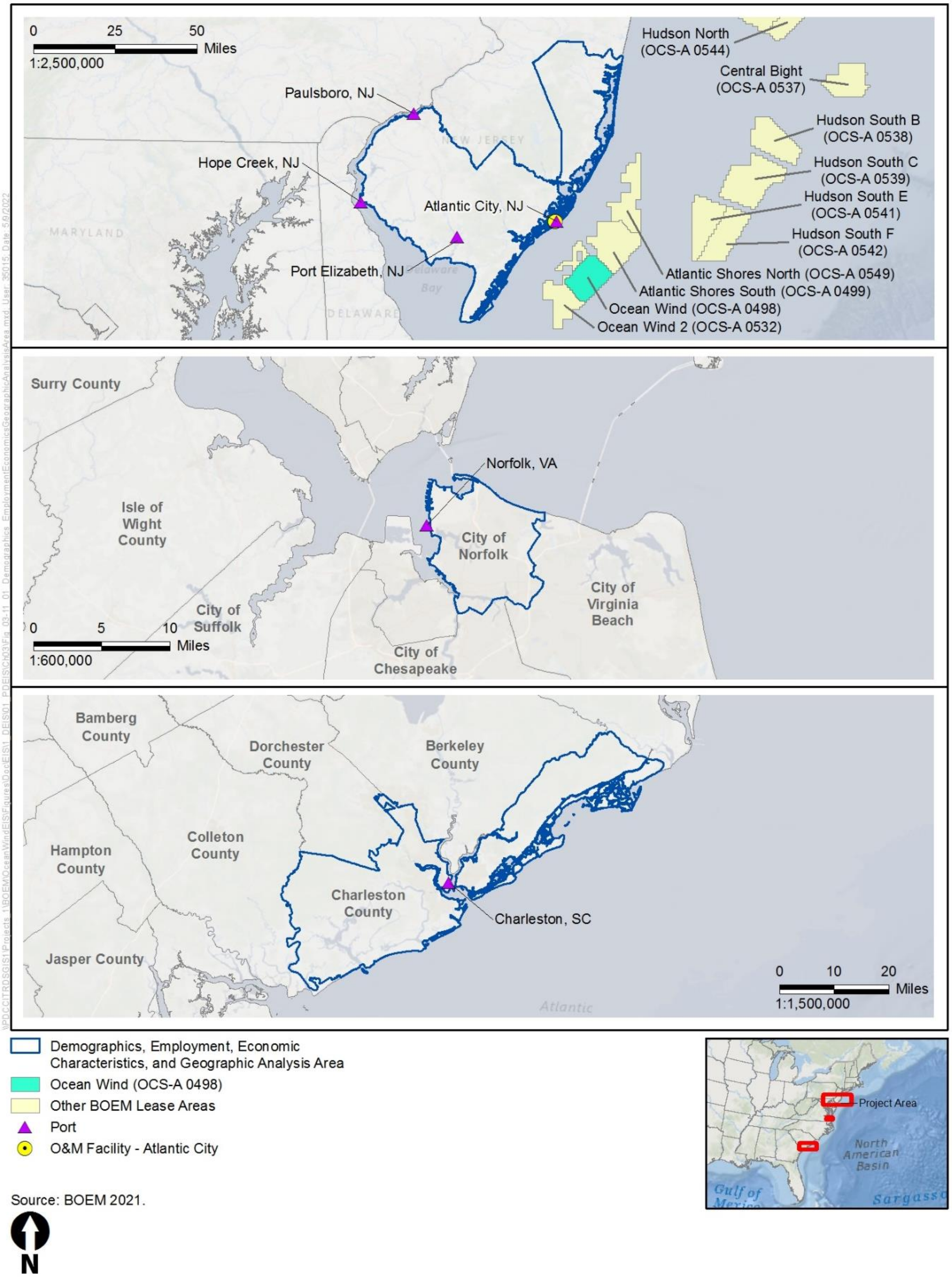


Figure 3.11-1 Demographics, Employment, and Economic Characteristics Geographic Analysis Area

Table 3.11-1 Demographic Trends, 2010–2019

Jurisdiction	2010 Population	2019 Population	Population Change, percent (2010–2019)	2019 Percent Population 18–64 Years	2019 Percent of Population 65 or Older	2019 Median Age
New Jersey	8,721,577	8,878,503	1.8	67.9	15.9	39.9
Ocean County	569,374	596,415	4.7	60.7	22.4	42.7
Atlantic County	273,162	266,105	-2.6	66.6	17.5	41.7
Cape May County	97,684	93,086	-4.7	61.1	25.8	49.6
Cumberland County	155,456	151,906	-2.3	61.3	14.9	37.6
Salem County	65,982	62,990	-4.5	65.5	18.3	42.1
Gloucester County	285,223	291,165	2.1	67.8	15.4	40.5
Virginia	7,841,754	8,454,463	7.8	68.9	15.0	38.2
Norfolk County	242,143	244,601	1.0	76.0	10.9	30.7
South Carolina	4,511,428	5,020,806	11.3	66.6	17.2	39.4
Charleston County	342,434	401,165	17.2	70.2	15.9	37.8

Source: U.S. Census Bureau 2021a

Table 3.11-2 Population, Income, and Employment Data

Jurisdiction	Population (2019)	Population Density (persons per mi^2)	Per Capita Income (2019)	Total Employment (Jobs, 2019)	Labor Force Participation Rate	Unemployment Rate (2019)
New Jersey	8,878,503	1,207.4	42,745	4,689,849	66%	5.5
Ocean County	596,415	948.6	36,100	275,104	59%	5.1
Atlantic County	266,105	479.1	33,284	139,427	65%	8.4
Cape May County	93,086	369.2	40,389	45,904	58%	6.8
Cumberland County	151,906	314.4	25,694	66,521	56%	7.3
Salem County	62,990	189.1	34,047	31,221	61%	6
Gloucester County	291,165	904.5	39,337	158,168	67%	5.5
Virginia	8,454,463	214.2	39,278	4,477,253	69%	4.6
Norfolk County	244,601	617.7	29,830	140,204	70%	7.6
South Carolina	5,020,806	167.1	29,426	2,447,854	61%	5.8
Charleston County	401,165	437.4	39,914	215,325	65%	3.7

Source: U.S. Census Bureau 2021b, 2022a, 2022b.
mi^2 = square mile

Ocean County occupies about 629 square miles of land area and contains 33 municipalities including its mainland and barrier island beaches. Ocean County is the second largest county in the state of New Jersey (COP Volume II, Section 2.3.1.1.1; Ocean Wind 2022). Atlantic County occupies about 556 square miles of land in the coastal region of New Jersey. Atlantic County has three barrier islands along its eastern coast, which, like the other barrier islands in New Jersey, are separated from the mainland by the Intracoastal Waterway. Egg Harbor Township is the one municipality in the BL England study area that is in Atlantic County. Cape May County occupies 251 square miles of land area on the southern tip of New Jersey. The eastern part of Cape May County is composed of five barrier islands extending 32 miles from Cape May City to Ocean City. These barrier beaches contain most of the county's infrastructure and are the heart of Cape May County's economy (Cape May County 2005).

Atlantic, Cape May, and Ocean Counties rely on tourism and visitors to their economies and have higher proportions of seasonal housing than New Jersey as a whole. Table 3.11-3 includes housing data for the geographic area of interest. Throughout New Jersey, 3.8 percent of housing units are seasonally occupied, compared to 6.4 percent of homes in Ocean County, 13.4 percent of homes in Atlantic County, and 50.9 percent of homes in Cape May County (U.S. Census Bureau 2021c). About 93,000 residents lived in Cape May County in 2019. During summer months, the population increases to at least six times the size of the permanent winter population because of tourism (Cape May County 2005). In 2013, Cape May County estimated its summer population at 796,695, or about eight times the permanent population (Cape May County 2013).

Table 3.11-3 Housing Data (2019)

Jurisdiction	Housing Units	Seasonal Vacant Units	Vacant Units (Non-Seasonal)	Non-Seasonal Vacancy Rate	Median Value (Owner-Occupied)	Median Monthly Rent (Renter-Occupied)
New Jersey	3,616,614	135,990	248,750	6.9	335,600	1,334
Ocean County	282,075	17,966	39,171	13.9	272,900	755
Atlantic County	127,987	17,190	11,211	8.8	218,300	890
Cape May County	99,157	50,452	8,689	8.8	296,600	1,884
Cumberland County	50,729	378	5,341	10.5	162,500	1,069
Salem County	27,644	3,472	190	0.7	185,300	794
Gloucester County	113,024	8,257	320	0.3	216,700	2,067
Virginia	3,491,091	87,550	275,437	7.4	264,900	1,767
Norfolk County	97,257	8,768	549	0.6	199,400	1,532
South Carolina	2,286,826	128,239	236,725	10.4	162,300	1,246
Charleston County	184,610	17,348	11,410	6.2	295,600	1,701

Source: U.S. Census Bureau 2021c

Table 3.11-4 includes data on the industries where residents in these counties work. The industries that employ workers reflect recreation and tourism's importance to these counties. A greater proportion of residents in these counties work jobs in arts, entertainment, and recreation; and accommodation and food services (22.51 percent in Atlantic County, 16.4 percent in Cape May County, and 8.8 percent in Ocean

County) than in New Jersey as a whole (8.1 percent) (U.S. Census Bureau 2021d). Table 3.11-5 contains data on at-place employment by industry in the geographic areas of interest. A greater proportion of jobs in these counties are in accommodation and food services (37.4 percent in Atlantic County, 19.9 percent in Cape May County, and 10.2 percent in Ocean County) and retail trade (14.2 percent in Atlantic County, 21.7 in Cape May County, and 18.7 in Ocean County) than in New Jersey as a whole (8.9 percent and 11.9 percent, respectively) (U.S. Census Bureau 2021e).

NOAA tracks economic activity dependent upon the ocean in its "Ocean Economy" data, which generally include, among other categories, commercial fishing and seafood processing, marine construction, commercial shipping and cargo-handling facilities, ship and boat building, marine minerals, harbor and port authorities, passenger transportation, boat dealers, and coastal tourism and recreation. In Atlantic, Cape May, and Ocean Counties, tourism and recreation account for 94.2, 86.4, and 86.7 percent of the overall Ocean Economy gross domestic product (GDP), respectively (NOAA 2021a). The "living resource" sector of the Ocean Economy is smaller but contributes to the identity of local communities as well as tourism. This includes commercial fishing, aquaculture, seafood processing, and seafood markets. The living resource sector accounts for 2.6 percent of employment and 3.2 percent of the GDP of the U.S marine economy. However, seafood markets are the largest producer in the living resources sector, accounting for 41.5 percent of the sector's GDP and for the most employed workers in the sector (NOAA 2021b). Among Atlantic, Cape May, Cumberland, Gloucester, Ocean, and Salem Counties, there are 88 living resources fisheries (NOAA 2021a).

The fishing industry is a large contributor to the economic vitality of New Jersey. The fishing industry has implications on fish and seafood markets and wholesalers, and seafood product preparation and packaging. In 2019, fish and seafood merchants brought in total annual wages of $61,404,501 with 1,083 average employees. Seafood product preparation and packaging brought in $26,374,344 with 517 average employees, and fish and seafood markets brought in $21,312,070 with 655 average employees (U.S. Bureau of Labor Statistics 2019).

Table 3.11-4 Employment of Residents, by Industry (2019)

Industry	New Jersey	Atlantic County	Cape May County	Cumberland County	Ocean County	Salem County	Gloucester County	Virginia	Norfolk	South Carolina	Charleston County
Agriculture, forestry, fishing	0.34%	0.46%	1.01%	4.00%	0.26%	1.98%	0.55%	0.88%	0.13%	0.96%	0.45%
Construction	5.94%	6.48%	9.63%	6.54%	8.16%	8.21%	6.70%	6.65%	6.98%	6.82%	7.43%
Manufacturing	8.15%	4.66%	2.91%	12.66%	5.20%	11.43%	7.32%	7.05%	7.06%	13.66%	6.25%
Wholesale trade	3.33%	2.12%	2.64%	4.17%	2.84%	3.94%	3.60%	1.76%	1.64%	2.40%	2.29%
Retail trade	10.89%	11.57%	10.44%	12.37%	13.60%	10.01%	11.76%	10.35%	11.20%	11.92%	10.21%
Transportation, warehousing, utilities	6.13%	4.36%	3.93%	5.45%	5.23%	10.32%	6.08%	4.41%	4.92%	5.1%	4.29%
Information	2.69%	1.15%	1.14%	0.99%	1.91%	1.02%	1.96%	1.91%	1.72%	1.61%	2.13%
Finance, insurance, real estate	8.48%	4.64%	7.09%	2.87%	6.54%	4.49%	6.65%	6.26%	5.72%	5.80%	6.61%
Professional services	13.50%	8.49%	7.68%	7.98%	10.64%	7.40%	11.23%	15.48%	11.68%	10.22%	15.41%
Educational, health care, social assistance	23.88%	23.85%	25.46%	25.61%	26.63%	25.35%	28.38%	22.22%	23.07%	21.75%	22.60%
Arts, entertainment, recreation, accommodation, food services	8.11%	22.51%	16.41%	6.40%	8.81%	6.51%	7.52%	8.94%	12.78%	10.18%	13.31%
Other services, except public administration	4.33%	4.38%	4.12%	3.70%	4.57%	4.57%	3.64%	5.29%	4.38%	5.16%	4.98%
Public administration	4.23%	5.34%	7.54%	7.24%	5.61%	4.77%	4.60%	8.81%	8.71%	4.42%	4.04%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: U.S. Census Bureau 2021d

Table 3.11-5 At-Place Employment, by Industry (2019)

Industry	New Jersey	Atlantic County	Cape May County	Cumber land County	Ocean County	Salem County	Gloucester County	Virginia	Norfolk	South Carolina	Charleston County
Agriculture, forestry, fishing	<0.1%	<0.1%	0.5%	0.1%	<0.1%	<0.1%	<0.1%	0.1%	<0.1%	0.2%	<0.1%
Mining, quarrying, oil and gas	<0.1%	<0.1%	0.2%	0.3%	<0.1%	<0.1%	<0.1%	0.2%	<0.1%	<0.1%	<0.1%
Utilities	0.5%	1.0%	0.4%	0.2%	0.7%	11.5%	0.2%	0.4%	<0.1%	0.6%	0.3%
Construction	4.3%	5.1%	8.6%	4.1%	5.7%	6.4%	7.9%	5.6%	3.6%	4.6%	5.4%
Manufacturing	5.9%	2.0%	2.3%	16.9%	3.3%	13.1%	9.9%	7.0%	6.4%	12.8%	7.4%
Wholesale trade	7.3%	2.2%	3.1%	10.1%	3.3%	7.7%	8.3%	3.1%	3.9%	3.9%	3.2%
Retail trade	11.9%	14.2%	21.7%	14.4%	18.7%	10.3%	17.4%	12.5%	10.7%	12.9%	14.1%
Transportation and warehousing	5.2%	2.0%	1.0%	6.5%	2.4%	6.5%	5.9%	3.3%	6.5%	3.8%	4.8%
Information	2.3%	0.9%	0.9%	1.0%	0.9%	0.3%	1.2%	2.9%	2.1%	1.9%	2.1%
Finance and insurance	5.2%	2.2%	4.1%	2.2%	2.2%	2.3%	1.8%	4.8%	4.1%	3.9%	3.2%
Real estate	1.6%	1.4%	2.9%	1.0%	2.3%	1.6%	17.4%	1.6%	3.3%	1.4%	2.3%
Professional services	8.8%	3.6%	3.7%	2.2%	5.2%	2.7%	3.8%	14.3%	10.4%	5.1%	7.9%
Management	3.4%	1.0%	0.3%	0.2%	0.8%	0.1%	0.5%	2.4%	2.4%	1.6%	1.4%
Administrative, business support, waste management	9.4%	3.2%	4.1%	3.7%	3.8%	2.5%	7.5%	8.1%	8.1%	14.6%	8.7%
Educational services	2.9%	1.1%	0.4%	2.4%	5.1%	0.7%	1.3%	2.4%	1.9%	1.6%	1.9%
Heath care and social assistance	16.4%	17.1%	15.7%	21.9%	26.3%	19.6%	15.8%	13.6%	19.4%	12.8%	12.5%
Arts, entertainment and recreation	1.8%	1.5%	4.1%	1.0%	3.0%	0.8%	1.6%	1.9%	1.4%	1.6%	2.2%

Industry	New Jersey	Atlantic County	Cape May County	Cumber land County	Ocean County	Salem County	Gloucester County	Virginia	Norfolk	South Carolina	Charleston County
Accommodation and food services	8.9%	37.4%	19.9%	7.8%	10.2%	10.0%	10.7%	10.8%	11.1%	12.3%	18.0%
Other services (e.g., public administration)	4.2%	3.9%	6.1%	4.0%	6.0%	3.6%	4.8%	5.0%	4.3%	4.3%	4.6%
Industries not classified	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: U.S. Census Bureau 2021e

Cumberland, Gloucester, and Salem Counties

Compared to Atlantic, Cape May, and Ocean Counties that have more ocean-based economies with seasonal work and recreation and tourism, Cumberland, Gloucester, and Salem Counties, which are along the Delaware Bay or on the Delaware River, in the case of Gloucester County, are less reliant on coastal industries. The population of Gloucester County grew 2.1 percent from 2010 to 2019 while the population of Cumberland and Salem Counties decreased by 2.3 percent and 4.5 percent, respectively. The share of New Jersey's population in Cumberland, Gloucester, and Salem Counties is 5.7 percent. Median age in Gloucester and Salem Counties (40.5 and 42.1 years, respectively) is older than New Jersey as a whole (39.9 years) while the median resident of Cumberland County (37.6 years) is younger than the median New Jersey resident (U.S. Census Bureau 2021f).

Cumberland, Gloucester, and Salem Counties are also less dependent on tourism than their coastal counterparts. The percentage of housing units that are seasonally occupied in these counties are 7.3, 12.6, and 5.8 percent, respectively (U.S. Census Bureau 2021b). Tourism and recreation likewise compose a smaller portion of Cumberland, Gloucester, and Salem Counties' Ocean Economies (19.0, 21.3, and 10.3 percent, respectively) (NOAA 2021a). Transportation and warehousing, utilities, and manufacturing are more important to the economies of Salem County, as a larger portion of the workers in this county works in those sectors than those in New Jersey. Manufacturing, retail trade, and education, health care, and social assistance have greater representation in Cumberland County than in New Jersey (U.S. Census Bureau 2021d).

Norfolk County

The city and county of Norfolk are in southeastern Virginia, 220 miles south of Washington, DC. The city and county are home to miles of coastline, including beaches on Chesapeake Bay. Norfolk is a key contributor to the Port of Virginia. From 2010 to 2019, Norfolk's population grew by 1.0 percent while the population of Virginia grew by 7.8 percent. Norfolk's population is also much younger than Virginia's. The median age of Norfolk residents is 30.7 years while the median Virginia resident is 38.2 years old. Residents aged 65 or older are underrepresented in Norfolk relative to Virginia (10.9 percent of the population as opposed to 15.0 percent) while residents aged 18–64 are overrepresented (76.0 percent as opposed to 68.9 percent) (U.S. Census Bureau 2021f). Compared to Virginia as a whole, Norfolk has a higher portion of residents who work in arts, entertainment, and recreation; and accommodation and food services (12.8 percent) than Virginia as a whole (8.9 percent) (U.S. Census Bureau 2021d). Norfolk's more service-based economy experienced a greater unemployment rate (8.7 percent) than the Commonwealth of Virginia as a whole (6.2 percent) (U.S. Bureau of Labor Statistics 2021). Because of its coastal location and amenities, 9.0 percent of housing units in Norfolk are seasonally occupied, compared to 2.5 percent in Virginia (U.S. Census Bureau 2021c).

Charleston County

Charleston County is in eastern South Carolina and is bordered on the east by the Atlantic Ocean. Since 2010, Charleston County's population growth (17.2 percent) has outpaced that of South Carolina (11.3 percent) and the county represents 8 percent of South Carolina's total population. Charleston County's population is younger than the state average. The median age in Charleston County is 37.8 years while it is 39.4 years in South Carolina. The portion of Charleston County's population 65 years or older (15.9 percent) is smaller than that of South Carolina (17.2 percent) while the portion of the population between 18 and 64 (70.2 percent) is larger than that of South Carolina (66.6 percent). A greater portion of residents in Charleston County work in arts, entertainment, and recreation; and accommodation and food services (13.3 percent) than in all of South Carolina (10.2 percent). Charleston County also has a disproportionate number of residents who work in professional services (15.4 percent) compared to South Carolina (10.2

percent). Moreover, 9.4 percent of housing units in Charleston County are seasonally occupied while 5.6 percent of housing units in South Carolina are seasonal (U.S. Census Bureau 2021b).

3.11.2 Environmental Consequences

3.11.2.1. Impact Level Definitions for Demographics, Employment, and Economics

Definitions of impact levels are provided in Table 3.11-6.

Table 3.11-6 Impact Level Definitions for Demographics, Employment, and Economics

Impact Level	Impact Type	Definition
Negligible	Adverse	No impacts would occur, or impacts would be so small as to be unmeasurable.
	Beneficial	Either no effect or no measurable benefit.
Minor	Adverse	Impacts on the affected activity or geographic place would be avoided and would not disrupt the normal or routine functions of the affected activity or geographic place. Once the affecting agent is eliminated, the affected activity or geographic place would return to a condition with no measurable effects.
	Beneficial	Small but measurable benefit on demographics, employment, or economic activity.
Moderate	Adverse	Impacts on the affected activity or geographic place would be unavoidable. The affected activity or geographic place would have to adjust somewhat to account for disruptions due to impacts of the Project, or, once the affecting agent is eliminated, the affected activity or geographic place would return to a condition with no measurable effects if proper remedial action is taken.
	Beneficial	Notable and measurable benefit on demographics, employment, or economic activity.
Major	Adverse	The affected activity or geographic place would experience unavoidable disruptions to a degree beyond what is normally acceptable, and, once the affecting agent is eliminated, the affected activity or geographic place could retain measurable effects indefinitely, even if remedial action is taken.
	Beneficial	Large local or notable regional benefit to the economy as a whole.

3.11.3 Impacts of the No Action Alternative on Demographics, Employment, and Economics

When analyzing the impacts of the No Action Alternative on demographics, employment, and economics, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

3.11.3.1. Ongoing and Planned Non-offshore Wind Activities

Under the No Action Alternative, the demographics, employment, and economics of the geographic analysis area would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Tourism, recreation, and marine industries (e.g., fishing) would continue to be important components of the regional economy. Ongoing activities within the geographic analysis area that will contribute to impacts on demographics, employment, and economics include continued commercial shipping and commercial fishing; ongoing port maintenance and upgrades; periodic channel dredging; maintenance of piers, pilings, seawalls, and buoys; and climate change. Coasts are sensitive to sea level rise, changes in the frequency and intensity of storms, increases in precipitation, and warmer ocean temperatures. Sea level rise and increased storm frequency and severity could result in property or infrastructure damage, increase insurance cost, and reduce the economic viability of coastal communities. Impacts on marine life due to ocean acidification, altered habitats and migration patterns, and disease frequency would affect industries that rely on these species. The impacts of climate change are likely to, over time, worsen problems that coastal areas already face (Moser et al. 2014). The socioeconomic impact of ongoing activities varies depending upon each activity. Activities that generate economic activity, such as port maintenance and channel dredging, would generally benefit the local economy by providing job opportunities and generating indirect economic activity from suppliers and other businesses that support activity along the New Jersey coast. Conversely, ongoing activities that disrupt economic activity, such as climate change, may adversely affect businesses, resulting in impacts on employment and wages.

Planned activities for coastal and marine activity, other than offshore wind, include development of diversified, small-scale, onshore renewable energy sources; ongoing onshore development at or near current rates; continued increases in the size of commercial vessels; potential port expansion and channel-deepening activities; and efforts to protect against potential increased storm damage and sea level rise (see Section F.2 in Appendix F for a description of ongoing and planned activities). Similar to ongoing activities, other planned non-offshore wind activities may result in beneficial socioeconomic impacts by generating economic activity that boosts employment but there is also the potential for some adverse impacts. See Table F1-9 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for demographics, employment, and economics.

3.11.3.2. Offshore Wind Activities (without Proposed Action)

Offshore wind could become a new industry for the Atlantic states and the nation. Although most offshore wind component manufacturing and installation capacity exists outside of the U.S., some studies acknowledge that domestic capacity is poised to increase. This EIS uses available data, analysis, and projections to make informed conclusions on offshore wind's potential economic and employment impacts within the geographic analysis area.

The BVG Associates Limited (2017) study estimated that the percentage of jobs sourced in the U.S. during the initial implementation of offshore wind projects along the U.S. northeast coast would range from 35 percent to 55 percent of jobs. As the offshore wind energy industry grows in the United States, this proportion of jobs would increase because of growth of a supply chain in the East Coast along with a growing number of maintenance and local operations jobs for established wind facilities. The proportion of jobs associated with offshore wind projected to be within the U.S. will be approximately 65 to 75 percent from 2030 through 2056. Overseas manufacturers of components and specialized ships based overseas that are contracted for installation of foundations and WTGs would compose the rest of the jobs outside the U.S. (BVG Associates Limited 2017).

The American Wind Energy Association (AWEA) estimates that the offshore wind industry will invest between $80 and $106 billion in U.S. offshore wind development by 2030, of which $28 to $57 billion will be invested within the United States. This figure depends on installation levels and supply chain growth, as other investment would occur in countries manufacturing or assembling wind energy components for U.S.-based projects. While most economic and employment impacts would be concentrated in Atlantic coastal states where offshore wind development will occur—there are over $1.3 billion of announced domestic investments in wind energy manufacturing facilities, ports, and vessel construction—there would be nationwide effects as well (AWEA 2020). The AWEA report analyzes base and high scenarios for offshore wind direct impacts, turbine and supply chain impacts, and induced impacts. The base scenario assumes 20 GW of offshore wind power by 2030 and domestic content increasing to 30 percent in 2025 and 50 percent in 2030, while the high scenario assumes 30 GW of offshore wind power by 2030 and domestic content increasing to 40 percent in 2025 and 60 percent in 2030. Offshore wind energy development will support $14.2 billion in economic output and $7 billion in value added by 2030 under the base scenario. Offshore wind energy development will support $25.4 billion in economic output and $12.5 billion in value added under the high scenario. It is unclear where in the U.S. supply chain growth would occur.

The University of Delaware projects that offshore wind power will generate 30 GW along the Atlantic coast through 2030. This initiative would require capital expenditures of $100 billion over the next 10 years (University of Delaware 2021). Although the industry supply chain is global and foreign sources would be responsible for some expenditures, more U.S. suppliers are expected to enter the industry.

Compared to the $14.2 to $25.4 billion in offshore wind economic output (AWEA 2020), the 2020 annual GDP for states with offshore wind projects (Connecticut, Massachusetts, Rhode Island, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina) ranged from $60.6 billion in Rhode Island to $1.72 trillion in New York (U.S. Bureau of Economic Analysis 2020) and totaled nearly $4.3 trillion. The $14.2 to $25.4 billion in offshore wind industry output would represent 0.3 to 0.6 percent of the combined GDP of these states.

The AWEA estimates that in 2030, offshore wind would support 45,500 (base scenario) to 82,500 (high scenario) full-time equivalent (FTE) jobs nationwide, including direct, supply chain, and induced jobs. Most offshore wind jobs (about 60 percent) are created during the temporary construction phase while the remaining 40 percent would be long-term O&M jobs. RODA in 2020 estimated that offshore wind projects would create 55,989 to 86,138 job years through 2030 in construction and 5,003 to 6,994 long-term jobs in O&M (Georgetown Economic Services 2020). These estimates are generally consistent with the AWEA study in total jobs supported, although the RODA study concludes that a greater proportion of jobs would be in the construction phase. The two studies conclude that states hosting offshore wind projects would have more offshore wind energy jobs while states with manufacturing and other supply chain activities may generate additional jobs.

In 2020, employment in New Jersey was 4.1 million (Table 3.11-2). While the extent to which there will be impacts on the geographic analysis area is unclear due to the geographic versatility of offshore wind jobs, a substantial portion of the planned offshore wind projects in New Jersey would likely be within commuting distance of ports in Atlantic City, Paulsboro, Hope Creek, and Port Elizabeth in New Jersey; Norfolk, Virginia; Charleston, South Carolina; and other ports that would be used for offshore wind staging, construction, and operations.

In addition to the regional economic impact of a growing offshore wind industry, BOEM expects offshore wind development to affect demographics, employment, and economics through the following primary IPFs.

Energy generation and security: Once built, offshore wind energy projects could produce energy at long-term fixed costs. These projects could provide reliable prices once built compared to the volatility of fossil fuel prices. Approximately 16 GW of capacity is estimated to occur in the New York/New Jersey offshore areas. The economic impacts of offshore wind activities (including associated energy storage and capacity projects) on energy generation and energy security could be long term, minor, and beneficial.

Lighting: Offshore WTGs require aviation warning lighting that could have economic impacts in certain locations. Aviation hazard lighting from up to 1,211 WTGs could be visible from some beaches, coastlines, and elevated inland areas, depending on vegetation, topography, weather, and atmospheric conditions. Visitors may make different decisions on coastal locations to visit and potential residents may choose to select different residences because of nighttime views of lights on offshore wind energy structures. As described in Section 3.20, at a height of 531 feet, the navigation light on a WTG would be visible out to 31 miles. A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). In a subsequent study, 1,723 beachgoers were surveyed to determine the impact of WTGs and the conclusion was that the farther away the WTGs, the less of an impact occurred. Nearly 70 percent of beachgoers said that WTGs 15 miles offshore would neither worsen nor increase their experience (Parsons et al. 2020). The vast majority of the WTG positions envisioned offshore of the geographic analysis area would be more than 15 miles (24.1 kilometers) from coastal locations with views of the WTGs, so impacts are anticipated to be negligible. These lights would be incrementally added over the construction period and would be visible for the operating lives of offshore wind activities. Distance from shore, topography, and atmospheric conditions would affect light visibility.

If implemented, ADLS would reduce the amount of time that WTG lighting is visible. Visibility would depend on distance from shore, topography, and atmospheric conditions. Such systems would likely reduce impacts on demographics, employment, and economics associated with lighting. Lighting for transit or construction could occur during nighttime transit or work activities. Construction of 13 offshore wind projects would occur within the New York and New Jersey lease areas between 2023 and 2030, with a maximum of 11 projects under construction concurrently during 2026 (Appendix F, Table F2-1). Vessel lights would be visible from coastal businesses, especially near the ports used to support offshore wind construction (COP Volume II, Section 2.2.5.2.1; Ocean Wind 2022).

Cable emplacement and maintenance: Cable installation for each project could temporarily cause commercial fishing vessels, static gear fishing vessels, and recreational vessels to relocate away from work areas and disrupt fish stocks, thereby reducing income and increasing costs during installation. Fishing vessels are not likely to access affected areas during active construction, as about 5,235 acres (21.2 km^2) of seafloor disturbance would occur associated with offshore cable and inter-array cable installation (Appendix F, Table F2-2). In the long term, concrete mattresses covering cables in hard-bottom areas could hinder commercial trawlers and dredgers (COP Volume II, Section 2.2.6.2.1; Ocean Wind 2022). Assuming similar installation procedures as under the Proposed Action, the duration and range of impacts would be limited, and the disturbance to marine species important to recreational fishing and sightseeing would recover following the disturbance (COP Volume II, Section 2.3.3.2; Ocean Wind 2022). Impacts of onshore cable installation would depend upon the specific location but could temporarily disrupt beaches and other recreational coastal areas. Disruptions may result in conflict over other fishing grounds, increased operating costs for vessels, and lower revenue. Seafood processing and wholesaling businesses could also experience short-term reductions in productivity. Disruptions from new cable emplacement would have localized, short-term, and minor impacts on demographics, employment, and economics. Maintenance is anticipated to have long-term intermittent and negligible impacts on demographics, employment, and economics.

Noise: Noise from O&M, pile driving, cable laying and trenching, and vessel traffic could result in temporary impacts on demographics, employment, and economics due to impacts on commercial/for-hire fishing businesses, recreational businesses, and marine sightseeing activities.

Assuming other offshore wind facilities generate vessel traffic similar to the projected Proposed Action vessel trips, construction of each offshore wind project would generate between 20 and 65 vessels operating at any given time (Section 3.16). Noise from vessel traffic during the maintenance and construction phases could affect species important to commercial/for-hire fishing, recreational fishing, and marine sightseeing activities (COP Volume II, Section 2.3.4.2; Ocean Wind 2022). This noise may also make these facilities less attractive to fishing operators and recreational boaters (COP Volume II, Section 2.3.3.1.2; Ocean Wind 2022). Similarly, noise from pile driving from offshore wind activities would affect fish populations that are crucial to commercial fishing and marine recreational businesses (COP Volume II, Section 2.1.2.2.1; Ocean Wind 2022). These impacts would be greater if multiple construction activities occur in close spatial and temporal proximity. An estimated 2,447 foundations (WTGs and substations) would be installed within the New York and New Jersey lease areas between 2023 and 2030.

Onshore construction noise could possibly result in a short-term reduction of economic activity for businesses near installation sites for onshore cables or substations, temporarily inconveniencing workers, residents, and visitors. Noise would have intermittent, short-term, and negligible impacts on demographics, employment, and economics.

Port utilization: Offshore wind installation would require port facilities for berthing, staging, and loadout. Development activities would bolster port investment and employment while also supporting jobs and businesses in supporting industries. Offshore wind development would also support planned expansions and modifications at ports in the geographic analysis area, including the ports of Atlantic City, New Jersey; Norfolk, Virginia; and Paulsboro and Hope Creek, New Jersey. While simultaneous construction or decommissioning (and, to a lesser degree, operation) activities for multiple offshore wind projects in the geographic analysis area could stress port capacity, it would also generate considerable economic activity and benefit the regional economy and infrastructure investment.

Port utilization would require a trained workforce for the offshore wind industry including additional shore-based and marine workers that would contribute to local and regional economic activity. Improvements to existing ports and channels would be beneficial to other port activity. Port utilization in the geographic analysis area would occur primarily during development and construction projects, anticipated to occur primarily between 2023 and 2030. Ongoing O&M activities would sustain port activity and employment at a lower level after construction.

Offshore wind activities and associated port investment and usage would have long-term, moderate beneficial impacts on employment and economic activity by providing employment and industries such as marine construction, ship construction and servicing, and related manufacturing. The greatest benefits would occur during offshore wind project construction between 2023 and 2030. If offshore wind construction results in competition for scarce berthing space and port service, port usage could potentially have short- to medium-term adverse impacts on commercial shipping.

Presence of structures: Under the No Action Alternative, the addition of up to 2,447 offshore wind structures (WTGs and substations) with 995 acres (4 km^2) of foundation and scour protection and 370 acres (1.5 km^2) of offshore export cable hard protection would increase the risk of gear loss connected with cable mattresses and structures along the East Coast (Appendix F, Table F2-2). Fisheries using bottom gear may be permanently disrupted, which would increase economic impacts on the commercial/for-hire recreational fishing industries (COP Volume II, Section 2.3.4.2.1; Ocean Wind 2022). These offshore facilities would also pose allision and height hazard risks, creating obstructions and navigational complexity for marine vehicles, which would impose fuel costs, time, and risk and require adequate technological aids and trained personnel for safe navigation (Appendix F, Table F2-1 and Table F2-2). In the event of an allision, vessel damage and spills could result in both direct and indirect costs for commercial/for-hire recreational fishing.

Due to the locations of offshore wind lease areas, it is possible that some commercial fishing areas would be displaced. Because of this, fishermen are likely to switch to their next best fishing location. These locations may involve lower catches per unit, catches of alternative species with different prices, or increased congestion, which would have its own effects, such as increased fishing costs among fishing fleets. In a study on the socioeconomic effects of offshore wind off the coast of Rhode Island and Massachusetts, Hoagland et al. (2015) found that losses associated with reduction to commercial fishing may be distributed in unexpected ways across the coastal economy. Regional coastal economies are linked across onshore industry sectors and offshore activities, and impacts on commercial fishing would not just affect fishing fleets and related coastal businesses. The study's authors found that impacts may be most pronounced in areas that are not close to the coastline (Hoagland et al. 2015), highlighting the potential for broad, regional socioeconomic impacts.

The potential for 2,447 offshore wind energy structures within the geographic analysis area could encourage fish aggregation and generate reef effects that attract recreational fishing vessels (COP Volume II, Section 2.2.7.2; Ocean Wind 2022). Fish aggregation could increase human fishing activities, but this attraction would likely be limited to the minority of recreational fishing vessels that already travel as far from the shore as the wind energy facilities. Fish aggregation could potentially result in broad changes in recreational fishing practices if these effects are widespread enough to encourage more participants to travel farther from shore.

The 995 acres (4 km^2) of hard coverage for offshore wind foundations could create foraging opportunities for harbor and gray seals, sea turtles, bats, northern gannets, loons, and peregrine falcons, possibly attracting private or commercial recreational sightseeing vessels. As a result, the presence of new habitat could increase economic activity associated with offshore sightseeing. New structures would be added intermittently between 2023 and 2030 and could benefit structure-oriented species as long as the structures remain (COP Volume II, Section 2.2.3.2.2; Ocean Wind 2022).

As a result of fish aggregation and reef effects associated with the presence of offshore wind structures, there would be long-term impacts on commercial fishing operations and support businesses such as seafood processing. The fishing industry is expected to be able to adapt its fishing practices over time in response to these changes. These effects could simultaneously provide new business opportunities such as fishing and tourism. Overall, the presence of offshore wind structures would have continuous, long-term, moderate impacts on demographics, employment, and economics.

Traffic: Offshore wind construction and decommissioning and, to a lesser extent, offshore wind operations would generate increased vessel traffic. This additional traffic would support increased employment and economic activity for marine transportation and supporting businesses and investment in ports. Assuming other offshore wind facilities generate vessel traffic similar to the projected Proposed Action vessel trips, construction of each offshore wind project would generate between 20 and 65 vessels operating at any given time (Section 3.16). Construction of 13 offshore wind projects could occur within the New York and New Jersey lease areas between 2023 and 2030, with a maximum of 13 projects under construction concurrently during 2026 (Appendix F, Table F2-1). Increased vessel traffic would have continuous, beneficial impacts during all project phases, with moderate impacts during construction and decommissioning.

Impacts of short-term, increased vessel traffic during construction could include increased vessel traffic congestion, delays at ports, and a risk for collisions between vessels. Increased vessel traffic would be localized near affected ports and offshore construction areas. Congestion and delays could increase fuel costs (i.e., for vessels forced to wait for port traffic to pass) and decrease productivity for commercial shipping, fishing, and recreational vessel businesses, whose income depends on the ability to spend time out of port. Collisions could lead to vessel damage and spills, which could have direct costs (i.e., vessel repairs and spill cleanup) as well as indirect costs from damage caused by spills. As a result of potential delays from increased congestion and increased risk of damage from collisions, vessel traffic is anticipated to have continuous, short-term, and minor impacts during construction and negligible impacts during operations.

Vessel traffic would occur among ports (outside the demographics, employment, and economic geographic analysis area) and offshore wind work areas. Most vessel traffic would travel to the WTG installation area with fewer vessels needed along the cable installation routes (COP Volume II, Section 2.3.6.2.2; Ocean Wind 2022).

Land disturbance: Land disturbance could result in localized, temporary disturbances of businesses near cable routes and construction sites for substations and other electrical infrastructure, due to typical construction impacts such as increased noise, traffic, and road disturbances. These impacts would be similar in character and duration to other common construction projects, such as utility installations, road repairs, and industrial site construction. Impacts on employment would be localized, temporary, and both beneficial (jobs and revenues to local businesses that participate in onshore construction) and adverse (lost revenue due to construction disturbances). Land disturbance impacts on demographics, employment, and economics would be minor.

3.11.3.3. Conclusions

Under the No Action Alternative, the geographic analysis area would continue to be influenced by regional demographic and economic trends. Ongoing and planned non-offshore wind activities and offshore wind activities would continue to sustain and support economic activity and growth within the geographic analysis area based on anticipated population growth and ongoing development of businesses and industry. Tourism and recreation would continue to be important to the economies of the coastal areas, especially Atlantic, Cape May, and Ocean Counties. Marine industries such as commercial fishing and shipping would continue to be active and important components of the regional economy. Counties in the geographic analysis area would continue to seek to diversify their economies—including maintaining or increasing their year-round population—and protect environmental resources.

BOEM anticipates that ongoing activities in the geographic analysis area (continued commercial shipping and commercial fishing; ongoing port maintenance and upgrades; periodic channel dredging; maintenance of piers, pilings, seawalls, and buoys; and the use of small-scale, onshore renewable energy) would have minor adverse and minor beneficial impacts on demographics, employment, and economics. Planned activities for coastal and marine activity, other than offshore wind, include development of diversified, small-scale, onshore renewable energy sources; ongoing onshore development at or near current rates; continued increases in the size of commercial vessels; potential port expansion and channel-deepening activities; and efforts to protect against potential increased storm damage and sea level rise. BOEM anticipates that there would be minor adverse and minor beneficial impacts on demographic, employment, and economics from these planned activities. BOEM expects the combination of ongoing and planned non-offshore wind activities to result in minor adverse impacts and minor beneficial impacts on ocean-based employment and economics, driven primarily by the continued operation of existing marine industries, especially commercial fishing, recreation/tourism, and shipping; increased pressure for environmental protection of coastal resources; the need for port maintenance and upgrades; and the risks of storm damage and sea level rise. Increased investment in land and marine ports, shipping, and logistics capability is expected to result along with component laydown and assembly facilities, job training, and other services and infrastructure necessary for offshore wind construction and operations. Additional manufacturing and servicing businesses would result either in the geographic analysis area or other locations in the United States if supply chains develop as expected. While it is not possible to estimate the extent of job growth and economic output within the geographic analysis area specifically, there will be notable and measurable benefits to employment, economic output, infrastructure improvements, and community services, especially job training, because of offshore wind development.

Offshore wind activities are expected to affect commercial and for-hire fishing businesses and marine recreational businesses (tour boats, marine suppliers) primarily through cable emplacement, noise and vessel traffic during construction, and the presence of offshore structures during operations. These IPFs would temporarily disturb marine species and displace commercial or for-hire fishing vessels, which could cause conflicts over other fishing grounds, increased operating costs, and lower revenue for marine industries and supporting businesses. The long-term presence of offshore wind structures would also lead to increased navigational constraints and risks and potential gear entanglement and loss. Many jobs generated by offshore wind are temporary construction jobs, lasting for a year or less. The long-term benefit of offshore wind projects is the medium-term (10 to 20 years) job market for offshore wind construction; long-term O&M jobs (25 to 35 years); long-term tax revenues; long-term economic benefits of improved ports and other industrial land areas; diversification of marine industries, especially in areas currently dominated by recreation and tourism; and growth in a skilled marine construction workforce. BOEM anticipates that there will be minor adverse and moderate beneficial impacts from offshore wind activities in the geographic analysis area.

Under the No Action Alternative, existing environmental trends and activities would continue, and demographics, employment, and economics would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **minor** adverse and **minor beneficial** impacts on demographics, employment, and economics. BOEM anticipates that the No Action Alternative, when combined with all planned activities (including other offshore wind activities), would result in **minor** adverse and **moderate beneficial** impacts due primarily to the impacts on commercial fishing and marine recreational businesses. Beneficial impacts would result from increased employment and economic activity associated with multiple offshore wind projects being developed and operated in the region.

3.11.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on demographic, employment, or economic characteristics:

- Overall size of project (approximately 1,100 MW) and number of WTGs;
- The extent to which Ocean Wind hires local residents and obtains supplies and services from local vendors;
- The port(s) selected to support construction, installation, and decommissioning and the port(s) selected to support O&M; and
- The design parameters that could affect commercial fishing and recreation and tourism because impacts on these activities affect employment and economic activity.

The size of the Project would affect the overall investment and economic impacts; fewer WTGs would mean less materials purchased, fewer vessels, and less labor and equipment required. Beneficial economic impacts within the geographic analysis area would depend on the proportion of workers, materials, vessels, equipment, and services that can be locally sourced and the specific ports used by the Project.

Ocean Wind has committed to measures to minimize impacts on demographics, employment, and economics, which include complying with NJDEP noise regulations (SOC-01), developing a construction schedule to minimize onshore construction activities during the peak summer recreation and tourism season (REC-01), and working cooperatively with commercial/recreational fishing entities and interests to ensure that construction and operation of the Project will minimize potential conflicts with commercial and recreational fishing (CFHFISH-01) (COP Volume II, Table 1.1-2; Ocean Wind 2022).

3.11.5 Impacts of the Proposed Action on Demographics, Employment, and Economics

The Proposed Action's beneficial impacts on demographics, employment, and economics depend on what proportion of workers, materials, vessels, equipment, and services can be locally sourced. In a study conducted by BW Research Partnership on behalf of E2, a national, nonpartisan group of advocates for policies that benefit both the economy and environment, every $1.00 spent building an offshore wind farm is estimated to generate $1.83 for New Jersey's economy (E2 2018). Ocean Wind's economic impact study estimates that the Proposed Action would support the following employment in New Jersey alone in direct, indirect, and induced job-years[1]: an estimated 663 FTE job-years during development, 6,598 FTE job-years during construction, 6,114 FTE job-years during operations, and 1,202 FTE job-years during decommissioning (COP Volume II, Table 2.3.1-4; Ocean Wind 2022).

The Proposed Action would generate employment during construction and installation, O&M, and decommissioning of the Project. The Proposed Action would support a range of positions for professionals such as engineers, environmental scientists, financial analysts, administrative personnel; trade workers such as electricians, technicians, steel workers, welders, and ship workers; and other construction jobs during construction and installation of the Proposed Action. O&M would create jobs for maintenance crews, substation and turbine technicians, and other support roles. The decommissioning phase would also generate professional and trade jobs and support roles. Therefore, all phases of the Proposed Action would lead to local employment and economic activity.

Most of the Project's employment impacts would occur during the construction and operations phases. The Proposed Action is expected to create 6,598 job-years during construction (3,103 direct, 1,111 indirect, and 2,384 induced), 6,114 job-years during operations (2,780 direct, 1,116 indirect, and 2,218 induced), and 1,202 job-years during decommissioning (289 direct, 468 indirect, and 446 induced). The 2,780 O&M direct job-years over the Project lifetime equate to approximately 79 per year over the 35-year operational life for the Proposed Action (COP Volume II, Table 2.3.1-4; Ocean Wind 2022).

Assuming that conditions are similar to those of the Vineyard Wind 1 project, job compensation (including benefits) is estimated to average between $88,000 and $96,000 for the construction phase, with occupations including engineers, construction managers, trade workers, and construction technicians. O&M occupations would consist of turbine technicians, plant managers, water transportation workers, and engineers, with average annual compensation of approximately $99,000 (BOEM 2021a). A study from the New York Workforce Development Institute provided estimates of salaries for jobs in the wind energy industry that concur with Vineyard Wind 1's projections. The expected salary range for trade workers and technicians ranges from $43,000 to $96,000, $65,000 to $73,000 for ships' crew and officers, and $64,000 to $150,000 for managers and engineers (Gould and Cresswell 2017).

The hiring of local workers would stimulate economic activity through increased demand on housing, food, transportation, entertainment, and other goods and services. A large number of seasonal housing units are available in the vicinity of the Project. During the summer, competition for temporary accommodations may arise, leading to higher rents (COP Volume II, Section 2.3.1.2; Ocean Wind 2022). However, this effect would be temporary during the active construction period and could be reduced if construction is scheduled outside the busy summer season. Permanent workers are expected to reside locally; there is adequate housing supply to accommodate the increase in the local workforce (Table 3.11-3).

Tax revenues for state and local governments would increase as a result of the Project. Equipment, fuel, and some construction materials would likely be purchased from local or regional vendors. These purchases would result in short-term impacts on local businesses by generating additional revenues and contributing to the tax base. Ocean Wind's economic impact study estimated total state and local taxes generated would be $39,858,672 during construction and $1,215,506 during operations (COP Volume II,

[1] Direct employment refers to jobs created by the direct hiring of workers. Indirect employment refers to jobs created through increased demand for materials, equipment, and services. Induced employment refers to jobs created at businesses where offshore wind industry workers would spend their incomes.
Job-years is an economic term that converts dollars spent into job equivalents based upon historical multipliers that consider factors such as salary, overhead, and hours worked.

Table 2.3.1-6; Ocean Wind 2022). Once the Project is operational, property taxes would be assessed on the value of the Ocean Wind 1 facilities. The increased tax base during operations would be a long-term, beneficial impact on local governments in the Project area.

The reasonably foreseeable environmental trends and impacts of the Proposed Action in addition to ongoing non-offshore wind activities, planned non-offshore wind activities, and offshore wind activities are described by IPF below.

Energy generation and security: The Proposed Action would produce up to 1,100 MW of electricity, or 3 percent of the estimated 35 GW of reasonably foreseeable offshore wind generation potential for the U.S. East Coast. Based on Ocean Wind's OREC allowance, the expected annual energy production would be up to 4,851 GW-hours per year (Ocean Wind 2021). According to the BPU OREC Award, ratepayers could see an increase in their monthly energy bill of $1.46 for residential customers, $13.05 for commercial customers, and $110.10 for industrial customers (New Jersey Office of the Governor 2019). Offshore wind energy projects could produce energy at long-term fixed costs, which could provide stability against fossil fuel price volatility once built, resulting in a minor beneficial impact.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined energy security and resilience impacts from ongoing and planned activities including offshore wind. Impacts related to energy generation and security would have long-term, regional, and minor beneficial impacts on demographics, employment, and economics.

Lighting: Both onshore and offshore structures emit light that could be visible from some beaches, coastlines, and elevated inland areas, depending on vegetation, topography, weather, and atmospheric conditions. Offshore, aviation hazard lighting on WTGs could affect employment and economics in these areas if the lighting discourages visits or vacation home rentals or purchases in coastal locations where the Proposed Action's WTG lighting is visible. Ocean Wind proposes to implement an ADLS to automatically turn the aviation obstruction lights on and off in response to the presence of aircraft in proximity to the wind farm. Such a system may reduce the amount of time that the lights are on, thereby potentially minimizing the visibility of the WTGs from shore and related effects on the local economy. Impacts related to structure lighting would have localized, long-term, and negligible impacts on demographics, employment, and economics.

The anticipated increase in vessel traffic would result in growth in the nighttime traffic of vessels with lighting. Lighting from vessels would occur during nighttime Project construction or maintenance. This lighting would be visible from coastal businesses, especially near the ports used to support Proposed Action construction. Short-term vessel lighting is not anticipated to discourage tourist-related business activities and would not affect other businesses; therefore, the impact of vessel lighting would be short term and negligible.

Between 2023 and 2030, there may be 12 offshore wind projects within the New York and New Jersey lease areas. WTG lighting in offshore wind activities would be visible from the same locations as the Proposed Action in addition to New Jersey coastal locations. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined lighting impacts from ongoing and planned activities including offshore wind, which would be negligible.

Cable emplacement and maintenance: The Proposed Action's cable emplacement would generate vessel anchoring and dredging at the worksite, requiring recreational vessels to avoid and navigate around the worksites and resulting in short-term disturbance to species important to recreation and tourism, with potential adverse effects on employment and income. Array cable installation would require a maximum of 18 vessels (3 main laying, 3 burial, and 12 support vessels) (COP Volume I, Table 6.1.2-3; Ocean Wind 2022). Offshore export cable installation would require a maximum of 24 vessels (3 main laying, 3 main cable jointing, 3 burial, and 15 support vessels) (COP Volume I, Table 6.1.2-5; Ocean Wind 2022). While it is not specified how long vessels would be present at a given location, there would be at least one location where cable splicing is necessary, which could require a vessel to remain at the same location for several days (COP Volume I, Table 4.4-1; Ocean Wind 2022).

The approximately 3,785 acres of seafloor disturbance (associated with offshore cable and inter-array cable installation), disruption of fish stocks, and concrete mattresses covering cables in hard-bottom areas could hinder commercial trawlers/dredgers, potentially reducing income and increasing costs for affected businesses over the long term. Cable installation would have localized, short-term, minor impacts on demographics, employment, and economics, while maintenance of the Proposed Action and other existing submarine cables would have intermittent, long-term, negligible impacts.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined cable emplacement and maintenance impacts on demographics, employment, and economics from ongoing and planned activities including offshore wind, which would be short term and minor.

Noise: Noise from vessel traffic would affect commercial fishing businesses and recreational businesses due to impacts on species important to commercial/for-hire fishing, recreational fishing, and marine sightseeing activities (COP Volume II, Section 2.3.4.2; Ocean Wind 2022); and noise from maintenance and repair operations that make the wind energy facilities less attractive to fishing operators and recreational boaters (COP Volume II, Section 2.3.3.1.2; Ocean Wind 2022). Noise from O&M activities would have localized, intermittent, long-term, negligible impacts on demographics, employment, and economics.

The estimated 101 foundations (WTGs and substations) would generate noise from pile driving, one of the most impactful noises on marine species, especially if multiple project construction activities occur in close spatial and temporal proximity (COP Volume III, Appendix R-2; Section C.6; Ocean Wind 2022). These disturbances would be temporary and localized, and extend only a short distance beyond the work area. Pile driving could harm marine species or cause avoidance by commercial fish populations, which would in turn affect commercial and for-hire fishing as well as recreational vessels that depend on these animals (COP Volume II, Section 2.2.7.2.1; Ocean Wind 2022). Pile driving and associated noise would have localized, short-term, and minor impacts on demographics, employment, and economics.

Infrequent trenching from pipeline and cable-laying activities emit noise. This noise could temporarily disrupt commercial fishing, marine recreational businesses, and onshore recreational businesses. Noise from trenching and trenchless technology would affect marine life populations, which would in turn affect commercial and recreational fishing businesses. Impacts on marine life would also affect onshore recreational businesses due to noise near public beaches, parks, residences, and offices. The use of trenchless technology at natural and sensitive landfall locations where possible would minimize direct impacts (COP Volume II, Section 2.2.2.2.1; Ocean Wind 2022). Cable laying and trenching would have localized, intermittent, short-term, and negligible impacts on demographics, employment, and economics.

Vessel noise could affect marine species relied upon by commercial fishing businesses, marine recreational businesses, recreational boaters, and marine sightseeing activities. Vessel traffic would occur between ports (outside the recreational and tourism geographic analysis area) and offshore wind work areas. Most vessel traffic would travel to the WTG installation area, with fewer vessels needed along the cable installation routes (COP Volume II, Section 2.3.6.2.2; Ocean Wind 2022). Noise from vessels would have short-term, intermittent, negligible impacts on demographics, employment, and economics.

Of the adjacent offshore wind projects, construction of the Proposed Action is anticipated to overlap with construction of the Atlantic Shores South offshore wind project for up to 1 year, potentially contributing to increased noise impacts during simultaneous construction activity (Appendix F, Table F2-1). While operational activity would overlap, noise impacts during operations would be far less than during construction. Therefore, in context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined noise impacts on demographics, employment, and economics from ongoing and planned activities including offshore wind, which would be short term and negligible.

Port utilization: Proposed Action activities at ports would support port investment and employment and would also support jobs and businesses in supporting industries and commerce. Several ports are indicated as possibly supporting proposed Project construction: the ports of Atlantic City, Hope Creek, Paulsboro, and Port Elizabeth in New Jersey; the port of Norfolk in Virginia; and the port of Charleston in South Carolina (COP Volume II, Section 2.3.6.2.1; Ocean Wind 2022). These ports would require a trained workforce for the offshore wind industry including additional shore-based and marine workers that would contribute to local and regional economic activity.

The economic benefits would be greatest during construction when the most jobs and most economic activity at ports supporting the Proposed Action would occur. During operations, activities would be concentrated in Atlantic City, New Jersey where the Project's onshore O&M facility would be located and in other ports that may support Project-related vessel traffic, including Norfolk, Virginia. Ocean Wind estimated that 69 permanent jobs would support operations in Atlantic City. The O&M facility would help to diversify the local economy by providing a source of skilled, year-round jobs. In addition, the facility would undergo dredging in the marina and at Absecon Inlet, which would benefit multiple marina users (COP Volume II, Section 2.4.1; Ocean Wind 2022). Overall, operation of the Proposed Action would generate 2,780 job-years of skilled permanent labor (direct job-years) and over 6,000 total job-years created (direct job-years plus indirect and induced job creation) (COP Volume II, Section 2.3.1.2.2; Ocean Wind 2022). The Proposed Action would have a moderate beneficial impact on demographics, employment, and economics from port utilization due to greater economic activity and increased employment at ports used by the Proposed Action.

Other offshore wind energy activity would provide business activities at the same ports as the Proposed Action as well as other ports within the geographic analysis area. Port investments are ongoing and planned in response to offshore wind activity. Maintenance and dredging of shipping channels are expected to increase, which would benefit other port users. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the impacts from other ongoing and planned activities, which would be long term, moderate, and beneficial on port utilization and the associated trained and skilled offshore wind workforce that would contribute economic activity in port communities and the region as a whole.

Presence of structures: The Proposed Action would add up to 101 offshore wind structures (98 WTGs and 3 substations), with 84 acres (0.3 km^2) of foundation and scour protection and 94 acres (0.4 km^2) of offshore export cable hard protection, which could affect marine-based businesses (i.e., commercial and for-hire recreational fishing businesses, offshore recreational businesses, and related businesses) through impacts such as entanglement and gear loss/damage, navigational hazard and risk of allisions, fish aggregation, habitat alteration, and space use conflicts. These structures may cause vessel operators to reroute, which would affect their fuel costs, operating time, and revenue. Due to the risk of gear entanglement, fisheries using bottom gear may be permanently disrupted, which would increase economic impacts on the commercial and for-hire recreational fishing industries. Marine-based businesses may be adversely affected due to the possible displacement of mobile species and potential for WTGs to become an exclusion area for fishing. Shoreside support services, such as bait and ice shops, vessels and infrastructure, insurance and maintenance services, processing, markets, and domestic/international shipping services, are anticipated to experience the same impacts as the fishing industry itself (BOEM 2017). As described in Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, considering the small number of vessels and fishing activity that would be affected, the impacts on other fishing industry sectors, including seafood processors and distributers and shoreside support services, would be adverse, with the level of impact depending on the fishery in question. The presence of structures would have continuous, long-term, and negligible to moderate impacts on demographics, employment, and economics.

Offshore wind structures could encourage fish aggregation and generate reef effects that attract recreational fishing vessels. These effects would only affect the minority of recreational fishing vessels that reach the wind energy facilities. This would have long-term, negligible benefits on demographics, employment, and economics. Proposed Action structures could increase economic activity associated with offshore sightseeing because these structures create foraging opportunities for harbor and gray seals, sea turtles, bats, northern gannets, loons, and peregrine falcons. These forms of marine life could attract private or commercial recreational sightseeing vessels (COP Volume II, Section 2.2.3.2.2; Ocean Wind 2022). This would have long-term, negligible beneficial impacts on demographics, employment, and economics.

Views of WTGs could have impacts on businesses serving the recreation and tourism industry. The presence of offshore wind structures could affect shore-based activities, surface water activities, wildlife and sightseeing activities, diving/snorkeling, and recreational boating routes (COP Volume II, Section 2.3.3.1.2; Ocean Wind 2022). As described in Section 3.18, during construction, viewers on the Jersey Shore would see the upper portions of tall equipment such as mobile cranes. These cranes would move from turbine to turbine as construction progresses, and thus would not be long-term fixtures. Based on the duration of construction activity, visual contrast associated with construction of the Proposed Action would have a temporary, negligible impact on recreation and tourism. The WTGs would be in open ocean approximately 15 miles east of Atlantic City, New Jersey. At maximum vertical extension, the blade tips of the WTGs would be theoretically visible to a viewer at the ocean surface or at beach elevations at distances up to 39.6 miles with clear-day conditions. Between 39.6 miles and 31 miles, only the WTG blades would be potentially visible above the horizon from the perspective of a beach-elevation viewer. Ocean Wind has voluntarily committed to use ADLS and non-reflective pure white (RAL Number 9010) or light gray (RAL Number 7035) paint colors as described in Appendix H to reduce impacts. Additionally, the lower sections of each WTG would be marked with high-visibility (RAL Number 1023) yellow paint from the water line to a minimum height of 50 feet (15.2 meters). Due to EC, the yellow paint would be below the horizon beyond approximately 11.4 miles (18.3 kilometers) from eye levels of 5 feet (1.5 meters). Portions of 949 WTGs from the Proposed Action combined with offshore wind projects could potentially be visible from coastal and elevated locations in the geographic analysis area. The simulations prepared by Ocean Wind show anticipated views in clear conditions of offshore wind projects associated with the No Action Alternative combined with the Proposed Action (Appendix M). The WTGs would be discernable on a clear day, with the color and irregular forms of the WTGs contrasting with the uninterrupted horizontal horizon line associated with the open ocean. As shown in the simulations, the Proposed Action WTGs would contribute the most from the closest locations, the northernmost coast of Cape May County and the coast of Atlantic County. The Proposed Action would be visually subordinate to offshore wind projects along the shore of Ocean County. Atmospheric conditions could limit the number of WTGs discernable during daylight hours for a significant portion of the year (COP Volume III, Appendix L; Ocean Wind 2022).

Across the New York and New Jersey lease areas, up to 2,646 offshore structures, including those of the Proposed Action, would affect employment and economics by affecting marine-based businesses. Presence of structures would have both beneficial impacts, such as by providing sightseeing opportunities and fish aggregation that benefit recreational businesses, and adverse effects, such as by causing fishing gear loss, navigational hazards, and viewshed impacts that could affect business operations and income. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined impacts on demographics, employment, and economics from other ongoing and planned activities including offshore wind, which would be long term and moderate due to impacts on commercial and for-hire recreational fishing, for-hire recreational boating, and associated businesses.

Traffic: The Proposed Action would generate vessel traffic in the Project area and to and from the ports supporting project construction, O&M, and decommissioning. Ocean Wind estimates that construction activity would generate between 20 and 65 vessels operating at any given time. During operations, the Proposed Action would generate approximately 10 vessel trips per day (refer to Section 3.16 for additional information regarding anticipated vessel traffic). Increased vessel traffic would increase the use of port and marine businesses, including tug services, dockage, fueling, inspection/repairs, and provisioning. The vessel traffic generated by the Proposed Action alone would result in increased business for marine transportation and supporting services in the geographic analysis area with continuous, short-term, and minor beneficial impacts during construction and decommissioning, and negligible beneficial impacts during operations. Vessel traffic associated with the Proposed Action could also result in temporary, periodic congestion within and near ports, leading to potential delays and an increased risk for collisions between vessels, which would result in economic costs for vessel owners. As a result of potential delays from increased congestion and increased risk of damage from collisions, the Proposed Action would have continuous, short-term, and minor impacts during construction and negligible impacts during operations.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts from ongoing and planned activities including offshore wind, which would be minor during construction and decommissioning and negligible during operations. Increased vessel traffic would produce demand for supporting marine services, with beneficial impacts on employment and economics during all project phases, including minor to moderate beneficial impacts during construction and decommissioning and negligible beneficial impacts during operations. The increased vessel traffic congestion and collision risk would also have long-term, continuous impacts on marine businesses during all project phases, with minor impacts during construction and decommissioning and negligible impacts during operations.

Land disturbance: Construction of the Proposed Action would require onshore cable installation and substation construction. Installation of the cables would occur within a 50-foot-wide temporary construction corridor. Based on the landfall options with the longest onshore cable routes, construction of the Oyster Creek onshore export cable could result in up to 32 acres of temporary disturbance, and construction of the BL England onshore export cable could result in up to 48 acres of temporary disturbance (COP Volume I, Table 6.2.1-1; Ocean Wind 2022). The employment and economic impact of the Proposed Action caused by disturbance of businesses near the onshore cable route and substation construction site would result in localized, short-term, minor impacts.

The exact extent of land disturbance associated with other projects would depend on the locations of landfall, onshore transmission cable routes, and onshore substations for offshore wind energy projects. Therefore, in context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the combined land disturbance impacts from ongoing and planned activities including offshore wind would be short term and noticeable due to the short-term and localized disruption of onshore businesses.

3.11.5.1. Conclusions

BOEM anticipates that the Proposed Action would have negligible impacts on demographics within the analysis area. While it is likely that some workers would relocate to the area due to the Proposed Action, this volume of workers would not be substantial compared to the current population and housing supply.

The Proposed Action alone would affect employment and economics through job creation, expenditures on local businesses, tax revenues, grant funds, and support for additional regional offshore wind development, which would have minor beneficial impacts. Construction would have a minor beneficial impact on employment and economics due to jobs and revenue creation over the short duration of the construction period. The beneficial impact of employment and expenditures during O&M would have a modest magnitude over the 35-year duration of the Project. Although tax revenues and grant funds would be modest in magnitude, they also would provide a beneficial impact on public expenditures and local workforce and supply chain development for offshore wind. If the Proposed Action becomes decommissioned, the impacts on demographics, employment, and economics would be minor and beneficial due to the construction activity necessary to remove wind facility structures and equipment. After decommissioning, the Proposed Action would no longer affect employment or produce other offshore wind-related revenues.

While the Proposed Action's investments in wind energy would largely benefit the local and regional economies through job creation, workforce development, and income and tax revenue, adverse impacts on individual businesses and communities would also occur. Short-term increases in noise during construction, cable emplacement, land disturbance, and the long-term presence of offshore lighting and structures would have negligible to minor adverse impacts on demographics, employment, and economics. The commercial fishing industry and other businesses that depend on local seafood production would experience impacts during construction. Overall, the impacts on commercial fishing and onshore seafood businesses would have minor impacts on demographics, employment, and economics for this component of the geographic analysis area's economy. Although commercial fishing is a small component of the regional economy, it is important to the identity of local communities within the region. The IPFs associated with the Proposed Action alone would also result in impacts on certain recreation and tourism businesses that range from negligible to minor, with an overall minor impact on employment and economic activity for this component of the analysis area's economy. In summary, the Proposed Action would have **minor adverse** and **moderate beneficial** impacts on demographics, employment, and economics.

In context of other reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on demographics, employment, and economics would range from undetectable to noticeable. BOEM anticipates that overall impacts on demographics, employment, and economics in the geographic analysis area associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **moderate beneficial**. The moderate beneficial impacts primarily would be associated with the investment in offshore wind, job creation and workforce development, income and tax revenue, and infrastructure improvements, while the minor adverse effects would result from aviation hazard lighting on WTGs, new cable emplacement and maintenance, the presence of structures, vessel traffic and collisions during construction, and land disturbance. Impacts on commercial and for-hire recreational fishing are anticipated to be moderate but only one component of the overall impacts. Because they are not expected to disrupt normal demographic, employment, and economic trends, the overall impacts in the geographical analysis area likely would be minor.

3.11.6 Impacts of Alternative B on Demographics, Employment, and Economics

Alternatives B-1 and B-2 would result in a slight reduction in both adverse and beneficial impacts on demographics, employment, and economics compared to the Proposed Action, but the overall impact magnitudes would be the same. Alternatives B-1 and B-2 would install fewer WTGs (up to 9 fewer WTGs for B-1; up to 19 fewer WTGs for B-2) and associated inter-array cables, which would slightly reduce the construction impact footprint and installation period. Construction of fewer WTGs would result in a shorter duration of noise impacts and less vessel traffic, which could reduce impacts on commercial and for-hire recreational fishing. Conversely, the reduced number of WTGs would also mean that the Project would generate less energy—with the removal of 9 WTGs, Alternative B-1 would result in an expected annual energy production of 4,178 GW-hours per year compared to 4,851 GW-hours per year under the Proposed Action (Ocean Wind 2021)—and would therefore result in slightly lower beneficial impacts associated with delivering a reliable supply of energy. The removal of 19 WTGs under Alternative B-2 would result in even less energy generation but selection of the alternative would be contingent on a larger turbine being commercially available, which would offset some of these potential energy losses. Because Alternative B would produce less energy, it would also offset fewer GHG emissions from fossil-fueled power generation compared to the Proposed Action, further reducing beneficial impacts. A reduced number of WTGs would also generate less economic activity, which would reduce port utilization and result in lower expenditures in general. However, the change in these impacts would all be slight and would not change the overall impact rating compared to the Proposed Action.

Alternatives B-1 and B-2 could potentially reduce visual impacts by removing the 9 and 19 WTGs, respectively, closest to the shore, thereby reducing potential impacts on the tourism, recreation, and real estate businesses that are sensitive to viewshed impacts from WTGs. However, because most of the WTGs would still be visible, localized, long-term, minor impacts are still anticipated. Fewer WTGs would reduce reef effects and fish aggregation, which would have unclear impacts on the commercial and for-hire and recreational fisheries that rely on marine species. Fewer WTGs would reduce the risk of allisions and the need for vessels to reroute, which would reduce travel time, fuel costs, and other associated costs.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B-1 and B-2 to the impacts from ongoing and planned activities including offshore wind would be similar to those described under the Proposed Action.

3.11.6.1. Conclusions

Alternatives B-1 and B-2 would result in slightly lower adverse impacts and slightly lower beneficial impacts compared to the Proposed Action, but would not change the overall impact levels, which are anticipated to range from **minor** adverse impacts and **moderate beneficial** impacts on demographics, employment, and economics.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B-1 and B-2 to the overall impacts on demographics, employment, and economics would be the same as under the Proposed Action and would range from undetectable to noticeable. Considering all the IPFs together, BOEM anticipates that the overall impacts on demographics, employment, and economics associated with Alternatives B-1 and B-2 when combined with impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **moderate beneficial**.

3.11.7 Impacts of Alternative C on Demographics, Employment, and Economics

Impacts of Alternatives C-1 and C-2 would be similar to those of the Proposed Action for demographics, employment, and economics. The 0.81- to 1.08-nm buffer between WTGs in the Ocean Wind 1 Lease Area and WTGS in the Atlantic Shores South Lease Area, as described in Section 3.16, would allow for the transit of larger fishing vessels or survey vessels through the Wind Farm Area. The buffer could improve safety for commercial and recreational fishing vessels in the Wind Farm Area (Sections 3.9 and 3.18).

Alternative C-1 would relocate eight WTG positions to attain the buffer while Alternative C-2 would compress the WTG layout from 1 nm between rows to no less than 0.99 nm between rows. At the distance of 15.3 miles from the shore, relocation of one row of WTGs under Alternative C-1 and compression of the WTG array under Alternative C-2 may be unnoticeable to the casual viewer and would not change visual-related impacts compared to the Proposed Action. Regarding footprint disturbance, BOEM does not expect relocation of the eight WTGs and compression of the 98 WTGs under Alternatives C-1 and C-2, respectively, to significantly change the potential impacts compared to the Proposed Action, as the number of WTGs would remain the same and the overall footprint would remain the same or slightly less (Section 3.13). All other design parameters and potential variability in the design would be the same as under the Proposed Action.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C to the impacts from ongoing and planned activities including offshore wind would be similar to those described under the Proposed Action.

3.11.7.1. Conclusions

The impacts on demographics, employment, and economics resulting from Alternatives C-1 and C-2 are anticipated to range from **minor** adverse and **moderate beneficial**. The 0.81- to 1.08-nm buffer would marginally improve safety of vessel transit, so the impacts resulting from individual IPFs associated with Alternatives C-1 and C-2 would be slightly less adverse than the Proposed Action’s impacts but the overall impact magnitudes would not change.

In context of reasonably foreseeable environmental trends, the impacts contributed by Alternatives C-1 and C-2 to the overall impacts on demographics, employment, and economics would be the same as under the Proposed Action and would range from undetectable to noticeable. Considering all the IPFs together, BOEM anticipates that the overall impacts on demographics, employment, and economics associated with Alternatives C-1 and C-2 when combined with impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **moderate beneficial**.

3.11.8 Impacts of Alternative D on Demographics, Employment, and Economics

Alternative D would install up to 15 fewer WTGs and associated inter-array cables, which would slightly reduce the construction impact footprint and installation period. Alternative D could potentially reduce localized impacts on marine species that local commercial/for-hire and recreational fishing use for seafood production compared to the Proposed Action but the overall impact magnitudes would not change. Alternative D would allow commercial fishing vessels to operate and fish without potential impacts from structures in the locations where the WTGs would be removed. In addition, reduced underwater noise from pile driving and vessels during construction activities, and reduced habitat alteration, vessel strikes, artificial lighting, and decommissioning activities, would lessen the potential for displacement of marine species and associated impacts on commercial and recreational vessels.

Construction of fewer WTGs would result in a shorter duration of noise impacts and less vessel traffic, which could reduce impacts on commercial and for-hire recreational fishing. The reduced number of WTGs would also mean that the Project would generate less energy—with the removal of 15 WTGs, Alternative D would result in an expected annual energy production of 3,922 GW-hours per year compared to 4,851 GW-hours per year under the Proposed Action (Ocean Wind 2021)—and would therefore result in slightly lower beneficial impacts associated with delivering a reliable supply of energy and reduced GHG emissions from offsetting fossil-fueled power generation. However, selection of the alternative would be contingent on a larger turbine being commercially available, which would offset some of these potential energy losses. A reduced number of WTGs would also generate less economic activity, which would reduce port utilization and result in lower expenditures in general. However, the change in these impacts would all be slight and would not change the overall impact rating compared to the Proposed Action.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative D to the impacts from ongoing and planned activities including offshore wind would be similar to those described under the Proposed Action.

3.11.8.1. Conclusions

Alternative D would result in slightly reduced impacts on demographics, employment, and economics compared to the Proposed Action, but the overall impact magnitude would not change. The removal of 15 WTGs under Alternative D would result in fewer impacts on marine species and, by extension, fewer impacts on commercial and for-hire recreational fisheries. Energy generation and associated beneficial impacts would be reduced under Alternative D because there would be fewer WTGs. Impacts on demographics, employment, and economics under Alternative D are anticipated to be **minor** adverse and **moderate beneficial**.

In context of reasonably foreseeable environmental trends, the impacts resulting from individual IPFs would be the same as those of the Proposed Action: **minor** adverse impacts and **moderate beneficial** impacts. Considering all the IPFs together, BOEM anticipates that the overall impacts on demographics, employment, and economics associated with Alternative D when combined with the impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **moderate beneficial**.

3.11.9 Impacts of Alternative E on Demographics, Employment, and Economics

The impacts of Alternative E on demographics, employment, and economics would be the same as those of the Proposed Action. Increased onshore construction activity on Island Beach State Park may potentially disturb and restrict park operations and visitation due to typical construction impacts such as increased noise, traffic, and road disturbances. However, impacts would remain localized and short term while the cables are being installed and BOEM does not anticipate impacts to be materially different than those described under the Proposed Action.

In context of reasonably foreseeable environmental trends, the incremental impacts resulting from individual IPFs would be similar to those described under the Proposed Action.

3.11.9.1. Conclusions

The increased length of the onshore cable route under Alternative E would slightly increase the potential for onshore impacts related to noise and traffic that could affect local businesses. However, the overall impact magnitudes are anticipated to be the same as those of the Proposed Action, ranging from **minor** adverse impacts to **moderate beneficial** impacts on demographics, employment, and economics.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the overall impacts on demographics, employment, and economics would be the same as those of the Proposed Action, ranging from undetectable to noticeable. Considering all the IPFs together, BOEM anticipates that the overall impacts on demographics, employment, and economics associated with Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **moderate beneficial**.

3.11.10 Proposed Mitigation Measures

No measures to mitigate impacts on demographics, employment, and economics have been proposed for analysis.

3.14. Land Use and Coastal Infrastructure

This section discusses potential impacts on land use and coastal infrastructure from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area, as shown on Figure 3.14-1, includes Ocean City, Upper Township, Berkeley Township, Lacey Township, and Ocean Township, and municipal boundaries surrounding the ports that may be used for the Project. Ocean Wind proposes the use of ports in Paulsboro, Hope Creek, and Port Elizabeth, New Jersey; Charleston, South Carolina; and Norfolk, Virginia. In addition, Ocean Wind proposes to use an O&M facility that would be in Atlantic City, New Jersey. These areas encompass locations where BOEM anticipates impacts associated with proposed onshore facilities and ports.

3.14.1 Description of the Affected Environment for Land Use and Coastal Infrastructure

Within the geographic analysis area, land use is diverse, including water, wetlands, barren land, forest, urban, and agricultural land uses. The proposed Project includes two interconnection points with the PJM electric transmission system at the BL England in Upper Township, New Jersey and at the Oyster Creek onshore substation in Lacey Township, New Jersey. Commercial development in northern Cape May County, which includes Ocean City, Upper Township, and Marmora and Beesley’s Point, primarily serves local needs with minimal large manufacturing or production, so has minimal, if any, large distribution facilities, and the county includes a variety of residential development types such as single family, townhouses, and over-55 communities. In Ocean City, New Jersey the dominant land use is urban, while wetlands, forest, and urban uses are found primarily on the mainland in Upper Township, New Jersey (COP, Volume II, Section 2.3.5; Ocean Wind 2022).

The proposed BL England onshore substation would be sited on a former coal, oil, and diesel plant in Upper Township, New Jersey. Land surrounding the proposed BL England onshore substation has an urban land use classification and in the Waterfront Town Center zoning district (NJDEP 2015; Township of Upper 2021). The BL England onshore export cable route has four landfall options within the PDE; three proposed landfall locations on the barrier island of Ocean City and one possible landfall location west of the Garden State Parkway in Upper Township, New Jersey. Based on NJDEP land use cover data, land use is classified as urban at all four landfall sites considered and the area surrounding those sites, with the land bordering the potential landfall location at 35th Street in Ocean City, New Jersey classified as barren land (NJDEP 2015). Along the proposed BL England onshore export cable routes, land use is classified as water, wetlands, barren lands, forest, urban, and agriculture (NJDEP 2015). Land along the proposed BL England onshore export cable route is zoned for residential use, including one-, two-, and multifamily, business, gateway/mixed use, and public use (Ocean City 2014).

The proposed Oyster Creek onshore substation would be sited on the former Oyster Creek nuclear plant in Lacey Township, New Jersey. Land surrounding the proposed Oyster Creek onshore substation has an urban land use classification and is within an industrial zoning district (NJDEP 2015; Township of Lacey 2009). Onshore export cable corridors near Oyster Creek are in Berkeley Township, Lacey Township, and Ocean Township. Land use in the vicinity of the Oyster Creek route is classified into five different land use groups: water, wetlands, barren land, forest, and urban (NJDEP 2015). The primary uses along the Oyster Creek onshore export cable corridor are a combination of wetlands, urban development, and forest land, with urban development primarily east of U.S. Route 9. Portions of the Oyster Creek onshore export cable corridor is within lands approved for acquisition by USFWS as part of the Edwin B. Forsythe National Wildlife Refuge; however, as they have yet to be acquired by USFWS, these lands do not need to be evaluated for impacts relative to the refuge (USFWS 2021).

The Oyster Creek export cable corridor would also cross Island Beach State Park, where there are many tidal rivers, waters, beaches, and wetlands (COP, Volume II, Section 2.3.5; Ocean Wind 2022). Island Beach State Park is managed pursuant to the Coastal Barrier Resources Act, enacted to minimize the loss of human life, wasteful federal expenditures, and damage to natural resources associated with the development of coastal barriers. Under the Coastal Barrier Resources Act, Island Beach State Park is listed as an “Otherwise Protected Area,” a categorization used for national wildlife refuges, state and national parks, and local and private conservation areas on coastal barriers that are held for conservation or recreation purposes (USFWS 2014). Because it is listed as an otherwise protected area, Coastal Barrier Resources Act consultation with USFWS is not required and the only federal spending restriction is a prohibition on federal flood insurance.

Important landscape features near BL England and Oyster Creek include a combination of natural views such as beaches, shorelines, and scenic vistas, and man-made views such as unique buildings, landscaping, parks, and other cultural features. Portions of the Onshore Project area are within the New Jersey Pinelands, which feature some of the largest unbroken tracts of Atlantic coastal pine forests in the eastern U.S., stretching across more than seven counties of New Jersey. While the entirety of the Onshore Project area is outside of the state-designated Pinelands Area (development in this area is regulated by the State of New Jersey Pinelands Commission), portions of the export cable corridors are within the federally designated Pinelands National Reserve (New Jersey Pinelands Commission 2021). The Great Egg Harbor River is a 129-mile river system and was designated as a Wild and Scenic River by Congress in 1992 (USNPS 2016). It is almost entirely within the Pinelands National Reserve and drains into wetlands within the reserve.

In addition to the landfall locations and onshore substations, the Project would use various ports of construction and O&M. The ports under consideration include Paulsboro, Hope Creek, and Port Elizabeth, New Jersey; Charleston, South Carolina; and Norfolk, Virginia. The O&M facility would be in Atlantic City on two parcels adjacent to Clam Creek that had previously served as a marine terminal. The area is currently zoned for commercial marine use (Atlantic City 2006). The Port of Paulsboro is surrounded by land zoned as the marina industrial business park (Borough of Paulsboro 2010). Hope Creek and Port Elizabeth are within areas zoned for industrial use (Township of Lower Alloways Creek 2014; City of Elizabeth 2000). Land use surrounding the Port of Charleston includes light industry, where uses compatible with surrounding commercial districts are permitted (City of Charleston 2012). The port in Norfolk, Virginia is within marine industrial land use (City of Norfolk 2021).

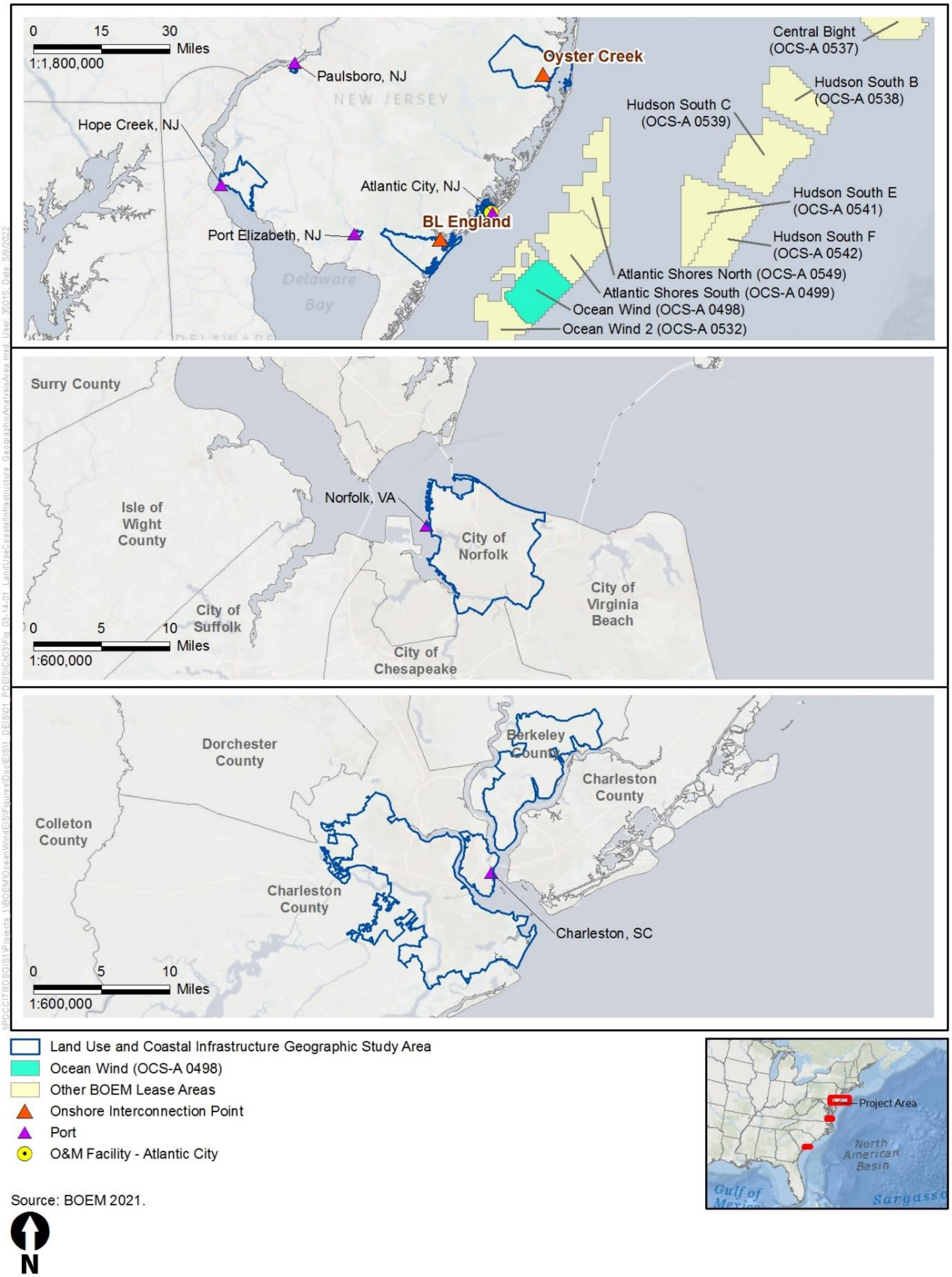


Figure 3.14-1 Land Use and Coastal Infrastructure Geographic Analysis Area

3.14.2 Environmental Consequences

3.14.2.1. Impact Level Definitions for Land Use and Coastal Infrastructure

Definitions of potential impact levels are provided in Table 3.14-1.

Table 3.14-1 Impact Level Definitions for Land Use and Coastal Infrastructure

Impact Level	Impact Type	Definition
Negligible	Adverse	Adverse impacts on area land use would not be detectable.
	Beneficial	Beneficial impacts on area land use would not be detectable.
Minor	Adverse	Adverse impacts would be detectable but would be short term and localized.
	Beneficial	Beneficial impacts would be detectable but would be short term and localized.
Moderate	Adverse	Adverse impacts would be detectable and broad based, affecting a variety of land uses, but would be short term and would not result in long-term change.
	Beneficial	Beneficial impacts would be detectable and broad based, affecting a variety of land uses, but would be short term and would not result in long-term change.
Major	Adverse	Adverse impacts would be detectable, long term, and extensive, and result in permanent land use change.
	Beneficial	Beneficial impacts would be detectable, long term, and extensive, and result in permanent land use change.

3.14.3 Impacts of the No Action Alternative on Land Use and Coastal Infrastructure

When analyzing the impacts of the No Action Alternative on land use and coastal infrastructure, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

3.14.3.1. Ongoing and Planned Non-Offshore Wind Activities

Under the No Action Alternative, land use and coastal infrastructure in the geographic analysis area would continue to be affected by ongoing and planned activities, especially onshore and coastal regional trends, development projects, and port expansion. The geographic analysis area lies within developed communities that would experience continued commerce and development activity in accordance with established land use patterns and regulations. The geographic analysis area is highly developed and most construction projects would likely affect land that has already been disturbed from past development, although some development on undeveloped land may also occur. Ports in the geographic analysis area would continue to serve marine traffic and industries and experience periodic dredging and improvement projects to meet ongoing needs. A channel-deepening project at the Port of Virginia is currently underway and is anticipated to be completed in 2024 (Virginia Port Authority 2021). Dredging and port improvements would allow larger vessels to use the port and may result in increased port use and conversion of surrounding land use if the ports are expanded. See Table F1-12 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for land use and coastal infrastructure.

3.14.3.2. Offshore Wind Activities (without Proposed Action)

BOEM has reviewed available information regarding the potential for other offshore wind activities to occur within the geographic analysis area for land use and coastal infrastructure. Atlantic Shores South proposes points of interconnection at the Cardiff Substation and Larrabee Substation (Atlantic Shores 2021). Transmission lines rated at 138 kV and higher have sufficient thermal capability to deliver power from an offshore wind project to the utility's load center. The *New Jersey Offshore Wind Energy: Feasibility Study* identified existing transmission lines and substations rated at 138 kV and above. These substations would be likely potential points of interconnection for future offshore wind activities but are outside of the geographic analysis area.

The geographic analysis area also includes municipal boundaries surrounding the ports that may be used for the Project. Atlantic Shores South has proposed use of an O&M facility in Atlantic City and identified that the Ports of Paulsboro and Charleston may be used during construction. Furthermore, the potential exists for other offshore wind activities to occur within the municipal boundaries surrounding the ports.

Therefore, BOEM expects other offshore wind development activities to affect land use and coastal infrastructure through the following primary IPFs.

Accidental releases: Accidental releases of fuel/fluids/hazardous materials may increase due to onshore construction for the landfalls and onshore export cable routes of offshore wind activities. Accidental release risks would be highest during construction, but still pose a risk during operation and decommissioning of offshore wind facilities. BOEM assumes all projects and activities would comply with laws and regulations to minimize releases. Accidental releases could result in temporary restrictions on use of adjacent properties and coastal infrastructure during the cleanup process; however, the impacts would be localized and short term. The exact extent of impacts would depend on the locations of landfall, substations, and cable routes, as well as the ports that support offshore wind energy projects. The impacts of accidental releases on land use and coastal infrastructure would be negligible (except in the case of very large spills that affect a large land or coastal area).

Lighting: As described in Section 3.20, aviation hazard lighting on portions of eight offshore wind projects (encompassing 761 WTGs) could potentially be visible from beaches and coastal areas in the geographic analysis area. A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). The majority of the WTG positions associated with other offshore wind activities would be more than 15 miles (24.1 kilometers) from coastal locations with views of the WTGs.

Nighttime lighting from onshore electrical substations could affect the ability to use nearby properties or decisions about where to establish permanent or temporary residences. Nighttime lighting impacts would be localized, constant, and long term. However, it is likely that other offshore wind projects would expand or construct new substations near existing substations, or would construct new substations in areas where land development regulations (i.e., zoning and land use plan designations) allow such uses. For new or expanded substations in business or industrial areas, lighting would have no adverse impacts on land uses. Lighting impacts would depend on the proposed substation locations, but would generally be negligible.

Port utilization: Offshore wind energy projects would make use of port facilities for shipping, berthing, and staging throughout construction, operations, and decommissioning. This use would be similar to existing activities at ports and is consistent with the zoning and land use plan designations of these areas. Offshore wind would likely increase port utilization, and ports would experience beneficial impacts such as greater economic activity and increased employment due to demand for vessel maintenance services and related supplies, vessel berthing, loading and unloading, warehousing and fabrication facilities for offshore wind components, and other business activity related to offshore wind. For larger ports, such as Charleston and Norfolk, offshore wind-related activities would make up a small portion of the total activities at the port; therefore, offshore wind activities are likely to have a negligible impact on land use through port utilization at these ports. However, for smaller ports within the geographic analysis area, such as Paulsboro and Hope Creek, port expansion may be necessary to accommodate the increased activity, resulting in changes to surrounding land use and coastal infrastructure as described below.

Offshore wind activity would make use of planned dredging and improvement projects at ports in the geographic analysis area, including ports in New Jersey and South Carolina. USACE has proposed maintenance dredging of portions of the Newark Bay, New Jersey federal navigation channel, including the removal of material from the Port Elizabeth Channel to occur between July 2021 and February 2022 (USACE 2021). Additionally, in 2017 USACE Charleston District awarded contracts as part of the Charleston Harbor Deepening Project, which will create a 52-foot depth at the entrance channel to Charleston Harbor in South Carolina (USACE n.d.). Dredging at ports is consistent with existing use and would support state strategic plans and local land use goals for the development of waterfront infrastructure. The Atlantic Shores South project would construct an O&M facility in Atlantic City, New Jersey on a shoreside parcel that was formerly used for vessel docking and other port activities. Limited dredging and bulkhead improvements would also be completed for the Atlantic Shores South O&M facility, resulting in minor beneficial impacts on coastal infrastructure (Atlantic Shores 2021). If multiple offshore wind energy projects are constructed at the same time and rely on the same ports, this simultaneous use could stress port resources and could potentially increase the marine and road traffic, noise, and air pollution in the area. Overall, offshore wind projects would have constant, long-term, minor beneficial impacts on port utilization due to the productive use of ports designated for offshore wind activity, as well as localized, short-term, adverse impacts in cases where individual ports are stressed due to simultaneous project activity.

Presence of structures: As described in Section 3.20, portions of eight offshore wind projects (encompassing 761 WTGs) could be visible from some shorelines depending on vegetation, topography, and atmospheric conditions. Visibility would vary with distance from shore, topography, and atmospheric conditions and impacts would generally be localized, constant, and long term. The presence of WTGs would have negligible impacts on land use because while WTGs could be visible from some shoreline locations in the geographic analysis area, WTGs would not result in changes to land use or zoning.

Noise: Noise from offshore wind construction activities is not expected to reach the geographic analysis area, and other offshore wind projects are not anticipated to occur within the geographic analysis area. Therefore, increased noise resulting from other offshore wind activities would not affect land use and coastal infrastructure.

3.14.3.3. Conclusions

BOEM expects ongoing and planned non-offshore wind activities, including offshore wind activities, to have continuing temporary and permanent impacts on land use and coastal infrastructure. The identified IPFs relevant to land use and coastal infrastructure are accidental releases, nighttime lighting of onshore construction activity and structures, port utilization and expansion, viewshed impacts of offshore structures, presence of onshore infrastructure, and land disturbance, noise, and traffic from construction.

BOEM anticipates that the impacts of ongoing activities, especially onshore and coastal commerce, industry, and construction projects, would have both minor beneficial and negligible adverse impacts in the geographic analysis area. Accidental releases and land disturbance could have temporary adverse impacts on local land uses but, overall, ongoing use and development sustains the region’s diverse mix of land uses and provides support for continued maintenance and improvement of coastal infrastructure. Planned activities other than offshore wind, primarily increased port maintenance and expansion and construction activity, would have impacts similar to those of ongoing activities, with minor beneficial and negligible adverse impacts. BOEM expects the combination of ongoing and planned activities other than offshore wind to result in minor beneficial and negligible adverse impacts on the IPFs affecting land use and coastal infrastructure. Under the No Action Alternative, existing environmental trends and activities would continue, and land use and coastal infrastructure would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **negligible** adverse and **minor beneficial** impacts on land use and coastal infrastructure.

BOEM anticipates that the No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor** adverse impacts and **minor beneficial** impacts. Offshore wind would adversely affect land use through land disturbance (during installation of onshore cable and substations) and accidental releases during onshore construction, as well as through the presence of offshore lighting on wind energy structures and views of the structures themselves that could affect the use and value of onshore properties. Beneficial impacts on land use and coastal infrastructure would result because the development of offshore wind would support the productive use of ports and related infrastructure designed or appropriate for offshore wind activity (including construction and installation, O&M, and decommissioning).

3.14.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on land use and coastal infrastructure:

- The time of year during which construction occurs. Tourism and recreational activities in the geographic analysis area tend to be higher from May through September, and especially from June through August (Parsons and Firestone 2018). If Project construction were to occur during this season, impacts on roads and land uses during the busy tourist season would be exacerbated.

Changes to the turbine design capacity would not alter the maximum potential impacts on land use and coastal infrastructure for the Proposed Action and other alternatives because the capacity or number of turbines would not affect onshore infrastructure or port utilization.

Ocean Wind has committed to measures to minimize impacts on land use and coastal infrastructure, which include developing crossing and proximity agreements with utility owners prior to utility crossings (LU-01), complying with NJDEP noise regulations and local noise regulations (SOC-01), and implementing a construction schedule to minimize onshore construction activities during the peak summer recreation and tourism season and to coordinate with local municipalities to minimize impacts on popular events in the area during construction (REC-01 and REC-02) (COP Volume II, Table 1.1-2; Ocean Wind 2022).

3.14.5 Impacts of the Proposed Action on Land Use and Coastal Infrastructure

The Proposed Action would likely result in localized impacts that would not alter the overall character of land use and coastal infrastructure in the geographic analysis area. The most impactful IPFs would likely include land disturbance during cable installation, the visual impact of offshore WTGs, and the utilization of ports.[1] Other IPFs would likely contribute impacts of lesser intensity and extent and would occur primarily during construction but may also occur during operations and decommissioning.

[1] The Proposed Action would not directly require any upgrades to port infrastructure, but would make productive use of existing ports.

Accidental releases: Accidental releases from the Proposed Action could include release of fuel/fluids/hazardous materials as a result of port usage, installation of the onshore cables and substation, and substation operation. Potential contamination may occur from unforeseen spills or accidents, and any such occurrence would be reported and addressed in accordance with the local authority. The impact of accidental releases on land use and coastal infrastructure could result in temporary restriction on use of adjacent properties and coastal infrastructure during the cleanup process. Accordingly, accidental releases from the Proposed Action alone would have localized, short-term, negligible to minor impacts on land use.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined accidental release impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind. The increased risk of and thus the potential impacts from accidental releases of fuel/fluids/hazardous materials in the geographic analysis area would result in localized, short-term, negligible to minor impacts on land use and coastal infrastructure.

Lighting: The Proposed Action would include the installation and continuous use of aviation hazard avoidance lighting on WTGs and OSS during low-light and nighttime conditions. During operations, lighting from all the Proposed Action's 98 WTGs could potentially be visible from certain coastal and elevated locations in the geographic analysis area. Ocean Wind proposes to implement an ADLS to automatically turn the aviation obstruction lights on and off in response to the presence of aircraft in proximity of the wind farm. Such a system may reduce the amount of time that the lights are on, thereby potentially minimizing the visibility of the WTGs from shore and related effects on land use. BOEM does not anticipate that intermittent nighttime lighting of the WTGs offshore would affect existing land uses onshore given the use of ADLS and the existing developed areas within the geographic analysis area. At onshore facilities, security lighting would be down shielded to mitigate light pollution (VIS-04; COP Volume II, Table 1.1-2; Ocean Wind 2022). Nighttime lighting from the onshore substations has the potential to affect the use of adjacent properties; however, the proposed onshore substations would be constructed in areas where land development regulations, such as zoning and land use plan designations, allow and would be consistent with such use. As a result, WTG lighting and lighting of onshore infrastructure for the Proposed Action alone would have a long-term, continuous, minor impact on land use and coastal infrastructure in the geographic analysis area.

As stated in Section 3.20, *Scenic and Visual Resources*, offshore nighttime construction lighting and operational aviation hazard lighting for portions of 859 WTGs associated with the Proposed Action and other offshore wind projects could be visible from some shorelines depending on vegetation, topography, weather, and atmospheric conditions. The land use impacts from the Proposed Action in the context of planned activities (i.e., other offshore wind development) would be similar to, but more extensive than, the impacts for the Proposed Action alone. Nevertheless, in context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined WTG lighting impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind, which would be continuous, long term and negligible to minor.

Port utilization: The Proposed Action includes no port expansion activities, but would use ports that have expanded or would expand to support the wind energy industry generally. For instance, the State of New Jersey is planning to build an offshore wind port on the eastern shore of the Delaware River in Lower Alloways Creek, Salem County, approximately 7.5 miles southwest of the city of Salem (New Jersey Wind Port 2021). Additionally, the State of New Jersey announced a $250 million investment in a manufacturing facility to build steel components for offshore wind turbines at the Port of Paulsboro on the Delaware River in New Jersey (State of New Jersey 2020). Construction on the facility began in January 2021, with production anticipated to begin in 2023.

Land uses and coastal infrastructure affected by construction of offshore components would include temporary construction ports, including Atlantic City, New Jersey for the construction management base; Paulsboro, New Jersey or Europe for foundation scope; Hope Creek, New Jersey or Norfolk, Virginia for WTG scope; and Port Elizabeth, New Jersey, Charleston, South Carolina, or Europe for cable staging. These ports are expected to be used during construction but have independent utility and would not be dedicated to the Project. Proposed uses at existing port facilities would be consistent with the current land uses occurring at these locations and are not expected to result in changes to land use or zoning.

Ocean Wind would use the regional onshore O&M facility in Atlantic City, New Jersey. O&M of the Proposed Action's offshore components would require daily activity at the O&M facility in Atlantic City. The increased activity within Atlantic City's port and nearby areas zoned for business and industrial uses would be consistent with the land use character of Atlantic City's harbor, town center, and business areas, and would provide a source of investment in the coastal infrastructure (COP Volume II, Section 2.4.1; Ocean Wind 2022).

Activities associated with Proposed Action construction would generate noise, vibration, and vehicular traffic at the ports temporarily used for construction described above. These impacts are typical for industrial ports and would not hinder other nearby land uses or use of coastal infrastructure. Overall, the construction and installation of offshore components, O&M, and decommissioning for the Proposed Action alone would have minor beneficial impacts on land use and coastal infrastructure by supporting designated uses and infrastructure improvements at ports.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind, which would be minor beneficial impacts. Offshore wind development, including the Proposed Action, would require port facilities for shipping, berthing, and staging, and development activities would support ongoing or new activity at authorized ports.

Presence of structures: Portions of all the Proposed Action WTGs could be visible from certain coastal and elevated areas of the geographic analysis area mainland, depending upon vegetation, topography, and atmospheric conditions. Most WTGs would be approximately 15 miles (24.1 kilometers) from the coastal viewers and the WTGs would not dominate offshore views, even when weather and atmospheric conditions allow views. The Proposed Action alone would have a long-term, continuous, negligible impact on land use and coastal infrastructure in the geographic analysis area because while WTGs would be visible onshore, their presence is not anticipated to result in changes to land use or zoning.

The Proposed Action has two offshore export cable routes, BL England and Oyster Creek, and multiple potential landfall locations in Ocean Township, Lacey Township, Ocean City, and Upper Township. The Oyster Creek export cable is expected to make landfall in either Lacey Township or Ocean Township, and the BL England export cable is expected to make landfall in Ocean City, New Jersey. At the potential landfall sites, the Oyster Creek route would travel west across undeveloped land, taking advantage of previously disturbed areas where possible, before following abandoned roadways associated with an existing confined disposal facility. Land that is currently undeveloped would be permanently affected due to the construction of Project components such as TJBs, duct bank, or substations. These impacts would be minimized by using land zoned for commercial or industrial development, or restoring areas to pre-disturbed conditions following construction and by following existing berms, paths, trails, and roadways where possible (COP Volume II, Section 2.3.5.2; Ocean Wind 2022). After making landfall in Ocean City, the BL England route would follow local roads west, cross Peck Bay at Roosevelt Boulevard Bridge, a currently undeveloped area, via trenchless technology methods, and then continue on existing county road right-of-way to the substation property at the decommissioned BL England Generating Station (COP, Volume III, Appendix L; Ocean Wind 2022). The onshore portion of the Oyster Creek cable route would be up to 5.3 miles, with approximately 200 feet of overhead tie-line to connect into the onshore substation. The onshore portion of the BL England cable route would be up to 8 miles, with approximately 100 feet of overhead tie-line to connect to the onshore substation. Ocean Wind would coordinate and obtain crossing agreements for the crossings of utilities, roadways, bridges, and railroads. Because the export cable routes would follow mostly existing road rights-of-way, there would be minimal impacts on existing land uses. Where the offshore export cables cross currently undeveloped areas, there would be a permanent conversion of land to utility right-of-way or easement.

The proposed Oyster Creek substation would occupy up to 31.5 acres (127,476 m^2) and be sited on the former Oyster Creek nuclear plant in Lacey Township, which was retired in 2018 and is in the process of decommissioning. The proposed BL England substation would occupy up to 13 acres (52,609 m^2) and be sited on a former coal, oil, and diesel plant in Upper Township. Because both Oyster Creek and BL England substations would be sited on previously developed sites, there would be no changes to existing land uses. The new substations would be consistent with the existing industrial uses of the two sites.

Onshore construction is expected to result in temporary or permanent impacts on local residents, businesses, and the community along the proposed onshore export cable routes during the construction period. Landfall construction methods would minimize land use impacts and areas would be restored to their previous condition after construction. Temporarily increased noise levels, lighting, and traffic during construction may affect local sensitive receptors (e.g., schools, medical facilities), but would be minimized through BMPs and would not change existing land uses. Ocean Wind has committed to implementing a construction schedule to minimize activities in the onshore export cable route during the peak summer recreation and tourism season and to coordinate with local municipalities to minimize impacts on popular events in the area during construction, to the extent practicable (REC-01 and REC-02; COP Volume II, Table 1.1-2; Ocean Wind 2022). These APMs would minimize impacts on tourism from construction activities.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined onshore transmission cable infrastructure impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind, which are anticipated to be minor. Assuming that new substations for offshore wind projects would be in locations designated for industrial or utility uses, and underground cable conduits would primarily be co-located with roads or other utilities, operation of substations and cable conduits would not affect the established and planned land uses for a local area.

Land disturbance: The Proposed Action's onshore export cable infrastructure would be installed underground in a duct bank, generally along, under, or adjacent to existing roads or utility right-of-way. Where feasible, trenchless technologies, such as HDD, may be used to minimize impacts on land disturbance, including at the crossing of Island Beach State Park along the Oyster Creek cable route and next to the bridge on Roosevelt Boulevard along the BL England cable route. Installation of the cable landfall sites and underground cable routes would temporarily disturb neighboring land uses through construction noise, vibration, dust, and travel delays along the affected roads. These impacts are anticipated to last for the duration of construction; following construction, the cable route corridors would be returned to their previous condition and use. The corridors would be maintained through regular vegetation trimming and herbicide application. Installation of the cables would occur within a 50-foot-wide temporary construction corridor. Based on the landfall options with the longest onshore cable routes, construction of the Oyster Creek onshore export cable could result in up to 32 acres of temporary disturbance, and construction of the BL England onshore export cable could result in up to 48 acres of temporary disturbance. O&M would not result in land disturbance except in the event that cable maintenance or replacement is required. Land use impacts would be minimized through the use of existing rights-of-way, co-locating project components, utilizing land that is primarily zoned for commercial or industrial development, or restoring areas to pre-disturbed conditions following construction (COP Volume II, Section 2.3.5.2.1; Ocean Wind 2022).

The construction of the onshore substations would result in temporary and permanent impacts due to construction and the use of temporary construction workspace. 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, an access road, and landscaping. However, the facilities would be consistent with surrounding land uses. The BL England substation would be in Upper Township, New Jersey in the Waterfront Town Center zoning district. Per the town zoning code, electrical substations are a permitted conditional use, and therefore would be authorized subject to conditions to ensure compatibility of surrounding land uses (Township of Upper 2020, 2021). Oyster Creek substation would be in Lacey Township, New Jersey and would be within an industrial zoning district (Township of Lacey 2009). Due to the locations and zoning, potential impacts on land use would be minor. Upgrades to the electrical transmission grid may be needed for interconnection; however, those upgrades would be consistent with the existing land use. This would have localized, short-term, minor impacts on land use and coastal infrastructure (COP Volume I, Section 6.2, and Volume II, Section 2.3.5.2.1; Ocean Wind 2022).

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the land disturbance impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind, which are anticipated to be localized, short term, and minor due to construction-related disturbance and access limitations along the export cable routes. Impacts on land use and coastal infrastructure would be additive only if land disturbance associated with one or more other projects occurs in close spatial and temporal proximity.

Noise: The Proposed Action would comply with NJDEP noise regulations and local noise regulations, to the extent practicable, to minimize impacts on nearby communities (SOC-01; COP Volume II, Table 1.1-2; Ocean Wind 2022). Typical construction equipment ranges from a generator or refrigerator unit at 73 dBA at 50 feet to an impact pile driver at 101 dBA at 50 feet. As the Proposed Action would be built 15 miles offshore, noise effects from offshore construction noise would be temporary and negligible (COP Volume III, Appendix R, Section 2.5; Ocean Wind 2022). New Jersey Administrative Code 7:29 limits noise from industrial facilities at residential property lines to 50 dBA during nighttime and 65 dBA during daytime (COP Volume II, Table 1.1-2; Ocean Wind 2022). Temporarily increased noise levels during construction may affect local sensitive receptors (such as religious locations, recreational areas, schools, and other places that are particularly sensitive to construction) but would be minimized through BMPs and would not change existing land uses.

Construction of other offshore wind projects is not anticipated to occur within the geographic analysis area. In context of reasonably foreseeable environmental trends, the contribution of the Proposed Action would contribute a noticeable increment to the combined noise impacts on land use and coastal infrastructure from ongoing and planned activities, which are anticipated to be localized, short term, and minor.

3.14.5.1. Conclusions

Overall, BOEM anticipates that impacts on land use and coastal infrastructure from the Proposed Action would be **minor** adverse with **minor beneficial** impacts. The Proposed Action would have **minor beneficial** impacts resulting from port utilization, minor impacts resulting from land disturbance during onshore installation of the cable route and substation, and negligible to minor impacts resulting from accidental spills. Noise and traffic from onshore construction would have localized, short-term, minor impacts on land use and coastal infrastructure.

In the context of other reasonably foreseeable environmental trends, the incremental contribution by the Proposed Action to the overall impacts on land use and coastal infrastructure would be noticeable. BOEM anticipates that the overall impacts on land use and coastal infrastructure in the geographic analysis area associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **minor beneficial**. The main drivers for this impact rating are the beneficial impacts of port utilization, minor impacts on the viewshed due to the presence of offshore structures, and minor impacts of land disturbance. The Proposed Action would contribute to the overall impact rating primarily through short-term impacts from onshore landfall, cable, and substation installation, as well as beneficial impacts due to the use of port facilities designated for offshore wind activity.

3.14.6 Impacts of Alternatives B, C, and D on Land Use and Coastal Infrastructure

The impacts of Alternatives B-1, B-2, C-1, C-2, and D on land use and coastal infrastructure would be the same as the those of Proposed Action for all impacts except for the impact of accidental releases, light, port utilization, and the presence of structures. Alternatives B-1, B-2, and D would install fewer WTGs (up to 9 fewer WTGs for Alternative B-1; up to 19 fewer WTGs for Alternative B-2; up to 15 fewer for Alternative D), which would slightly reduce the construction impact footprint and installation period. Alternative C-1 would relocate eight WTGs, and Alternative C-2 would compress the WTG array layout. Each of these alternatives would slightly modify the visibility of the WTGs from coastal and elevated onshore areas in the geographic analysis area, but there would be an overall negligible difference as compared to the Proposed Action (Section 3.20). Because there would be fewer WTGs under these alternatives, there would be less potential for contamination from unforeseen spills or accidents, less light being omitted from offshore, and less need for port facilities for shipping, berthing, and staging. However, under all of these alternatives, the majority of the WTGs would still be visible and there would be no meaningful difference in impacts on land use and coastal infrastructure.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, C, and D to the impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind would be similar to those of the Proposed Action and would contribute a noticeable increment.

3.14.6.1. Conclusions

Alternatives B-1, B-2, C-1, C-2, and D would result in slightly reduced impacts on land use and coastal infrastructure compared to the Proposed Action, but the overall impact magnitude would remain the same. Alternatives B-1 and B-2 would result in slightly reduced visual impacts of WTGs on coastal communities by removing the WTGs closest to those coastal communities. Alternatives C-1, C-2, and D would relocate and remove WTGs but the visual effects would not be noticeable. Because there would be fewer WTGs constructed, Alternatives, B, C, and D would all result in reduced port utilization compared to the Proposed Action, along with reduced associated noise and traffic impacts, and accidental releases, but there would be no change to the overall impact magnitudes. Impacts on land use and coastal infrastructure would be **minor** adverse with **minor beneficial** impacts. Impact ratings associated with individual IPFs would not change.

In context of reasonably foreseeable environmental trends, the impacts contributed by Alternatives B-1, B-2, C-1, C-2, and D to the overall impacts on land use and coastal infrastructure would be the same as those of the Proposed Action, and would contribute a noticeable increment. BOEM anticipates that the overall impacts on land use associated with Alternatives B-1, B-2, C-1, C-2, and D when combined with the impacts from ongoing and planned activities including offshore wind would be very similar to those of the Proposed Action: **minor** adverse impacts and **minor beneficial** impacts. This impact rating is primarily driven by impacts from installation of onshore infrastructure and port utilization, which would not change among alternatives.

3.14.7 Impacts of Alternative E on Land Use and Coastal Infrastructure

The impacts of Alternative E on land use and coastal infrastructure would be the same as those of the Proposed Action for all impacts except for land disturbance, traffic, and noise associated with the modifications made to the Oyster Creek export cable route to minimize impacts on SAV in Barnegat Bay.

Land disturbance: Alternative E would limit the onshore portion of the Oyster Creek export cable route on Island Beach State Park to the northern export cable route option. Construction of the northern export cable route option would increase the area of temporary disturbance by 2.2 acres compared to the southern export cable route option under the Proposed Action. The impact of Alternative E would be restricted to Island Beach State Park. Trenching and installation activities to bury the cable would temporarily disturb wetlands and vegetation on the barrier island and potentially interfere with recreational activities in the state park. After construction, the right-of-way would be restored to pre-disturbance conditions and long-term effects would not be anticipated.

Traffic: Cable installation within the roadway would result in temporary traffic impacts such as lane closures, shifted traffic patterns, or closed roadways and parking areas. Central Avenue/Shore Road is the only north-south through road on the barrier island, so road closures would restrict access to the southern portion of the island. Roadways would be returned to pre-construction conditions and changes to the existing land use would not result.

Noise: Alternative E would involve more onshore construction activities such as open trench excavation and trenchless technologies such as HDD or direct pipe for cable installation as a result of the longer onshore export cable route. Under Alternative E as under the Proposed Action, land use impacts would be minimized through the use of existing rights-of-way, co-locating Project components, and restoring some areas to pre-disturbed conditions following construction. While the northern export cable route option would likely result in extended construction with potentially increased impacts on noise and traffic, the overall impacts of construction would be of the same magnitude as those of the Proposed Action.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind would be noticeable.

3.14.7.1. Conclusions

Alternative E would slightly increase the onshore portion of the Oyster Creek export cable route, resulting in increased impacts on land use associated with temporary construction activity compared to the Proposed Action. The overall impact magnitudes would be the same because the cable corridors would follow existing right-of-way and the primary impacts would be limited to the duration of construction. Impacts on land use and coastal infrastructure would be **minor** adverse with **minor beneficial** impacts. Impact ratings associated with individual IPFs would not change.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the overall impacts on land use and coastal infrastructure would be the same as those of the Proposed Action and would be noticeable. BOEM anticipates that the overall impacts associated with Alternative E when combined with impacts from ongoing and planned activities including offshore wind would be very similar to those of the Proposed Action: **minor** adverse impacts and **minor beneficial** impacts. This impact rating is primarily driven by impacts from installation of onshore infrastructure and port utilization, which would not change among alternatives.

3.14.8 Proposed Mitigation Measures

No measures to mitigate impacts on land use and coastal infrastructure have been proposed for analysis.

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3.19. Sea Turtles

This section discusses potential impacts on sea turtles from the proposed Project, alternatives, and ongoing and planned activities in the sea turtle geographic analysis area. The sea turtle geographic analysis area, as shown on Figure 3.19-1, encompasses two LMEs, namely the Northeast U.S. OCS and Southeast U.S. OCS LMEs. These LMEs capture most of the movement range of sea turtles within the U.S. Atlantic Ocean waters. Due to the size of the geographic analysis area, for analysis purposes in this EIS, the focus is on sea turtles that would likely occur in the proposed Project area and be affected by Project activities. The geographic analysis area does not include all areas that could be transited by Project vessels (e.g., it does not consider vessel transits from Europe).

3.19.1 Description of the Affected Environment for Sea Turtles

Four species of sea turtles are known to occur in or near the Ocean Wind Project area, all of which are protected under the ESA (16 USC 1531 et seq.). These include the leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and green sea turtle (*Chelonia mydas*). A fifth species, the hawksbill sea turtle (*Eretmochelys imbricata*), occurs in the larger geographic analysis area but is very unlikely to occur in the Project area because it typically inhabits tropical waters. While it has been recorded in New England during the summer (Lazell 1980), there are no sightings of hawksbill sea turtle currently documented within Atlantic coastal waters off New Jersey (Conserve Wildlife Foundation of New Jersey 2021). Therefore, this species is not considered further. Table 3.19-1 lists the four sea turtle species and DPS that could occur in the North Atlantic coastal waters offshore New Jersey, and provides the listing status and likelihood of occurrence in the Project area.

Sea turtles inhabit tropical and subtropical seas throughout the world. In coastal U.S. Atlantic waters, sea turtles are seasonally distributed, migrating to and from habitats extending from Florida to New England, with overwintering concentrations in southern waters and nesting sites on southern beaches from Virginia south through Florida. There is potential for the four sea turtle species to seasonally inhabit offshore waters in the Project area in the spring (March–May), summer (June–August), and fall (September–November) including the area of direct effects during the winter months (December–February). Water temperature is a primary factor influencing sea turtle distribution; sea turtles typically occur in the coastal waters off New Jersey when water temperatures exceed 59°F (NJDEP 2010). Green, loggerhead, and Kemp's ridley sea turtles migrate north from warmer South Atlantic waters in the spring (May and June) to take advantage of abundant prey in warming northeastern waters, including both the OCS and inshore embayments and estuaries. Sea turtles return to southern waters as water temperatures decline in the fall and are unlikely to be present in the Project area after November 30. However, not all sea turtles leave the area during winter and there are occasional strandings of sea turtles that become incapacitated or "cold-stunned" at temperatures below 50°F (NJDEP 2010 citing Mrosovsky 1980).

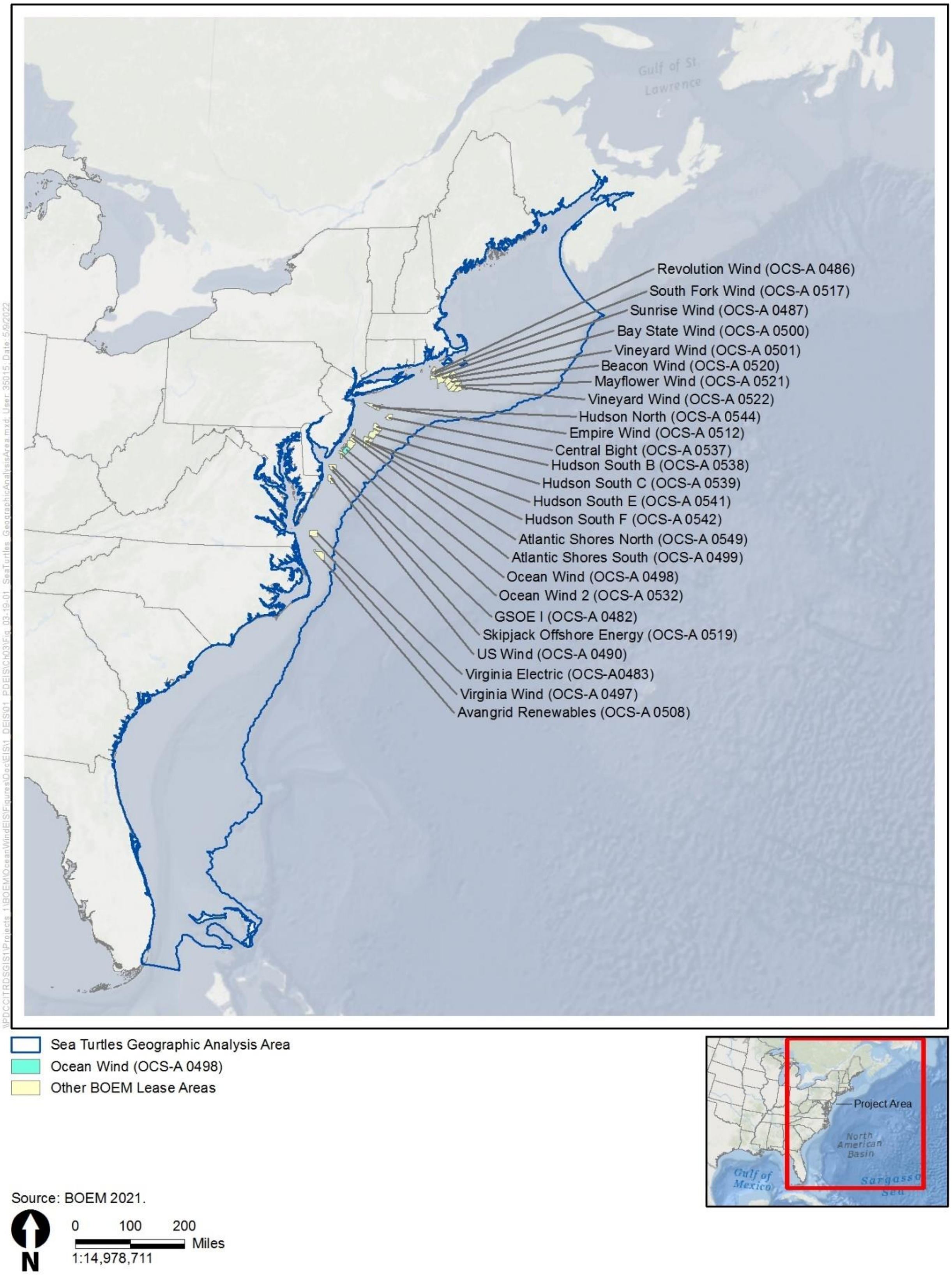

Figure 3.19-1 Sea Turtles Geographic Analysis Area

Table 3.19-1 Sea Turtle Species that May Potentially Occur in the Project Area

Common Name	Scientific Name	DPS	ESA Status[1]	Frequency of Occurrence in New Jersey	Seasonal Occurrence in Project Area	Likelihood of Occurrence in Project Area
Leatherback sea turtle	*Dermochelys coriacea*	Not applicable[2]	E	Common	May to November[3]	Likely
Loggerhead sea turtle	*Caretta caretta*	Northwest Atlantic	T	Common	May to November[3]	Likely
Kemp's ridley sea turtle	*Lepidochelys kempii*	Not applicable	E	Uncommon	May to November[3]	Likely
Green sea turtle	*Chelonia mydas*	North Atlantic	T	Uncommon	May to November[3]	Unlikely

Sources: NMFS 2021a; NJDEP 2006, 2010
[1] ESA status: E = Endangered, T = Threatened
[2] NMFS and USFWS have not designated DPSs for leatherback sea turtles because the species is listed as endangered throughout its global range (85 *Federal Register* 48332).
[3] May to November is the primary season, but each species can occur beyond these months (see text).

Sea turtle nesting does not occur in New Jersey and there are no nesting beaches or other critical habitats in the vicinity of the Project (GARFO 2021). Individuals occurring in the Project area are either migrating or foraging, and are likely to spend the majority of time below the surface. Sea turtles can remain underwater for extended periods, ranging from several minutes to several hours, depending on factors such as daily and seasonal environmental conditions and specific behavioral activities associated with dive types (Hochscheid 2014; NSF and USGS 2011). Such physiological traits and behavioral patterns allow them to spend as little as 3 to 6 percent of their time at the water's surface (Lutcavage and Lutz 1997). These adaptations are important because sea turtles often travel long distances between their feeding grounds and nesting beaches (Meylan 1995).

The combination of sightings, strandings, and bycatch data provides the best available information on sea turtle distribution in the Project area. This section summarizes data for each of the four sea turtle species from shipboard and aerial surveys of New Jersey's offshore wind study area (NJDEP 2010), NMFS AMAPPS (Palka et al. 2017, 2021), NMFS Sea Turtle Stranding and Salvage Network (STSSN) (NMFS 2021a), and recent and historic population or density estimates from NMFS, the Department of the Navy, and the New York State Energy Research and Development Authority, where available. Population dynamics and habitat use of different sea turtle species along the New Jersey shore is still poorly understood. Sea turtles are wide-ranging and long-lived, making population estimates difficult, and survey methods vary depending on species (TEWG 2007; NMFS and USFWS 2013, 2015a, 2015b). Because sea turtles have large ranges and highly migratory behaviors, the current condition and trend of sea turtles are affected by many factors beyond the geographic analysis area.

The *Atlantic OCS Proposed Geological and Geophysical Activities: Final Programmatic Environmental Impact Statement* (BOEM 2012), incorporated here by reference, provides further details about each species' range and distribution, population status, ecology and life history, and conservation and management.

Leatherback Sea Turtle: The leatherback sea turtle is the largest and the most widely distributed sea turtle species, ranging broadly from tropical and subtropical to temperate regions of the world's oceans (NMFS and USFWS 1992). Individuals in the Project area belong to the Northwest Atlantic population, which is one of seven leatherback populations globally. The species was listed as endangered under the ESA in 1970 (35 *Federal Register* 8491), inclusive of all populations.[1] Unlike the other three sea turtle species, the leatherback does not use shallow waters to prey on benthic invertebrates or sea grasses. Leatherbacks are highly pelagic in nature and feed largely on jellyfish, but are also commonly observed in coastal waters along the U.S. OCS (NMFS and USFWS 1992). Leatherback sea turtles dive the deepest of all sea turtles to forage and are thought to be more tolerant of cooler oceanic temperatures than other sea turtles. In a study tracking 135 leatherbacks fitted with satellite tracking tags, leatherbacks were identified to inhabit waters with sea surface temperatures ranging from 52°F to 89°F (Bailey et al. 2012). The study also found that oceanographic features such as mesoscale eddies, convergence zones, and areas of upwelling attracted foraging leatherbacks because these features are often associated with aggregations of jellyfish. The breeding population (total number of adults) estimated in the North Atlantic is 34,000 to 94,000 (NMFS and USFWS 2013; TEWG 2007). NMFS and USFWS (2020) concluded that the Northwest Atlantic population has a total index of nesting female abundance of 20,659 females with a decreasing nest trend at nesting beaches with the greatest known nesting female abundance. During visual aerial and shipboard abundance surveys conducted under AMAPPS I (2010 to 2014) and AMAPPS II (2014 to 2019), approximately 6 percent were positively identified as leatherback sea turtles. Leatherbacks were detected in the vicinity of the Project area during summer and fall (June through November), but not during winter and spring (December through May). The majority of leatherbacks

[1] NMFS and USFWS have not designated DPSs for leatherback sea turtles because the species is listed as endangered throughout its global range (85 *Federal Register* 48332).

tagged by AMAPPS research have remained in Atlantic OCS waters from North Carolina up the mid-Atlantic shelf and into southern New England and the Gulf of Maine (Palka et al. 2021). From 2010 through 2020, the STSSN reported 12 offshore and six inshore leatherback sea turtle strandings within Zone 39, which encompasses southern New Jersey (NMFS 2021a). During NJDEP (2010) aerial and shipboard surveys for marine mammals and sea turtles, sightings included a total of 12 leatherback sea turtles in waters ranging from 59 to 98 feet deep, with a mean depth of 79 feet. Sightings were recorded from 6.4 to 22.5 miles from shore, with a mean distance of 17.8 miles. The sea surface temperatures associated with leatherback sea turtle sightings ranged from 64.6°F to 68.5°F with a mean temperature of 66.2°F. Leatherback sea turtles undergo extensive migrations in the western North Atlantic and usually start arriving along the New Jersey coast in late spring/early summer (Shoop and Kenney 1992; James et al. 2006). A surrogate density estimate was calculated using the results from New York State Energy Research and Development Authority’s surveys across the New York offshore planning area by Normandeau Associates and APEM (2018a, 2018b, 2019a, 2019b, 2020). The estimated leatherback sea turtle density during the fall, the season with the highest density, was 0.789 turtle per 100 km^2, which translates to around three leatherback sea turtles within the Project area (Table 3.19-2). Another density estimate is available from the Navy OPAREA Density Estimates model for the Atlantic Ocean, which estimates sea turtle density each season based on habitat variables (e.g., sea surface temperature, seafloor depth) (Navy 2007) and indicates that the density of leatherback sea turtles in the Project area during fall ranges from 2.675 to 3.745 animals per 100 km^2. That equates to a higher density of approximately 7 to 11 leatherback sea turtles within the 68,450-acre Wind Farm Area. Based on this information, BOEM expects leatherback sea turtles to be common in New Jersey and likely in the Project area from May to November (Table 3.19-1).

Table 3.19-2 Sea Turtle Density Estimates Derived from New York State Energy Research and Development Authority Annual Reports

Common name	Density (animals/100 km^2)			
	Spring (March–May)	Summer (June–August)	Fall (September–November)	Winter (December–February)
Leatherback sea turtle	0	0.331	0.789	0
Loggerhead sea turtle	0.254	26.799	0.19	0.025
Kemp’s ridley sea turtle	0.05	0.991	0.19	0
Green sea turtle	0	0.038	0	0

Sources: Normandeau Associates and APEM 2018a, 2018b, 2019a, 2019b, 2020.

Loggerhead Sea Turtle: Loggerhead sea turtles range widely and have been observed along the entire Atlantic Coast as far north as Canada (Brazner and McMillan 2008; Ceriani et al. 2014; Shoop and Kenney 1992). Loggerheads in the Project area belong to the Northwest Atlantic DPS, which is listed as threatened under the ESA (76 *Federal Register* 58868). The regional abundance estimate in the Northwest Atlantic OCS in 2010 was approximately 588,000 adults and juveniles of sufficient size to be identified during aerial surveys (interquartile range of 382,000 to 817,000 [NEFSC and SEFSC 2011]). The three largest nesting subpopulations responsible for most of the production in the western North Atlantic (peninsular Florida, northern United States, and Quintana Roo, Mexico) have all been declining since at least the late 1990s, thereby indicating a downward trend for this population (TEWG 2009). While some progress has been made since publication of the 2008 Loggerhead Sea Turtle Recovery Plan, the recovery units have not met most of the critical benchmark recovery criteria (NMFS and USFWS 2019).

Winton et al. (2018) reported that loggerheads tagged within the Northwest Atlantic primarily restrict their summertime distribution to OCS waters and occasionally make excursions inshore to bays and estuaries. Core habitat includes sea surface temperatures from 59.0°F to 82.4°F and at depths between 26.3 and 301.8 feet, and the highest probability of occurrence occurs in regions with sea surface temperatures from 63.9°F to 77.5°F and at depths between 85.6 and 243.5 feet (Patel et al. 2021). Studies have indicated that the Mid-Atlantic Bight of the Atlantic OCS, where the Project area occurs, is an important a seasonal foraging ground for approximately 40,000 to 60,000 juvenile and adult loggerheads during summer months (NEFSC and SEFSC 2011). Satellite telemetry data indicate that potentially 30 to 50 percent of loggerheads that nest and reside along the U.S. eastern seaboard seasonally forage within the Mid-Atlantic Bight (Winton et al. 2018; Patel et al. 2021). Spatial models developed by Winton et al. (2018) based on satellite-tagged turtles demonstrate that the Project occurs within an area of medium to high relative density of loggerheads from May through October; higher densities are predicted to occur farther offshore to the east of the Project (NROC 2021). AMAPPS surveys reported that loggerhead sea turtles are by far the most commonly sighted sea turtles on the Atlantic OCS waters from New Jersey to Nova Scotia, Canada, with 47 percent of all sea turtle observations being positively identified as loggerheads (Palka et al. 2021). Loggerheads were detected in the Project vicinity during spring (March through May) and summer and fall (March through November) but not during winter months (December through February) (Palka et al. 2021).

The NJDEP (2010) aerial and shipboard surveys recorded a total of 615 loggerhead sea turtle sightings between January 2008 and December 2009. The loggerhead sea turtle was the second most frequently sighted species during the survey and the vast majority of sightings were during the summer (NJDEP 2010). From 2010 through 2020, STSSN reported 139 offshore and 74 inshore loggerhead sea turtle strandings within Zone 39, which encompasses southern New Jersey (NMFS 2021a). Loggerheads are stranded far more often than other sea turtles in New Jersey (NMFS 2021a), as they have a higher relative abundance. New York State Energy Research and Development Authority reported that, in the New York offshore planning area, most of the sea turtles recorded were loggerhead sea turtles, by an order of magnitude. The estimated density of loggerhead sea turtles was greatest during summer (26.779 turtles per 100 km^2), followed by fall with approximately 74 animals within the Project area (0.1 turtle per 100 km^2) (Table 3.19-2) (Normandeau Associates and APEM 2018a, 2018b, 2019a, 2019b, 2020). Additionally, the Navy (2007) OPAREA Density Estimates models predict that the density of loggerhead sea turtles in the Project area during summer ranges from 3.608 to 7.955 animals per 100 km^2, which equates to approximately 10 to 22 loggerhead sea turtles within the 68,450-acre Wind Farm Area. Collectively, available information indicates that loggerhead sea turtles are expected to occur commonly as adults, subadults, and juveniles from the late spring through fall, with the highest probability of occurrence from July through September. Based on this information, BOEM expects loggerhead sea turtles to be common in New Jersey and likely within the Project area from May to November (Table 3.19-1).

Kemp’s Ridley Sea Turtle: Kemp’s ridley sea turtles are most commonly found in the Gulf of Mexico and along the U.S. Atlantic Coast. Juvenile and subadult Kemp’s ridley sea turtles are known to travel as far north as Cape Cod Bay during summer foraging (NMFS et al. 2011). All Kemp’s ridley sea turtles belong to a single population that is endangered under the ESA (35 *Federal Register* 183290). The species is primarily associated with habitats on the Atlantic OCS, with preferred habitats consisting of sheltered areas along the coastline, including estuaries, lagoons, and bays (Burke et al. 1994; NMFS 2019) and nearshore waters less than 120 feet deep (Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters. The population was severely reduced prior to 1985 due to intensive egg collection and fishery bycatch, with a low in 1985 of 702 nests counted from an estimated 250 nesting females on three primary nesting beaches in Mexico (NMFS and USFWS 2015a). Recent estimates of the total population of age 2 years and older is 248,307; however, recent models indicate a persistent reduction in survival or recruitment, or both, in the nesting population, suggesting that the population is not recovering to historical levels (NMFS and USFWS 2015a). A total of 20,570 nests were documented in Mexico in 2011. Similar to Mexico, Texas also experienced an increase in the number of nests from 1985 through 2009, but saw a noticeable decline in 2010 when only 141 nests were recorded. The number of nests continues to be low with 199 in 2011, 209 in 2012, 153 in 2013, and 119 in 2014 (NMFS and USFWS 2015a).

Recent models indicate a persistent reduction in survival or recruitment, or both, in the nesting population, suggesting that the population is not recovering (NMFS and USFWS 2015a). Visual sighting data are limited because this small species is difficult to observe using typical aerial survey methods (Kraus et al. 2016) or because their density is truly low in Atlantic OCS waters. AMAPPS surveys rarely encountered Kemp’s ridley sea turtles, with around 1 percent of all sea turtle observations being positively identified as Kemp’s ridley. No Kemp’s ridley sea turtles were detected in the vicinity of the Project area (Palka et al. 2021). The Marine Mammal Stranding Center in New Jersey rescued an average of 45 Kemp’s ridley turtles each year between 1995 and 2005, of which 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 (NJDEP 2006). From 2010 through 2020, STSSN reported 11 offshore and five inshore Kemp’s ridley sea turtle strandings within Zone 39, which encompasses southern New Jersey (NMFS 2021a).

Based on surveys by Normandeau Associates and APEM (2018a, 2018b, 2019a, 2019b, 2020) across the New York offshore planning area, the estimated density of Kemp’s ridley sea turtles was greatest during the summer (0.991 turtle per 100 km^2) and is approximately three animals within the Project area (see Appendix J, Table J-6). Additionally, the Navy (2007) OPAREA Density Estimates model indicates that the density of Kemp’s ridley sea turtles in the Project area during summer ranges from 0 to 0.0186 animal per 100 km^2, which equates to approximately 0 to 1 Kemp’s ridley sea turtle within the 68,450-acre Wind Farm Area. Kemp’s ridley sea turtles commonly occur in inshore and nearshore New Jersey waters as they migrate to the North Atlantic during May and June and forage for crabs in SAV (Burke et al. 1994). These often are juveniles foraging for food and return to the Gulf of Mexico as coastal waters cool in fall (Ocean Wind 2022). Based on this information, Kemp’s ridley sea turtles could occur infrequently as juveniles and subadults from July through September, potentially occurring as late as November. The highest likelihood of occurrence is in coastal nearshore areas adjacent to Ocean City and Barnegat Bay where the offshore export cable is anticipated to make landfall, as they seek protected shallow-water habitats. BOEM expects Kemp’s ridley sea turtles to occur in the Project area from May to November.

Green Sea Turtle: Green sea turtles are found in tropical and subtropical waters around the globe. However, juveniles and subadults are occasionally observed in Atlantic coastal waters as far north as Massachusetts (NMFS and USFWS 1991). They are most commonly observed feeding in the shallow waters of reefs, bays, inlets, lagoons, and shoals that are abundant in algae or marine grass (NMFS and USFWS 2007). Green turtles do not nest on beaches in the Project area; their primary nesting beaches are in Costa Rica, Mexico, the United States (Florida), and Cuba.

Green sea turtles in the Project area belong to the North Atlantic DPS, which is listed as threatened under the ESA (81 *Federal Register* 20057). The most recent status review for the North Atlantic DPS estimates the number of female nesting turtles to be approximately 167,424 individuals (NMFS and USFWS 2015b). According to NMFS and USFWS (2015b), nesting trends are generally increasing for this population. Because of their association with warm waters, green turtles are uncommonly found in New Jersey waters during the summer, foraging on marine algae and marine grasses (Conserve Wildlife Foundation of New Jersey 2021). 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). They 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.

AMAPPS visual aerial and shipboard positively detected low numbers of green sea turtles that displayed similar seasonal migrations as other sea turtles; it reported that green sea turtles composed approximately 4 percent of the 9,455 positively identified sea turtles. Green sea turtles were detected in the vicinity of the Project area during summer and fall (June through November), but not during winter and spring (December through May) (Palka et al. 2021). NMFS STSSN rescued eight green sea turtles between 1995 and 2005, of which six had evidence of human interactions with fishing activities, boat strikes, and impingement on a power plant grate (NJDEP 2006). From 2010 to 2020, STSSN reported seven offshore and two inshore green sea turtle strandings within Zone 39, which encompasses southern New Jersey (NMFS 2021a).

Based on surveys in the New York offshore planning area by Normandeau Associates and APEM (2018a, 2018b, 2019a, 2019b, 2020), the estimated density green sea turtles was greatest during the summer (0.38 turtle per 100 km^2). Fall density estimates were less than one animal within the Project area (see Appendix J, Table J-6). Additionally, the Navy OPAREA Density Estimates data modeled the density of green sea turtles in the Project area during summer with ranges from 0 to 2.338 animals per 100 km^2 (Navy 2007). This translates to approximately 0 to 6 green sea turtles within the 68,450-acre Wind Farm Area. Based on this information, the occurrence of green sea turtles in the Project area is expected to be uncommon and limited to small numbers.

Sea turtles in the geographic analysis area are subject to a variety of ongoing human-caused impacts, including collisions with vessels, entanglement with fishing gear, fisheries by-catch, dredging, anthropogenic noise, pollution, disturbance of marine and coastal environments, effects on benthic habitat, accidental fuel leaks or spills, waste discharge, and climate change. Sea turtle migrations can cover long distances, and these factors can have impacts on individuals over broad geographical scales.

3.19.2 Environmental Consequences

3.19.2.1. Impact Level Definitions for Sea Turtles

Definitions of impact levels are provided in Table 3.19-3.

Table 3.19-3 Impact Level Definitions for Sea Turtles

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on sea turtles would be undetectable or barely measurable, with no consequences to individuals or populations.
	Beneficial	Impacts on sea turtles would be undetectable or barely measurable, with no consequences to individuals or populations.
Minor	Adverse	Impacts on sea turtles would be detectable and measurable, but of low intensity, highly localized, and temporary or short term in duration. Impacts may include injury or loss of individuals, but these impacts would not result in population-level effects.
	Beneficial	Impacts on sea turtles would be detectable and measurable, but of low intensity, highly localized, and temporary or short term in duration. Impacts could increase survival and fitness, but would not result in population-level effects.
Moderate	Adverse	Impacts on sea turtles would be detectable and measurable and could result in population-level effects. Adverse effects would likely be recoverable and would not affect population or DPS viability.

Impact Level	Impact Type	Definition
	Beneficial	Impacts on sea turtles would be detectable and measurable and could result in population-level effects. Impacts would be measurable at the population level.
Major	Adverse	Impacts on sea turtles would be significant and extensive and long term in duration, and could have population-level effects that are not recoverable, even with mitigation.
	Beneficial	Impacts would be significant and extensive and contribute to population or DPS recovery.

3.19.3 Impacts of the No Action Alternative on Sea Turtles

When analyzing the impacts of the No Action Alternative on sea turtles, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

3.19.3.1. Ongoing and Planned Non-offshore Wind Activities

Under the No Action Alternative, baseline conditions for sea turtles would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities. The ongoing non-offshore wind activities that may affect sea turtles include marine transportation; onshore development activities; dredging and port improvements; marine minerals use and ocean dredged material disposal; commercial and recreational fishing; undersea transmission lines, gas pipelines, and other submarine cables; oil and gas activities; military use; and global climate change.(see Section F.2 in Appendix F for a complete description of ongoing and planned activities). Under the No Action Alternative, BOEM expects ongoing activities would continue having temporary to permanent impacts (disturbance, displacement, injury, mortality, and reduced foraging success) on sea turtles, primarily due to lighting associated with coastal development, noise, marine pollution, vessel strikes, entanglement or ingestion of fishing gear, and ongoing climate change.

Planned non-offshore wind activities that may affect sea turtles include but are not limited to various coastal development projects permitted through regional planning commissions, counties, and towns; dredging for the New Jersey Wind Port on the Delaware River in Salem County; the Davisville/ Brooklyn/Newark Container-on-Barge Service; the approved liquefied natural gas export terminals in Elba Island, Georgia, and Jacksonville, Florida; the Roosevelt Island Tidal Energy Project; dredging for beach replenishment used for the Long Beach Island Coastal Storm Risk Management Project, Barnegat Inlet to Little Egg Inlet; the Atlantic City marina upgrades; and the Port of Virginia channel deepening. These and other planned non-offshore wind activities may affect sea turtles via the same IPFs listed above and discussed in further detail below. Impacts on sea turtles may be temporary (displacement or behavioral responses) or permanent (e.g., habitat loss or mortality). All activities would be required to comply with federal, state, and local regulations, which would avoid or minimize most potential impacts.

See Table F1-21 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for sea turtles.

Lighting: The impacts of coastal development affects sea turtles primarily through habitat loss from development and artificial lighting near sea turtle nesting areas, which can disorient nesting females and hatchlings. Artificial lighting on the OCS does not appear to have the same potential for effects. In spite of increasing human population growth and associated coastal development, and negative correlation between sea turtle nest numbers and the presence of artificial light (Mazor et al. 2013), Weishampel et al.

(2016) found that nighttime light levels decreased for more than two-thirds of Florida's surveyed sea turtle nesting beaches despite of coastal urbanization trends. It is anticipated that there will be increasing adoption of state and local lighting ordinances in places where sea turtles nest. However, the impacts of lighting on sea turtles resulting from ongoing and planned non-offshore wind activities would be minor because coastal development trends are likely to continue and sea turtle nesting is also affected by light from more distant urban lighting.

Noise: Very little data exist on the behavioral responses of sea turtles to noise. Of the available studies, sea turtles typically change their behavior in some way in response to noise. Further information on sea turtle hearing and thresholds for potential impacts (PTS, TTS, or behavioral disturbance) are provided in the analysis of other offshore wind activities (Section 3.19.3.2). In the geographic analysis area, ongoing and other planned activities that may produce noise would include site characterization surveys and scientific surveys (i.e., G&G surveys). These would be infrequent and produce high-intensity impulsive noise that has the potential to affect sea turtles, including potential auditory injuries and behavioral responses, which could include short-term displacement of feeding or migrating (NSF and USGS 2011). The potential for PTS and TTS in sea turtles is considered possible if these animals were to occur in close proximity to the G&G survey noise source. Also, noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can result in high-intensity, low-exposure-level, and long-term but localized intermittent risk to sea turtles. Lastly, noise from infrequent trenching activities for pipeline and cable laying, as well as other cable burial, dredging, and marine minerals extraction, could cause behavioral disturbance to sea turtles, which is expected to be localized and temporary. The impacts of noise on sea turtles resulting from ongoing and planned non-offshore wind activities are expected to be minor. Although there is some risk for permanent injury (PTS), no mortality is expected.

Traffic (vessel strikes): Vessel strike is an increasing concern for sea turtles. Injuries from propellers and collisions resulting from small boats and ships are expected to occur even more frequently as recreational boat activity increases in conjunction with ongoing coastal development. For example, the percentage of loggerhead strandings attributed to vessel strikes has increased from approximately 10 percent in the 1980s to a record high of 20.5 percent in 2004 (NMFS and USFWS 2007). Sea turtles cannot reliably avoid being struck by vessels exceeding 2 knots (Hazel et al. 2007) and typical vessel speeds in the geographic analysis area may exceed 10 knots. Increased vessel traffic could result in sea turtle injury or mortality (Foley et al. 2019). The impacts of vessel traffic on individual sea turtles resulting from ongoing and planned non-offshore wind activities would be minor. Although population-level impacts from vessel strikes alone have not been demonstrated, marine traffic is increasing and vessel strikes are understood to be a major threat to sea turtles.

Accidental releases: Marine pollution is an ongoing threat, as sea turtle ingestion of human trash and debris has been observed in all species of sea turtles (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). Ingestion often occurs when sea turtles mistake debris for potential prey items (Gregory 2009; Hoarau et al. 2014; Thomás et al. 2002). Although the threat varies among species and life stages due to differing feeding, plastic ingestion is an issue for marine turtles from the earliest stages of life (Eastman et al. 2020) and the volume of debris ingested is related to the size of the turtles (Thomás et al. 2002). Fuel spills have lesser potential impacts on sea turtles due to their low probability of occurrence and relatively limited spatial extent, although impacts of large spills can be significant. However, sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka et al. 2010) or sublethal effects on individual fitness. Sea turtles could also become entangled in lost or abandoned fishing gear, which is a significant source of mortality for both juveniles and adults (National Research Council 1990). The impacts of accidental releases on sea turtles resulting from ongoing and planned non-offshore wind activities would be minor. Marine pollution is believed to be a significant factor limiting the recovery of sea turtles.

Gear utilization: A primary threat to sea turtles is their unintended capture in fishing gear, which can result in drowning or cause injuries that lead to injury and mortality (e.g., swallowing hooks). For example, trawl fishing is among the greatest continuing primary threats to the loggerhead turtle (NMFS and USFWS 2019) and sea turtles are also caught as bycatch in other fishing gear including longlines, gillnets, hook and line, pound nets, pot/traps, and dredge fisheries. A substantial impact of commercial fishing on sea turtles is the entrapment or entanglement that occurs with a variety of fishing gear. Although the requirement for the use of bycatch mitigation measures, such as requirements for "turtle excluder devices" in trawl fishing gear, has reduced sea turtle bycatch, Finkbeiner et al. (2011) compiled data on sea turtle bycatch in U.S. fisheries and found that in the Atlantic, a mean estimate of 137,700 interactions, 4,500 of which were lethal, occurred annually since implementation of bycatch mitigation measures. The impacts of gear utilization associated with fisheries use on sea turtles are expected to be minor. A reduction of sea turtle interactions with fisheries is a priority for sea turtle recovery.

Climate change: Global climate change could result in population-level impacts on sea turtle species by displacement, impacts on prey species, altered population dynamics, and increased mortality. It is well established that climate change has the potential to affect the distribution and abundance of sea turtles and their prey due to changing water temperatures, ocean currents, and increased acidity. Furthermore, rising sea levels and increased storm intensity may negatively affect turtle nesting beaches. Increasing air temperatures can affect sea turtle population structure because temperature-dependent sex determination of embryos would result in a shift toward more female-biased sex ratios (Poloczanska et al. 2009). Patel et al. (2021) used global climate models to predict that the future distribution of suitable thermal habitat for loggerheads along the OCS will likely increase in northern regions. Sea turtle nesting could also shift northward on the U.S. Atlantic Coast. Because these changes may affect sea turtle reproduction, survival, and demography, the impacts of climate change on sea turtles are expected to be minor.

3.19.3.2. Offshore Wind Activities (without Proposed Action)

Offshore wind activities have the potential to produce impacts resulting from site characterization studies, site assessment data collection activities that involve installation of meteorological towers or buoys, and installation and operation of turbine structures. Other offshore wind projects in the geographic analysis area are estimated to collectively:

- Install 3,109 WTG and OSS foundations
- Install 4,988 miles (8,027 kilometers) of offshore export cable and 5,309 miles (8,544 kilometers) of inter-array cable
- Disturb 27,126 acres (110 km^2) of seabed for WTG foundations and scour protection, cable emplacement, and anchoring
- Store 5,300 gallons (19,041 liters) of diesel fuel, oils, lubricants, and coolant per WTG

BOEM expects other offshore wind activities (without the Proposed Action) to affect the primary IPFs of accidental releases, discharges, EMF, cable placement and maintenance, noise, vessel traffic, port utilization, presence of structures, and gear utilization. This section provides a general description of these activities, recognizing the extent and significance of potential effects on conditions cannot be fully quantified for projects that are in the conceptual or proposal stage and have not been fully designed. Where appropriate, certain potential effects resulting from these actions can be generally characterized by comparison to effects resulting from the Proposed Action that are likely to be similar in nature and significance. The intent of this section is to provide a general overview of how reasonably foreseeable future activities might influence environmental conditions. Should any or all of the activities described in Appendix F proceed, each would be subject to independent NEPA analyses and regulatory approvals, and their environmental effects would be fully considered therein.

Accidental releases: Accidental releases of fuel, fluids, hazardous materials, trash, and debris may increase as a result of offshore wind activities. The risk of any type of accidental release would be increased primarily during construction, but also during operations and decommissioning of offshore wind facilities.

Other offshore wind development would require large quantities of coolant fluids, oils and lubricants, and diesel fuel (see Table F2-3 in Appendix F for specific quantities). In the planned activities scenario (see Table F2-3 in Appendix F), there would be a low risk of a leak of fluids from any single one of approximately 2,946 WTGs, each with approximately 5,300 gallons (19,041 liters) of diesel fuel, oils, lubricants, and coolant stored. According to BOEM's modeling (Bejarano et al. 2013), a release of 128,000 gallons is likely to occur no more often than once per 1,000 years, and a release of 2,000 gallons or less is likely to occur every 5 to 20 years. The likelihood of a spill occurring from multiple WTGs and OSS at the same time is very low and, therefore, the potential impacts from a spill larger than 2,000 gallons are largely discountable. Based on the volumes potentially involved, the likely amount of additional releases associated with offshore wind development would fall within the range of accidental releases that already occur on an ongoing basis from non-offshore wind activities. Impacts resulting from accidental releases may pose a long-term risk to sea turtles and could potentially lead to mortality and sublethal impacts on individuals present in the vicinity of the spill, but the potential for exposure would be minor given the isolated nature of these accidental releases and the variable distribution of sea turtles in the geographic analysis area.

The accidental release of trash and debris may occur by vessels during construction, operations, and decommissioning of offshore wind facilities. Ingestion of trash or exposure to aquatic contaminants can be lethal to sea turtles. However, sea turtles may also be affected sublethally in a variety of ways, which could include experiencing depressed immune system function, poor body condition, and reduced growth rates, fecundity, and reproductive success (Hoarau et al. 2014). Sea turtles could also become entangled in debris accidentally released by offshore wind project vessels, causing lethal or injurious impacts. Additionally, refueling of primary construction vessels at sea would likely be proposed for offshore wind activities, which could affect sea turtles and their prey if spills were to occur. Impacts on individual sea turtles, including decreased fitness, health effects, and mortality, may occur if individuals are present in the vicinity of a spill, but accidental releases are expected to be rare and injury or mortality are not expected to occur. BOEM assumes all vessels will comply with laws and regulations to minimize releases. In the unlikely event of a trash or debris release, it would be an accidental, localized event in the vicinity of an offshore wind lease area.

Accidental releases from other offshore wind activities would likely result in minor impacts for sea turtles and are unlikely to result in population-level effects, although consequences to individuals would be detectable and measurable.

EMF: The EMFs produced by cables have the potential to affect sea turtle migration because they are known to possess geomagnetic sensitivity and use cues from Earth's magnetic field for orientation, navigation, and migration. Sea turtles appear to have a detection threshold of magnetosensitivity and behavioral responses to field intensities ranging from 0.0047 to 4,000 microteslas for loggerhead turtles and 29.3 to 200 microteslas for green turtles, with other species likely similar due to anatomical, behavioral, and life history similarities (Normandeau et al. 2011). In the planned activities scenario, up to 4,988 miles (8,027 kilometers) of offshore export cable and 5,309 miles (8,544 kilometers) of inter-array cable would be added in the geographic analysis area for sea turtles, producing EMFs in the vicinity of each cable during operations (Appendix F, Table F2-1). Submarine power cables in the geographic analysis area for sea turtles are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF from cable operation to low levels. Juvenile and adult sea turtles may detect the EMF over relatively small areas near cables (e.g., when resting on the bottom or foraging on benthic organisms near cables or concrete mattresses). There are no data on impacts on sea turtles from EMFs generated by underwater cables, although anthropogenic magnetic fields can influence migratory deviations (Luschi et al. 2007; Snoek et al. 2016). Lohmann et al. (2008) speculated that navigation methods used by adult and juvenile sea turtles were dependent upon the stage of migration, initially relying on magnetic orientation. While the specific mechanisms of leatherback sea turtle navigation are unknown, it is believed that they possess a compass sense similar to hardshell turtle species, possibly related to geomagnetic cues (Eckert et al. 2012; Luschi et al. 2007; NMFS and USFWS 2013). Therefore, although EMF associated with offshore wind development cables could cause some deviations to sea turtle routes, these deviations would likely be minor (Normandeau et al. 2011) and biologically insignificant due to the minor energy expenditure they may cause. Furthermore, this IPF would be limited to extremely small portions of the areas used by resident or migrating sea turtles. As such, exposure to EMF would be negligible.

Lighting: All WTGs and OSS would be lit with navigational and FAA hazard lighting. Although lighting on nesting beaches or in nearshore habitats has the potential to result in disorientation to nesting females and hatchling turtles, artificial lighting on the OCS does not appear to have the same effects. Orr et al. (2013) indicated that lights on WTGs that flash intermittently for navigational or safety purposes do not present a continuous light source, and therefore do not appear to have a disorienting influence for any sea turtle life history stages. BOEM anticipates that impacts on sea turtles from structure lighting would be negligible.

Cable emplacement and maintenance: Other offshore wind development would require new cabling to bring generated electricity onshore and would result in seafloor disturbance and elevated levels of suspended sediment. This could affect 32,346 acres (131 km^2) of seabed while associated undersea cables are installed, causing an increase in suspended sediment (see Appendix F, Table F2-2). Cable emplacement may occur from a variety of methods that include trenching devices, plows, and jetting and are dependent upon seabed sediments. The impacts from these cable emplacement methods are variable but typically include suspension of seabed sediments that vary in extent and intensity depending on the project and site-specific conditions. Impacts from cable burial would be spatially and temporally localized, with the main impacts occurring within a few feet vertically and a few hundred feet horizontally from the point of disturbance. Suspended sediment concentrations due to jet plow would be within the range of natural variability. Potential impacts from construction activities on sea turtles would be short term and involve increased turbidity for 1 to 6 hours in the immediate vicinity of the cable emplacement corridor. If elevated turbidity caused any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, such behaviors would be temporary. Sea turtles would be expected to swim away from the sediment plume and return to the area once turbidity has returned to background levels. Elevated turbidity could temporarily affect the foraging behavior of sea turtles by attracting prey to feed on detritus or interfering with visual prey detection, but no impacts due to swimming through the plume would be expected (NMFS 2020). It is expected that mitigation measures would be implemented to minimize and reduce the potential for adverse effects from water quality changes on sea turtles.

Dredging for sand wave clearance may be necessary in places to ensure cable burial below mobile seabed sediments, which could result in additional impacts on sea turtles related to impingement, entrainment, and capture associated with mechanical and hydraulic dredging techniques. Sea turtles have been known to become entrained in trailing suction hopper dredge or trapped beneath the draghead as it moves across the seabed. Direct impacts, especially for entrainment, typically results in severe injury or mortality (Dickerson et al. 2004; USACE 2020). About 69 projects have recorded sea turtle takes within channels in New Jersey, Delaware, and Virginia and there have likely been numerous other instances not officially recorded (Ramirez et al. 2017). However, the risk of interactions between hopper dredges and individual sea turtles is expected to be lower in the open ocean areas where dredging may occur compared to nearshore navigational channels where sea turtles are more concentrated in a constrained operating environment (Michel et al. 2013; USACE 2020). This may be due to the lower density of sea turtles in these areas as well as differences in behavior and other risk factors. Dredging within nearshore areas could affect green sea turtle habitat by directly removing SAV or creating suspended sediments that may be deposited on top of seagrass (see Section 3.6, *Benthic Resources*). To mitigate that risk, it is anticipated that offshore wind projects would perform SAV surveys and avoid these areas during construction, to the extent practicable. Changes in turbidity and suspended sediments could temporarily disrupt normal sea turtle behaviors, especially if turtles rely on vision to forage. Sea turtles may experience behavioral effects upon exposure to turbidity or suspended sediments and become more susceptible to other threats like vessel collision, but this has not been studied or measured. There are also no studies that evaluate the behavioral effects of suspended sediments on mobile prey species and Johnson (2018) suggested that any effects on sea turtle prey species from suspended sediments, sediment deposition, or turbidity may cause turtles to move to other areas and then return to the affected areas at some time in the future. It is not believed that dredging would permanently change the sea turtle prey base (Michel et al. 2013) and wind projects would implement turbidity reduction measures to contain the silt and sediment stirred up by dredging.

Lastly, while there would be a loss of existing benthic habitat, the presence of scour protection and hard protection on top of cables could create a more complex habitat and increase the abundance of associated organisms like mussels and crustaceans on and around the cables (Hutchison et al. 2020), providing a prey resource for loggerhead and Kemp’s ridley sea turtles. The hard substrate may increase the abundance of jellyfish, an important prey species for leatherback sea turtles (Janßen et al. 2013). It is anticipated that offshore wind cables may cause long-term to permanent impacts on some areas with SAV, adversely affecting green sea turtles’ forage availability, although cable routes for future projects have not been fully determined at this time. Studies on the effects of dredging on green sea turtles in Florida found that they utilized adjacent unaffected habitats and returned to the dredged area within 2 years (Michel et al. 2013).

Given the available information, the risk of injury or mortality of individual sea turtles resulting from dredging necessary to support other offshore wind projects would be minor and population-level effects are unlikely to occur.

Noise: In the geographic analysis area, offshore wind activities that could cause underwater noise are impact pile driving (installation of WTGs and OSS), vibratory pile driving (installation and removal of cofferdams), HRG surveys, detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and turbine operation.

The installation of ongoing WTG foundations into the seabed involves pile driving and other construction activities that could cause underwater noise in the geographic analysis area and result in short-term behavioral disturbance and impacts on sea turtle hearing that may recover over time (i.e., TTS) as well as long-term impacts on sea turtle hearing (i.e., PTS). Noise from pile driving would occur during installation of foundations for offshore structures. The potential for underwater noise to result in adverse impacts on a sea turtle depends on the received sound level and the frequency content of the sound relative to the hearing ability of the animal. The limited data available on sea turtle hearing abilities are summarized in Table 3.19-4. Sea turtles appear to hear frequencies from 30 Hz to 2 kilohertz, with a range of best hearing sensitivity between 100 and 700 Hz; however, there is some sensitivity to frequencies as low as 60 Hz and possibly as low as 30 Hz (Ridgway et al. 1969). Therefore, there is substantial overlap in the frequencies that sea turtles can detect and the dominant frequencies produced by offshore wind activities, including pile driving, impulsive sources used for HRG surveys, and UXO.

Table 3.19-4 Hearing Capabilities of Sea Turtles

Sea Turtle Species	Hearing		Source
	Range (Hertz)	Highest Sensitivity (Hertz)	
Green Sea Turtle (*Chelonia mydas*)	60–1,000	300–500	Ridgway et al. 1969
	100–800	600–700 (juveniles) 200–400 (subadults)	Bartol and Ketten 2006; Ketten and Bartol 2006
	50–1,600	50–400	Piniak et al. 2012a, 2016
Loggerhead Sea Turtle (*Caretta caretta*)	250–1,000	250	Bartol et al. 1999
	50–1,100	100–400	Martin et al. 2012; Lavender et al. 2014
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	100–500	100–200	Bartol and Ketten 2006; Ketten and Bartol 2006
Leatherback Sea Turtle (*Dermochelys coriacea*)	50–1,600	100–400	Piniak et al. 2012b

Given the high energy levels of offshore wind energy survey and installation noise sources, it can be concluded that sea turtles could be affected by associated noise. However, there are no available empirical data regarding threshold levels for impacts on sea turtle hearing from sound exposure. As a result, there have been no regulatory threshold criteria established for sea turtles. There are limited data pertaining to behavioral responses of sea turtles and none specifically to sounds generated by offshore wind activities. McCauley et al. (2000) observed that one green turtle and one loggerhead sea turtle in an open water pen increased swimming behaviors in response to a single seismic airgun at received levels of 166 dB re 1 µPa and exhibited erratic behavior at received levels greater than 175 dB re 1 µPa. Moein et al. (1994) documented similar avoidance reactions to similar levels of seismic signals, although both studies were done in a caged environment, so the extent of avoidance could not be monitored. DeRuiter and Larbi Doukara (2012) observed that 57 percent of loggerhead sea turtles exhibited a diving response after seismic airgun array firing at received levels between 175 and 191 dB re 1 µPa. Moein et al. (1994) did observe a habituation effect to the airguns; the animals stopped responding to the signal after three presentations. Sea turtles can become habituated to repeated noise exposure over time and not suffer long-term consequences (O'Hara and Wilcox 1990). This type of noise habituation has been demonstrated even when the repeated exposures were separated by several days (Bartol and Bartol 2011; Navy 2018).

In the absence of NMFS acoustic thresholds, the U.S. Navy has adopted PTS and TTS thresholds for sea turtles as presented in Finneran et al. (2017) (see Table 3.19-5). Table 3.19-5 outlines the acoustic thresholds for the onset of PTS, TTS, and behavioral disturbance for sea turtles for impulsive and non-impulsive noise sources. NMFS has considered behavioral response beginning at 175 dB re 1 µPa SPL_{RMS} (Navy 2017). These thresholds apply to juvenile, subadult, and adult life stages.

Table 3.19-5 Acoustic Thresholds for Onset of Acoustic Impacts (PTS, TTS, or Behavioral Disturbance) for Sea Turtles

Injury (PTS)		TTS		Behavioral Disturbance
SPL_{peak} (dB re 1 µPa) Impulsive	SEL_{cum} (dB re 1 µPa^{2}s) Impulsive/Non-Impulsive	SPL_{peak} (dB re 1 µPa) Impulsive/Non-Impulsive	SEL_{cum} (dB re 1 µPa^{2}s) Impulsive Non-Impulsive	SPL_{RMS} (dB re 1 µPa) Impulsive/Non-Impulsive
232	204	226	189	175

dB re 1 µPa = decibels relative to 1 micropascal; dB re 1 µPa^{2}s = decibels relative to 1 micropascal squared second; SEL_{cum} = cumulative sound exposure level

In the planned activities scenario (see Appendix F), the construction of 3,109 WTG and OSS foundations would create underwater noise and may temporarily affect sea turtles if they are present in the ensonified area. While these potential effects are acknowledged, their potential significance is unclear.

Impact pile driving noise: Impulsive underwater noise from impact pile driving during planned offshore wind development, due to the anticipated frequency and spatial extent of effects, represents the highest likelihood for exposure of adverse effects on individual sea turtles. Sea turtles migrating through the area when pile driving occurs are expected to adjust their course to avoid the area where noise is elevated above 175 dB re 1 µPa SPL_{RMS}. Such behavioral alterations could cause turtles to cease foraging or expend additional effort and energy avoiding the area. Presumably, sea turtles could continue foraging activities outside the area of elevated noise levels as adjacent habitat provides similar foraging opportunities. Although information is lacking, some sea turtles could be temporarily displaced into areas that have a lower foraging quality or result in higher risk of interactions with ships or fishing gear. Sea turtles may experience physiological stress during this avoidance behavior, but this stressed state would be anticipated to dissipate over time once the sea turtle is outside the ensonified area. Furthermore, this displacement would result in a relatively small energetic consequence that would not be expected to have long-term impacts on sea turtles.

While there have been no documented sea turtle mortalities associated with pile driving and no direct evidence of PTS occurring in sea turtles, TTS has been demonstrated in many species from exposure to impulsive and non-impulsive noise (a full review is provided in Southall et al. 2007 and NOAA 2013). Prolonged or repeated exposure to sound levels sufficient to induce TTS without recovery time can lead to PTS (Southall et al. 2007). The accumulated stress and energetic costs of avoiding repeated exposure to pile-driving noise over a season or a life stage could have long-term impacts on survival and fitness (Navy 2018). Conversely, sea turtles could become habituated to repeated noise exposure over time and not suffer long-term consequences (O'Hara and Wilcox 1990). This type of noise habituation has been demonstrated even when the repeated exposures were separated by several days (Bartol and Bartol 2011; Navy 2018). The magnitude of potential impacts on sea turtles would be dependent upon the locations of concurrent construction operations, as well as the number of hours per day, the number of days that pile driving would occur, and the time of year in which pile driving occurs. Individuals repeatedly exposed to pile driving over a season, year, or life stage may incur energetic costs that have the potential to lead to long-term consequences (Navy 2018). However, individuals may become habituated to repeated exposures over time and ignore a stimulus that was not accompanied by an overt threat (Hazel et al. 2007); individuals have been shown to retain this habituation even when the repeated exposures were separated by several days (Bartol and Bartol 2011; Navy 2018).

HRG survey noise: Offshore wind energy projects perform HRG surveys that use a combination of sonar-based methods to map shallow geophysical features and can be classified as impulsive or non-pulsive noise sources. The equipment is towed behind a moving survey vessel and generates a short-duration pulse in the 1.1- to 200-kilohertz range, with the interval between pulses ranging from 0.2 to 1 second, depending on the specific type of equipment used. The equipment only operates when the vessel is moving along a survey transect, meaning that the ensonified area is intermittent and constantly moving. HRG surveys that use non-impulsive sources are not expected to affect sea turtles because they operate at frequencies above the sea turtle hearing range.

BOEM (2018) and NMFS (2021b) evaluated potential underwater noise effects on sea turtles from HRG surveys using impulsive sources (boomers/airguns/sparkers/sub-bottom profilers) and concluded that for an individual sea turtle to experience PTS (204 dB re 1 μPa²s SEL_{cum}; 232 dB re 1 μPa²·s SPL [0–pk] impulsive sources), it would have to be within 1 meter of the loudest possible noise source. In fact, NMFS (2021b) states that none of the equipment being operated for HRG surveys with hearing overlap for sea turtles has source levels loud enough to result in PTS or TTS. However, noise from impulsive sources used during HRG surveys could exceed the behavioral effects threshold (175 dB) up to 90 meters from the source, depending on the type of equipment used. Given the limited extent of potential noise effects, injury-level exposures (PTS/TTS) are unlikely to occur. As stated above and based on the loudest impulsive noise source, it is highly unlikely that noise from HRG survey sound sources would cause PTS or TTS in sea turtles (NMFS 2021b). While low-level behavioral exposures could occur, these disruptions would be limited in extent and short term in duration given the movement of the survey vessel and the mobility of the animals. Therefore, underwater noise impacts from HRG surveys are expected to be minor.

UXO detonation noise: Offshore wind activities may encounter UXO on the seabed in their lease areas or along export cable routes. While non-explosive methods may be employed to lift and move these objects, some may need to be removed by explosive detonation. Underwater explosions of this type generate high pressure levels that could cause disturbance and injury to sea turtles, but the number of affected individuals would be small relative to the population sizes. The number and location of detonations that may be required for other projects as well as the Proposed Action are relatively unknown. Impacts associated with UXO detonations for other projects would be similar to those described and modeled for the Proposed Action in Section 3.19.5.

Vessel noise: Due to the large number of vessels required for ongoing offshore wind development, vessel noise could potentially result in impacts on individual sea turtles. The use of ocean vessels could potentially result in long-term but infrequent impacts on sea turtles, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes, especially their submergence patterns (NSF and USGS 2011; Samuel et al. 2005). However, Hazel et al. (2007) suggest that sea turtles' ability to detect approaching vessels is primarily vision-dependent, not acoustic. Sea turtles may respond to vessel approach, noise, or both, with a startle response (diving or swimming away) and a temporary stress response (NSF and USGS 2011). Samuel et al. (2005) indicated that vessel noise can have an effect on sea turtle behavior, especially their submergence patterns. BOEM anticipates that the potential effects of noise from construction and installation vessels would elicit brief responses to the passing vessel that would dissipate once the vessel or the turtle left the area.

Operational noise: The sound levels produced during the operation of offshore wind projects would be less than the behavioral and injurious thresholds defined by NMFS for sea turtles. Sea turtles may respond to underwater noise generated by WTG operation through avoidance or behavioral alteration for some sea turtles. Such localized behavioral effects would be negligible and sea turtles could be expected to become habituated to the sound. In contrast, the decommissioning of a project would reverse any sea turtle displacement effects caused by operational noise. Also, underwater noise from offshore wind project operation is unlikely to result in significant effects on the forage base for sea turtles. These species are primarily invertivores or, in the case of green sea turtles, omnivorous vegetarians. The sound sensitivity of invertebrates like crabs, jellyfish, and mollusks is restricted to particle motion and the affect dissipates rapidly such that any effects are highly localized to the immediate proximity (i.e., less than 3.3 feet [1 meter]) of the noise source (Edmonds et al. 2016). Although loggerhead and Kemp's ridley sea turtles may periodically prey on fish, fish represent a minor component of a flexible and adaptable diet. Underwater noise could temporarily reduce the availability of fish prey species, but these effects would be limited in extent and duration.

Based on the above discussion, BOEM anticipates that the impacts of noise on sea turtles from other offshore wind activities would be minor.

Traffic (vessel collisions): Offshore wind projects on the OCS would be constructed between 2023 and 2030, contributing to increases in vessel traffic and associated noise impacts within the sea turtle geographic analysis area. Based on the current vessel traffic generated by ongoing activities, it is assumed that vessel traffic associated with offshore wind development poses a high-frequency, high-exposure collision risk to sea turtles in coastal waters when transiting through offshore wind lease areas during construction, operations, and decommissioning. Construction of each individual offshore wind project would generate approximately 20 to 65 simultaneous construction vessels (refer to Section 3.16 for additional information regarding vessel traffic). This vessel traffic increase would be expected to result in a small incremental increase in overall vessel traffic within the geographic analysis area for sea turtles. Sea turtles are likely to be most susceptible to vessel collision in coastal waters, where they forage from May through November. Vessel speed may exceed 10 knots in such waters, and those vessels traveling at greater than 10 knots would pose the greatest threat to sea turtles (Hazel et al. 2007).

The relative risk of vessel strikes from wind industry vessels would depend upon the density of sea turtles within the project area, stage of project development, time of year, number of vessels, and speed of vessels during each stage. Offshore wind projects may also cause shifts in vessel traffic, including temporary restrictions of fishing vessels during construction due to implementation of safety zones, potential increases in vessel traffic within the offshore wind lease areas after construction due to an influx of recreational fishing vessels targeting species associated with an artificial reef effect, and likely shifts in commercial fishing vessels from the offshore wind lease areas to areas not routinely fished due to recreation vessel congestion and gear-conflict concerns. Collision risk to sea turtles would be expected to occur primarily when vessels transit to and from the offshore wind lease areas from ports. Once within the offshore wind lease areas, vessels would typically be stationary and no collision risk would be expected, but some transits between locations may also occur. The increased collision risk from transiting vessels has the potential to result in injury to or mortality of individual sea turtles, but impacts would be minor given the broad distribution and low densities of most sea turtle species. Population-level impacts would also be expected to be minor, again due to the low densities of each species and their extensive distribution within the geographic analysis area.

Port utilization: Offshore wind on the mid-Atlantic OCS may require the expansion or improvement of regional ports to support planned projects. The State of New Jersey is planning to build an offshore wind port on the eastern shore of the Delaware River in Lower Alloways Creek (Appendix F). Port improvements could lead to an increase in vessel traffic during construction, O&M, and decommissioning. The resulting change in vessel traffic in the geographic analysis area cannot be predicted, however, because only locations for port expansion are identified and no specific project plans have been proposed. Any future port expansion and associated increase in vessel traffic would be subject to independent NEPA analysis and regulatory approvals requiring full consideration of potential effects on sea turtles regionwide. For these reasons, the impacts of port utilization on sea turtles from other offshore wind activities would likely be minor because the potentially affected habitats would be small relative to the habitat used by sea turtles in the geographic analysis area.

Presence of structures: Development of offshore wind projects in the planned activities scenario would install more buoys, meteorological towers, foundations, and hard protection. Up to 3,109 new WTG and

OSS foundations would be installed, which could create a reef effect. These structures would affect ocean mixing and alter thermal stratification, which although small compared to other naturally occurring mixing mechanisms (Schultze et al. 2020) could influence sea turtle dive behavior and thermoregulation. This effect would also influence primary and secondary productivity, the distribution and abundance of fish and invertebrates, and overall community structure within and in proximity to project footprints. Depending on proximity and extent, hydrodynamic and reef effects from future actions could influence the availability of prey and forage resources for sea turtles.

As discussed above regarding scour protection for cable emplacement, the presence of new, hard surfaces, including WTG foundations, would provide habitat that could be colonized by an abundance of organisms that are sea turtle prey, like mussels, crustaceans, and jellyfish. In the Gulf of Mexico, loggerhead, leatherback, green, Kemp's ridley, and hawksbill sea turtles have been documented in the vicinity of offshore oil and gas platforms, with the probability of occupation increasing with the age of the structures (Gitschlag and Herczeg 1994; Hastings et al. 1976). Sea turtles would be expected to use habitat in between the WTGs as well as around structures for feeding, breeding, resting, and migrating for short periods, but residency times around structures may increase with the age of structures if communities develop on and around foundations.

Project-specific effects would vary, recognizing that larger and contiguous projects could have more significant effects on prey and forage resources, but the extent and significance of these effects cannot be predicted based on currently available information. The ultimate effects of offshore wind structures on ocean productivity, sea turtle prey species, and thereby sea turtles are difficult to predict with certainty and are expected to vary by location, season, and year, depending on broader atmospheric conditions and ecosystem processes. Impacts would also be highly localized and unlikely to have biologically meaningful effects on individual sea turtles. Project decommissioning, including the removal of the monopile foundations and scour and cable protection, would reverse the artificial reef effect provided by these structures and remove or disperse the associated biological community. Sea turtle species accustomed to the foraging opportunities provided in this community would have to adapt.

While the anticipated reef effect would result in long-term beneficial impacts on sea turtles, some potential exists for increased exposure to fishing gear that could lead to entanglement, ingestion, injury, and death. The presence of structures may concentrate recreational fishing around foundations and would also increase the risk of gear loss or damage. This could cause entanglement, especially with monofilament line, and increase the potential for entanglement in both lines and nets leading to injury and mortality due to abrasions, loss of limbs, and increased drag, resulting in reduced foraging efficiency and ability to avoid predators (Barnette 2017; Berreiros and Raykov 2014; Foley et al. 2008). The reef effect may attract recreational fishing effort from inshore areas and attract sea turtles for foraging opportunities, resulting in a small increased risk of sea turtle entanglement and hooking or ingestion of marine debris where fishermen and turtles are concentrated around the same foundations.

Given the available information, the risk of injury to or mortality of individual sea turtles due to the presence of structures, and the interactions with fishing gear that they may cause, would be minor and population-level effects are unlikely to occur. Likewise, any beneficial impacts from the reef effect would be minor, as individuals may benefit but there would be no population-level effects.

Gear utilization (biological/fisheries monitoring surveys): Sea turtles could be affected by monitoring surveys of offshore wind activities due to vessel traffic and associated underwater vessel noise and potential for vessel strikes. These effects would be similar to those discussed above under *Noise* and *Traffic*. Additional impacts on sea turtles could result from trawl and trap surveys and the use of acoustic survey technologies. Offshore wind projects are expected to use trawl surveys, among other methods, for project monitoring. The capture and mortality of sea turtles in bottom-trawl fisheries are well documented (Henwood and Stuntz 1987; NMFS and USFWS 1991, 1992; National Research Council 1990). While sea turtles are capable of remaining submerged for long periods of time, they appear to rapidly consume oxygen stores when entangled and forcibly submerged in fishing gear (Lutcavage and Lutz 1997). The preponderance of available research (Epperly et al. 2002; Sasso and Epperly 2006) and anecdotal information from past trawl surveys indicates that limiting tow times to less than 30 minutes would likely eliminate the risk of death for incidentally captured sea turtles. It is anticipated that the proposed trawls for offshore wind project monitoring would be limited to 20 minutes, indicating that this activity poses a negligible risk of mortality and mitigation measures would be expected to eliminate the risk of serious injury and mortality from forced submergence for sea turtles caught in bottom-trawl survey gear.

Other fisheries resource surveys using stationary gear like Chevron traps or baited remote underwater video could pose a risk of entanglement for sea turtle species due to buoy and anchor lines. While there is a theoretical risk of sea turtle entanglement, particularly for leatherbacks, in trap and pot gear (NMFS 2016), the likelihood would be discountable given the limited, patchy distribution of sea turtles, the small number of vertical lines used in the surveys, and the limited duration of each survey event. Efforts would also be taken to reduce sea turtle interactions during fisheries surveys. Sea turtle prey items such as horseshoe crabs, other crabs, whelks, and fish may be removed from the marine environment as bycatch in trap gear. However, all bycatch is expected to be returned to the water alive, dead, or injured to the extent that the organisms would shortly die. Injured or deceased bycatch would still be available as prey for sea turtles, particularly loggerhead sea turtles, which are known to eat a variety of live prey as well as scavenge dead organisms. Given this information, any effects on sea turtles from the collection of potential sea turtle prey in trap gear would be so small that it cannot be meaningfully measured, detected, or evaluated and, therefore, effects would be insignificant.

The equipment used in the clam, oceanography, and pelagic fish surveys pose minimal risk to sea turtles. Tows for the clam survey have a very short duration of 120 seconds, and the vessels would be subject to mitigation measures similar to those for the trawl survey. Both the oceanography and pelagic fish surveys are non-extractive and would also be subject to mitigation measures that would avoid minimize potential impacts on sea turtles. Therefore, the effects of the equipment used in clam, oceanography, and pelagic fish surveys on sea turtles would insignificant or discountable. Lastly, the passive acoustic monitoring surveys would not have any direct impacts on sea turtles; as with all other monitoring surveys, impacts on sea turtles could arise from vessel noise and the potential for vessel strike as discussed above. Mooring lines for such surveys pose a theoretical entanglement risk to sea turtles but BOEM anticipates requiring that moored systems would use the best available technology to reduce any potential risks of entanglement and that they would pose a discountable risk of entanglement to sea turtles.

Monitoring surveys are expected to occur at short-term, regular intervals over the lifetime of a project and therefore impacts of this IPF on sea turtles from other offshore wind projects would be negligible even though the potential extent and number of animals potentially exposed cannot be determined without project-specific information.

3.19.3.3. Conclusions

Under the No Action Alternative, baseline conditions for sea turtles would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities, including other offshore wind activities. BOEM expects ongoing activities would have temporary to permanent impacts on sea turtles (disturbance, displacement, injury, mortality, and reduced foraging success), primarily due to lighting associated with coastal development, noise, marine pollution, vessel strikes, entanglement or ingestion of fishing gear, and ongoing climate change.

Planned non-offshore wind activities include marine transportation, new submarine cables and pipelines, maintenance dredging, channel-deepening activities, military activities, and the installation of new towers, buoys, and piers (Appendix F), with impacts similar to under ongoing activities. Construction of other offshore wind projects in the geographic analysis area could affect migration, feeding, breeding, and individual fitness of sea turtles through the primary IPFs. Most impacts on sea turtles would be localized and temporary or short term. Intermittent, temporary impacts from underwater noise may be of high intensity and result in a high exposure level but impacts on sea turtles are not expected to result in population-level effects. Although there would be a loss of existing benthic habitat, WTG and OSS foundations may provide foraging and sheltering opportunities for sea turtles. The significance of this reef effect is unknown, however, and is not expected to result in biologically significant impacts on sea turtles and the presence of structures would result in negligible beneficial impacts.

Under the No Action Alternative, existing environmental trends and activities would continue, and sea turtles would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **minor** impacts on sea turtles because impacts on sea turtles would be detectable and measurable but of low intensity, localized, and temporary or short term in duration. BOEM anticipates that the No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor** impacts, because potential impacts may include injury or loss of individuals, but these impacts would not result in population-level effects.

3.19.4 Relevant Design Parameters and Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on sea turtles:

- Noise associated with the construction, operation, and decommissioning of Project structures (e.g., pile driving and construction vessels), which could have behavioral and physiological effects, or cause auditory injury to sea turtles;
- Vessel traffic, which could increase collision risk to sea turtles due to vessels transiting to and from the Wind Farm Area during construction, operations, and decommissioning, and increased recreational fishing vessels; and
- The presence of structures, which could cause both beneficial and adverse impacts on sea turtles through localized changes to hydrodynamic disturbance, prey aggregation and associated increase in foraging opportunities, incidental hooking from recreational fishing around foundations, entanglement in lost and discarded fishing gear, migration disturbances, and displacement.

Variability of the proposed Project design exists as outlined in Appendix E. The following is a summary of potential variances in impacts:

- Foundation Type. The potential acoustic impacts on sea turtles differ among the foundation types that Ocean Wind would use, which is up to three pin-piled jacket foundations or monopile foundations for OSS and up to 98 monopile foundations for WTGs. Construction of the jacket-type foundation would have a higher acoustic impact than construction of the monopile foundation due to the increased risk of exposure because of the longer time required to install more piles (up to four 9.8-foot [3-meter] pin piles per jacket).
- Monopile diameter. The potential acoustic impacts on sea turtles differ among the WTG monopile diameters that may be used. Ocean Wind would use monopiles with a maximum outer diameter at seabed of 34 feet (11 meters) that taper to a maximum top diameter of 25 feet (8 meters). The acoustic impacts of a monopile with a smaller diameter would differ.
- The WTG number. All potential impacts would be lessened with a decrease in number of WTGs built.

- Onshore export cable routes: The route chosen (including variants within the general route) would determine the amount of habitat affected.
- Season of construction: The active season for sea turtles in New Jersey is from May through November. Construction outside of this window would have a lesser impact on sea turtles than construction during the active season.

Although some variation is expected in the design parameters, the impact assessment on sea turtles in this section analyzes the maximum-case scenario.

Ocean Wind has committed to measures to minimize impacts on sea turtles. The APMs are considered part of the Proposed Action and applicable action alternatives and are assessed within each IPF. The measures outlined in the COP include maintaining reasonable distances from sea turtles (MMST-01), adhering to NMFS Regional Viewing Guidelines to minimize the risk of vessel collision (MMST-02), posting protected species observers as required by NMFS during construction activities (MMST-04), obtaining necessary permits and establishing appropriate and practicable mitigation and monitoring measures (MMST-05), and developing and implementing a Protected Species Mitigation and Monitoring Plan (MMST-06) (COP Volume II, Table 1.1-2; Ocean Wind 2022).

As part of its COP, Ocean Wind has also developed a Protected Species Mitigation and Monitoring Plan for marine mammals, sea turtles, and ESA-listed fish species (COP Volume III, Appendix AA; Ocean Wind 2022). Measures proposed in the Protected Species Mitigation and Monitoring Plan include but are not limited to protected species observers, vessel avoidance measures such as separation distances and speed restrictions, pile driving time-of-year restrictions, visual monitoring for HRG surveys, UXO detonation monitoring, marine debris awareness training, and monitoring and reporting of sea turtle observations during activities with potential impacts. Appendix H, Table H-1 provides a full list of the committed measures in greater detail.

3.19.5 Impacts of the Proposed Action on Sea Turtles

This section summarizes the potential impacts of the Proposed Action on sea turtles during the various phases of the proposed Project. Routine activities would include construction, O&M, and decommissioning of the proposed Project, as described in Chapter 2, *Alternatives*. BOEM prepared a BA for the potential effects on ESA-listed species under NMFS' jurisdiction, which found that the Proposed Action *may affect and is likely to adversely affect* ESA-listed sea turtles (BOEM 2022). The BA concluded that auditory effects due to the Proposed Action may affect, but are not likely to adversely affect, ESA-listed sea turtles. Non-auditory effects from UXO detonations due to the Proposed Action could include mortality and therefore may adversely affect ESA-listed sea turtles. Also, trawl surveys could lead to the capture and minor injury of small numbers of individual sea turtles, which may adversely affect small numbers of sea turtles as detailed in the BA (BOEM 2022).

The analysis of impacts under the No Action Alternative (see Section 3.19.3.2), and references therein, applies to the following discussion of the Proposed Action. The most impactful IPFs associated with the Proposed Action are discussed below and include underwater noise, which could cause temporary impacts for 4 hours per pile during WTG construction (98 days over 2 years); pile driving for up to three OSS foundations; increased vessel traffic, which could lead to injury or mortality from vessel strikes; the presence of structures, which would lead to permanent impacts that may be either adverse or beneficial; and cable emplacement and maintenance, which could affect sea turtles from mechanical and hydraulic dredging techniques and via water quality effects.

Accidental releases: Accidental release of trash and debris may occur from Project vessels during construction, operations, and decommissioning. BOEM assumes operator compliance with federal and international requirements for managing shipboard trash; such events also have a relatively limited spatial impact. While precautions to prevent accidental releases would be employed by vessels and port operations associated with the Project, it is likely that some debris could be lost overboard during construction, maintenance, and routine vessel activities. However, the amount would likely be miniscule compared to other inputs. In the event of a release, it would be an accidental, localized event in the vicinity of the Project area, likely resulting in non-measurable impacts, if any. However, because sea turtle ingestion of trash can be fatal, the overall impact would be minor. Proposed mitigation and monitoring for waste management, including marine debris awareness and elimination training for Project personnel, would be required, reducing the likelihood of an accidental release.

In context of reasonably foreseeable trends, the Proposed Action would contribute an undetectable increment to the combined accidental release impacts on sea turtles from ongoing and planned activities including offshore wind, which are expected to be minor.

EMF: The Project would install up to 190 miles of 8-inch 170-kV array cable among the WTGs. Up to 175 miles of up to three 13-inch 275-kV export cables would be added in the Project area, buried to a depth of 4 to 6 feet (1.2 to 1.8 meters) depending on site conditions (Ocean Wind 2022). Normandeau et al. (2011) concluded that sea turtles are unlikely to detect magnetic field intensities below 50 milligauss, suggesting that these species would be insensitive to EMF effects from the Project's electrical cables. Furthermore, the proposed shielding and burial depths would minimize EMF intensity and extent. Given the extremely small area where exposure to this IPF would occur and the proposed burial depth of the submarine cable, no measurable impacts such as changes in swimming direction and altered migration routes would be expected. These effects on sea turtles are more likely to occur with direct current cables than with alternating current cables (Normandeau et al. 2011). Because alternating current cables have been proposed for the Project and the Project area represents an extremely small area within the coastal waters used by sea turtles, BOEM expects non-measurable, minor impacts, if any, on sea turtle behavior.

In context of reasonably foreseeable trends, the Proposed Action would contribute an undetectable increment to the combined EMF impacts on sea turtles from ongoing and planned activities including offshore wind, which are expected to be negligible.

Cable emplacement and maintenance: The Proposed Action would include up to 390 acres (1.6 km^2) of seafloor disturbance by cable installation, which would mostly be done by jet or mechanical plow. The predicted concentrations of suspended sediment for various cable emplacement activities are described in Section 3.15.5, *Impacts of the Proposed Action on Marine Mammals.* Sediment within the Wind Farm Area is generally fine and medium-grained sand with areas of gravelly sand and gravel deposits near the Wind Farm Area. Based on the grain sizes evaluated by the studies in Massachusetts, Rhode Island, and Virginia, the gravelly sand and gravel deposits near the Wind Farm Area are likely to settle to the bottom of the water column quickly and sand re-deposition would be minimal and close to the trench centerline. For grain sizes that are fine and medium-grained sand within the Wind Farm Area, sediments would settle on the seafloor within minutes and potentially extend laterally up to 160 meters. Although turbidity is likely to be high in the affected areas, the sediment would no longer affect water quality once it has settled. Elevated turbidity levels would be localized, short term, and temporary in duration. Physical or lethal effects are unlikely to occur because sea turtles are air-breathing and lay eggs on land, and therefore do not share the physiological sensitivities of susceptible organisms like fish and invertebrates. If elevated turbidity caused any behavioral responses in sea turtles such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary (Michel et al. 2013). Furthermore, sea turtles are migratory species that forage over wide areas and would likely be able to avoid short-term suspended sediment impacts that are limited in severity and extent without consequence. Because the effect of sediment suspension would be short term and localized and the use of dredging would be restricted, negligible impacts, if any, would be expected.

Dredging may be used for cable installation in areas for sand wave clearance and for HDD in-water exit pits. The area of potential dredging is currently unknown due to the dynamic nature of sand waves. Dredging would also most likely be required in shallow areas in Barnegat Bay to allow vessel access for the export cable installation, which may include the prior access channel on the western side of Island Beach State Park and the western side of Barnegat Bay at the export cable landfall. Seafloor affected by dredging prior to cable installation would result in turbidity effects that have the potential to have temporary impacts on some sea turtle foraging habitat, including about 20 acres of SAV in proximity to Island Beach State Park, and prey species in the immediate area (e.g., benthic mollusks, crustaceans, sponges, sea pens, crabs); however, abundant similar habitat and prey would be found in adjacent areas, resulting in fewer impacts on sea turtles. Dredging could also contribute additional impacts on sea turtles related to impingement, entrainment, and capture associated with mechanical and hydraulic dredging techniques. As noted in Section 3.19.3, considerations should be taken for the dredge type used. Sea turtles have been known to become entrained in trailing suction hopper dredge or trapped beneath the draghead as it moves across the seabed. Direct impacts, especially for entrainment, typically result in severe injury or mortality (Dickerson et al. 2004; USACE 2020). About 69 projects have recorded sea turtle takes within channels in New Jersey, Delaware, and Virginia and there have likely been numerous other instances not officially recorded (Ramirez et al. 2017). However, the risk of interactions between hopper dredges and individual sea turtles is expected to be lower in the open ocean areas where dredging may occur compared to nearshore navigational channels where sea turtles are more concentrated in a constrained operating environment (Michel et al. 2013; USACE 2020). This may be due to the lower density of sea turtles in these areas as well as differences in behavior and other risk factors. Given the available information, the risk of injury or mortality of individual sea turtles resulting from dredging necessary to support offshore wind Project construction would be low and population-level effects are unlikely to occur.

In context of reasonably foreseeable trends, the Proposed Action would contribute an undetectable increment to the combined cable emplacement and maintenance impacts on sea turtles from ongoing and planned activities including offshore wind, which are expected to be minor.

Noise: Project noise transmitted through water, through the seabed, or both can result in high-intensity, low-exposure-level, and long-term but localized intermittent risk to sea turtles. Data regarding sea turtle hearing abilities were summarized in Table 3.19-4. The acoustic thresholds for the onset of PTS, TTS, and behavioral disruptions for sea turtles for impulsive and non-impulsive noise sources were detailed in Table 3.19-5. Underwater noise generated by impact installation of monopiles and pin piles, vibratory installation and removal of sheet piles for cofferdams, detonations of UXO, vessel activity, and WTG operation would increase sound levels in the marine receiving environment and may result in potential adverse effects on sea turtles in the Project area including PTS, TTS, or behavioral disturbance.

Impact pile-driving noise: Noise from pile driving, which would occur during the installation of Project structures, would result in a potential risk of behavioral disturbance or TTS in sea turtles. Pile driving would involve two pile types: monopiles and pin piles. For the WTGs, a single (8-meter-diameter at top, 11-meter-diameter at bottom) vertical hollow steel monopile would be installed for each location using an impact hammer (IHC-4000 or IHC-S-2500 kilojoule impact hammer or similar) to an expected penetration depth of 50 meters. Installation of a single monopile is expected to take 9 hours (1 hour pre-clearance period, 4 hours piling, 4 hours moving to next location). Up to two piles are expected to be installed per 24-hour period. Concurrent monopile installation at more than one location is not planned. For the OSS, a piled jacket foundation is being considered. This would involve installing 16- by 2.44-meter-diameter pin piles as a foundation for each OSS foundation using an impact hammer (IHC-S-2500 kilojoule impact hammer or similar) to an expected penetration depth of 70 meters. Alternatively, a single monopile like the ones used for WTGs may be used for each OSS. Each pin pile takes approximately 4 hours to install, and a single OSS foundation is expected to take 6 days to install.

For installation of both the WTG and OSS monopile foundations, 24-hour-per-day pile driving is expected to occur. A total of 98 monopiles would be installed for WTGs and 48 pin piles (or three monopiles) would be installed for OSS, constituting about 584 hours of active pile driving (404 if monopiles are used, assuming OSS monopile installation is identical to WTG). Sea turtle hearing sensitivity is within the frequency range of sound produced by impact pile driving, although their rigid external anatomy may make sea turtles highly protected from such impulsive sound effects (for a summary, see Popper et al. 2014). Any sea turtle present in the area could be exposed to the noise from one pile-driving event per day, repeated over a period of days.

As described in Section 3.15, Ocean Wind has committed to using a noise mitigation system during installation of both monopiles and pin piles that achieves a performance of 10 dB broadband attenuation during pile-driving activities. Accordingly, the modeled isopleths for potential behavioral disturbance to sea turtles for one monopile per day ranged from 0.76 to 1.18 kilometers during summer. The number of sea turtles predicted to receive sound levels above exposure criteria during pile driving for WTGs and OSS is summarized in Tables J-12 through J-14 in Appendix J. The number of individual sea turtles predicted to receive sound levels above PTS (e.g., injury) with 10-dB attenuation during impact pile driving for WTG and OSS installation is discountable for Kemp’s ridley, leatherback, and green sea turtles, as fewer than one individual sea turtle is predicted to be affected.

Potential PTS effects on loggerhead sea turtles are considered possible, and up to eight individuals may be exposed to underwater noise in excess of PTS thresholds during WTG monopile installation. Up to 16 Kemp’s ridley, seven leatherback, and 175 loggerhead sea turtles could be exposed to underwater noise exceeding behavioral thresholds from impact pile-driving of WTG and OSS monopiles. Acoustic modeling of pile driving for pin piles supporting OSS jacket foundations predicted that an additional 15 loggerheads could be exposed to underwater noise exceeding behavioral thresholds. With the use of APMs such as soft-start procedures, noise-attenuating systems, and implementation of monitoring zones and clearance zones (Table H-1), mortality or injury (PTS) would not be expected and pile-driving noise would therefore not be expected to affect the population level of any of the sea turtle species.

Vibratory pile driving noise: Temporary sheet pile cofferdams may be installed at the following four locations and would likely involve vibratory pile driving:

- Oyster Creek HDD, two cofferdams (Atlantic Ocean to Island Beach State Park; sea-to-shore)
- Island Beach State Park Barnegat Bay HDD, two cofferdams (Barnegat Bay onshore; bay-to-shore)
- Oyster Creek HDD, two cofferdams (bayside of Oyster Creek; shore-to-bay)
- BL England HDD, one cofferdam (sea-to-shore)

Selection of a preferred design for cofferdams and landfall works is pending additional design and coordination. Ocean Wind anticipates that impacts relating to cofferdam installation and removal would eclipse any potential impacts of alternative methods, and therefore cofferdam estimates represent the most conservative values and are carried forward in this EIS. It is possible that some injury (TTS or PTS) and behavioral disturbance effects could occur on green and Kemp’s ridley sea turtles, but the installation and removal is only expected to occur over a 4-day period. Given the low density of sea turtles within inshore areas of New Jersey, impacts from vibratory pile driving on sea turtles would be negligible to minor.

In summary, pile-driving noise (impact and vibratory) associated with the Proposed Action may result in temporary impacts, including behavioral effects and minor auditory injury to individual turtles activities. Given that pile-driving activities would be conducted with mitigation measures such as the use of noise-attenuating systems, soft-start procedures, and protected species observers, impacts on individual sea turtles through this sub-IPF would be expected to be reduced. Once pile driving stops, this sub-IPF would be removed from the environment and sea turtle behavior would be expected to return to normal. If exposed to noise that leads to PTS, individuals would experience permanent effects. Impacts at the population level are not anticipated given the low density of turtles in the Project area and the spacing between individual work areas.

HRG survey noise: Ocean Wind expects that there would be an estimated 19,496 miles (31,375 kilometers) of HRG surveys required in the Offshore Project area (including the export cable routes), with a single vessel being able to cover 43.5 miles (70 kilometers) per day. Specific details of these surveys can be found in Section 2.1.2.2.1, *Site Preparation Activities.*

As discussed above under the No Action Alternative, HRG surveys used in the Project area can use a combination of sonar-based methods to map shallow geophysical features and can be classified as impulsive or non-pulsive noise sources. HRG surveys that use non-impulsive sources are not expected to affect sea turtles because they operate at frequencies above the sea turtle hearing range.

Previously, BOEM (2018) and NMFS (2021b) evaluated potential underwater noise effects on sea turtles from HRG surveys using impulsive sources (boomers, airguns, sparkers, sub-bottom profilers) and concluded that for an individual sea turtle to experience PTS, it would have to be within 3.3 feet (1 meter) of the loudest possible noise source. Furthermore, it was determined that none of the equipment being operated for HRG surveys with hearing overlap for sea turtles has source levels loud enough to result in PTS or TTS.

The only potential effects on sea turtles may be the noise from impulsive sources used during HRG surveys that exceed the behavioral effects threshold (175 dB). For sea turtles to experience behavioral disturbance they would have to be within 295 feet (90 meters) of the sound source (maximum sound levels). Ocean Wind estimates that the number of sea turtles exposed to sound levels eliciting behavioral changes would be low given the large monitoring and shutdown zone monitored. Activities would be stopped if an animal entered the 295-foot (90-meter) shutdown zone. While low-level behavioral exposures could occur, these disruptions would be limited in extent and short term in duration given the movement of the survey vessel and the mobility of the animals and would have limited effects on both the individual and population. Therefore, underwater noise impacts from HRG surveys are expected to be minor.

UXO detonation noise: UXO detonations could generate high pressure levels that could cause disturbance and injury to sea turtles. Ocean Wind conducted modeling of acoustic ranges for UXO, which included three sound pressure metrics (peak pressure level, SEL, and acoustic impulse), four different depths at four different sites, and five charge weight bins (ranging from 2.3 kilograms [bin E4] up to 454 kilograms [bin E12]). The modeling of acoustic fields was performed using a combination of semi-empirical and physics-based computational models. The modeling assumed that the full weights of UXO explosive charges are detonated together with their donor charges and that no shielding by sediments occurs. It also assumed that only one UXO would be detonated within a 24-hour period. Both unmitigated and mitigated (10-dB reduction) detonations were included in the model. For UXO detonations, auditory PTS thresholds for all sea turtles would be exceeded up to 1,549 feet (472 meters) from the source, and for behavioral thresholds this distance increases to 7,382 feet (2,250 meters). Potential non-auditory effects on sea turtles from UXO could be expected up to 1,273 feet (388 meters) from the source. UXO detonations could thus result in mortality of sea turtles in spite of pre-clearance efforts because surveys for small species in clearance zones can be difficult. However, impacts would be minor given the relatively low number of potential UXO anticipated to be encountered within the Project area and Ocean Wind’s commitment to using a dual noise mitigation system. Additional details about impacts of UXO detonations and other underwater noise on sea turtles are also presented in the BA (BOEM 2022).

Vessel noise: The frequency range for vessel noise (10 to 1,000 Hz; MMS 2007) overlaps with sea turtles’ known hearing range (less than 1,000 Hz with maximum sensitivity between 200 to 700 Hz;

Bartol and Ketten 2006) and, therefore, the vessel noise would be audible. The broadband source level of a modern commercial container ship traveling at 21.7 knots is up to 188 dB re 1 µPa (McKenna et al. 2012). This source level is below the non-impulsive acoustic injury threshold of 204 dB re 1 µPa for sea turtles (Finneran et al. 2017), meaning that only behavioral responses could be expected for sea turtles exposed to Project vessel noise. The increase in vessel traffic associated with the Project would be greatest during construction, with an estimated 20 to 65 vessels operating at any given time. In total, the Proposed Action would generate approximately 3,847 vessel trips during the construction and installation phase (COP Volume I, Section 6.1, Tables 6.1.2-1 through 6.1.2-5; Ocean Wind 2022). The construction vessels used for Project construction are described in the COP Volume 1, Section 6.1.2.4.2 and Tables 6.1.2-1 to 6.1.2-4 (Ocean Wind 2022). Typical large construction vessels used in this type of project range from 325 to 350 feet in length, from 60 to 100 feet in beam, and draft from 16 to 20 feet (Denes et al. 2021). The noise from these smaller, slower vessels may be below the behavioral response thresholds of sea turtles or limited to the area immediately adjacent to the vessel. Sea turtles are regularly subjected to commercial shipping traffic and other vessel noise and may be habituated to vessel noise as a result of this exposure. Given the lower sound levels associated with vessel transit and operation and the limited ensonified area produced by this source, the risk of impacts on sea turtles is expected to be negligible to minor.

Turbine operation noise: Sound generated by WTGs aerodynamics and mechanical vibration may result in long-term, continuous underwater noise in the offshore environment. Noise generated by offshore WTGs less than 6.15 MW range from around 80 to 135 dB re 1 µPa SPL_{RMS} underwater, with frequencies between 10 Hz and 8 kilohertz (Tougaard et al. 2020). Recent studies conducted by Stöber and Thomsen (2021) have suggested that operational noise from larger, current-generation WTGs on the order of 10 MW would generate higher source levels than the range noted above, at around 170 dB re 1 µPa SPL_{RMS}. However, the shift from using gear boxes to direct-drive technology is expected to reduce the sound level by 10 dB. Based on the current available data, underwater noise from turbine operations is unlikely to cause PTS or TTS in sea turtles but could cause behavioral effects. It is expected that these effects would be at relatively short distances from the foundations and would reach ambient underwater noise levels within 50 meters of the foundations (Miller and Potty 2017; Tougaard et al. 2009) and sea turtles would be expected to habituate to the noise.

Summary of Noise Impacts: Noise generated from Project activities would include impulsive (e.g., impact pile driving, UXO detonations, some HRG surveys) and non-impulsive sources (e.g., vibratory pile diving, some HRG surveys, vessels, aircraft, cable laying or trenching, dredging, turbine operations). Of those activities, only impact pile driving, UXO detonations, and, to a lesser extent, vibratory pile driving could cause injury-level effects (i.e., PTS) in sea turtles. UXO detonation may also cause non-auditory mortality at close range. All noise sources have the potential to cause behavior-level effects and some may also cause TTS. The APMs proposed to reduce the effects of underwater noise on sea turtles are expected to be effective in limiting the potential for PTS and non-auditory injury and mortality; however, the potential for some PTS, TTS, and behavioral effects remains. The intensity of this IPF is considered medium for impact and vibratory pile driving, as PTS thresholds would be exceeded; severe for UXO detonations, as mortality thresholds would be exceeded; and low for all other activities, as TTS and behavioral thresholds would be exceeded. The predicted effects would be permanent in the case of some PTS effects and non-auditory injury/mortality resulting from UXO detonations and short term with respect to TTS, behavioral effects, and masking. The geographic extent is considered localized for PTS effects and extensive for behavioral disturbance effects. The frequency of the activity causing the effect is considered infrequent for impact pile driving, vibratory pile driving, UXO detonations, aircraft, cable-laying, and trenching and dredging noise; frequent for HRG survey noise; and continuous for WTG operational noise. With the APMs in place for UXO detonations such as pre-clearance surveys and the relatively small areas where mortality is possible, the likelihood of mortality of a sea turtle from UXO detonations is considered low. With implementation of effective APMs such as a noise mitigation system (for impact pile driving), impacts on individual sea turtles are anticipated but not at the population level.

In context of reasonably foreseeable trends, the Proposed Action would contribute a noticeable increment to the combined noise impacts on sea turtles from ongoing and planned activities including offshore wind, which are expected to be minor.

Traffic (vessel): Increased vessel traffic associated with the Project may increase the potential for high-intensity impacts from vessel strikes traveling between the Offshore Project area and the WTG pre-assembly site at either Hope Creek, New Jersey or Norfolk, Virginia and the commissioning harbor in Atlantic City, New Jersey. Sea turtle exposure would be expected to be moderate and risk highly localized to nearshore habitats during Project construction, which is estimated to occur between 2023 to 2025. This is because nearshore areas would be most regularly traversed by high volumes of Project vessels and shallow foraging habitat may be particularly dangerous for turtles because of their tendency to flee toward deeper water and use deeper water to rest between foraging bouts during the day as well as overnight (Hazel et al. 2007). The collision risk for turtles in all areas is likely to be further exacerbated if water clarity is low and if vessel traffic continues at night, because both turbid water and darkness would impede turtles' visual detection of danger areas.

Based on information provided by Ocean Wind, construction activities (including offshore installation of WTGs, substations, array cables, interconnection cable, and export cable) would require up to 20 to 65 simultaneous construction vessels (COP Volume I Tables 6.1.2-1 to 6.1.2-4; Ocean Wind 2022). In total, the Proposed Action would generate approximately 3,847 vessel trips during the construction and installation phase (COP Volume I, Section 6.1, Tables 6.1.2-1 through 6.1.2-5; Ocean Wind 2022). Project construction would also cause shifts in commercial fishing vessel traffic, which includes over 1,000 annual vessel trips in the Lease Area (see Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*). These vessels would be displaced during Project construction and might decide to avoid the Lease Area during Project operation. This reduction in commercial fishing within the Wind Farm Area could lead to a reduced risk of turtle collisions, but collision risk could increase in those areas where fishing vessels relocate. Conversely, recreational fishing vessel traffic in and around the Wind Farm Area could increase as a result of the reef effect generated by the monopile foundations. This assumes similar densities of sea turtles occur in both areas; however, the future distribution of commercial and recreational fishing vessels in response to the Project cannot be predicted. The increased collision risk in some areas is anticipated to be commensurate with the decreased risk within the Wind Farm Area, so changes in collision risk from relocated commercial and for-hire fishing vessels during Project construction would not be measurable from baseline. At most, impacts of relocation of fishing vessel traffic would be considered minor on sea turtles.

Given the mobility of sea turtles and the use of trained, dedicated protected species observers, vessel speed restrictions, and protected species identification training and implementation of monitoring/clearance zones and shutdown zones, interactions between Project vessels and sea turtles would be reduced. Protected species observers would be provided by a third party. Monitoring at night or in low-visibility conditions, protected species observers would use night-vision goggles with thermal clip-ons, a hand-held spotlight, or a mounted thermal camera system. However, sea turtles are not fast swimmers and have difficulty detecting vessels traveling more than 4 kilometers per hour (Hazel et al. 2007). Also, sea turtles are hard to detect in the open ocean. While these mitigation measures would reduce the probability of a Project-related vessel strike, they would not result in complete avoidance. The Project would have a period of peak vessel activity lasting approximately 1 year (during construction and installation of offshore export cables, WTGs, OSS, and inter-array cables). However, avoidance measures would be designed to avoid vessel strikes on sea turtles by reducing vessel speed and avoiding sighted turtles. The additional measure of training personnel to watch for and report sea turtles would further increase vigilance to avoid striking sea turtles.

In context of reasonably foreseeable trends, the Proposed Action would contribute a noticeable increment to the combined vessel traffic impacts on sea turtles from ongoing and planned activities including offshore wind, which are expected to be minor.

Presence of structures: Impacts on sea turtles could result from the reef effect created by the presence of up to 101 foundations and 131 acres (0.53 km^2) of scour/cable protection. Studies have found increased biomass for benthic fish and invertebrates (Pezy et al. 2018; Raoux et al. 2017; Wang et al. 2019), indicating that offshore wind facilities can generate beneficial permanent impacts on local ecosystems, translating to increased foraging opportunities for sea turtles. The WTG and OSS foundations would provide some level of reef effect and may result in long-term, minor beneficial impacts on sea turtle foraging and sheltering; however, long-term, minor adverse impacts could occur as a result of increased interaction with fishing gear. The reef effect and associated increase in fish biomass could increase recreational fishing effort in and around turbine foundations, which may increase marine debris from fouled fishing gear in the area. Sea turtle entanglement in fishing gear is not considered a new IPF, however, but a change in the distribution of fishing effort from other locations.

In context of reasonably foreseeable trends, the Proposed Action would contribute a noticeable increment to the combined impacts on sea turtles through this IPF from ongoing and planned activities including offshore wind, which are expected to be minor.

Gear utilization (biological/fisheries monitoring surveys): The presence of gear used for fisheries and benthic monitoring surveys under the Proposed Action could affect sea turtles by entrapment or entanglement as described for other offshore wind projects in Section 3.19.3. Surveys are expected to occur at short-term, regular intervals over the lifetime of the Project and therefore impacts on sea turtles would likely be negligible.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts of gear utilization from other ongoing and planned activities including offshore wind, which are expected to be negligible.

3.19.5.1. Conclusions

Project construction and installation, O&M, and conceptual decommissioning would result in habitat disturbance, entrainment and impingement, underwater and airborne noise, water quality degradation, vessel traffic (strikes and noise), artificial lighting, and potential discharges/spills and trash. BOEM anticipates the impacts resulting from the Proposed Action would range from **negligible** to **minor** adverse impacts and could include potentially **minor beneficial** impacts. Adverse impacts are expected to result mainly from pile-driving noise and increased vessel traffic. Beneficial impacts are expected to result from the presence of structures.

In context of other reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on sea turtles would range from undetectable to noticeable. Considering all the IPFs together, BOEM anticipates that the overall impacts on sea turtles associated with the Proposed Action when combined with impacts from ongoing and planned activities including offshore wind would be **minor**. The main drivers for these impact ratings are pile-driving noise and associated potential for auditory injury, the presence of structures, ongoing climate change, and ongoing vessel traffic posing a risk of collision. The Proposed Action would contribute to the overall impact rating primarily through pile-driving noise and the presence of structures. BOEM made this decision because the overall effect would be detectable and measurable, but these impacts would not result in population-level effects.

3.19.6 Impacts of Alternatives B-1, B-2, C-1, and D on Sea Turtles

Alternatives B-1, B-2, C-1, and D would include exclusion of proposed WTGs and would lead to the same types of impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. Alternatives B-1, B-2, C-1, and D would exclude up to 9, 19, 8, and 15 turbines, respectively; this is equivalent to an approximately 10- to 20-percent reduction in the size of the Project. Table 3.19-6 summarizes the differences in the number of monopiles as they related to each alternative. The corresponding reduction in the number or duration of construction vessels in the Offshore Project area is unknown; therefore, the discussion regarding a reduction in vessels during construction is qualitative.

Table 3.19-6 Summary of Changes to Impact Pile-Driving Requirements Among Alternatives

Alternative	WTGs	Reduction in Monopiles	Total Number of Monopiles	Total Hours of Impact Pile Driving (4 to 6 hrs/pile)	Number of days
Proposed Action	98	98	98	392 to 588 hours	98
Alternative B-1	exclusion of up to 9 WTG positions	Up to 9 fewer	89	356 to 534 hours	89
Alternative B-2	exclusion of up to 19 WTG positions	Up to 19 fewer	79	316 to 474 hours	79
Alternative C-1	exclusion of 8 WTG positions	Up to 8 fewer	90	360 to 540 hours	90
Alternative D	exclusion of up to 15 WTG positions	Up to 15 fewer	83	332 to 498 hours	83

Notes: Assumes each pile would require 4 to 6 hours of impact pile driving per pile, with a maximum-case scenario of one pile per day.
hrs/pile = hours per pile

These alternatives may change the duration for the IPFs in comparison to that described for the Proposed Action in Section 3.19.5, as described in following paragraphs.

Noise: The 10- to 20-percent reduction in the number of monopiles for Alternatives B-1, B-2, C-1, and D would reduce the overall number of impact pile-driving hours required for installation. This would limit the duration of the effect by the days outlined in Table 3.19-6. However, the overall effects would remain the same (e.g., PTS, TTS, disturbance, and masking) as described in Section 3.19.5. Limiting the duration of the effect could reduce the number of sea turtles exposed to underwater sound. However, the overall sound levels resulting from construction and decommissioning activities would still have temporary, minor impacts on sea turtles due to potential auditory injuries and behavioral effects as described previously; no mortality or injury (PTS) would be expected. Likewise, a reduction in the number of WTGs would result in a reduction in the number or duration of construction vessels used and may reduce the probability of UXO detonations during Project construction. The magnitude of the effects of underwater noise from Project vessels during construction would remain the same (e.g., disturbance, masking) as described in Section 3.19.5; however, the duration of the effects would be reduced.

Presence of structures: The 10- to 20-percent reduction in the number of monopiles would reduce the overall footprint of the alternatives on the seafloor as compared to the Proposed Action. The beneficial impact of the reef effect on sea turtle resting and foraging and the potential adverse effects of sea turtle entanglement with fisheries gear on WTG foundations would both be slightly reduced.

Cable emplacement and maintenance: Alternatives B-1, B-2, C-1, and D would have short-term and localized water quality impacts from inter-array and export cable installation via jet or mechanical plow, and dredging if necessary for sand wave clearance and installation of HDD in-water exit pits, which would produce undetectable, negligible impacts on sea turtles due to increased turbidity. Compared to the Proposed Action, there would be a smaller area of seabed disturbance and water column disturbance and a shorter duration of associated water quality degradation. The area of seabed disturbed by scour protection would be reduced by 0.82 acre per WTG foundation; thus, the 80 acres of total seabed scour protection under the Proposed Action would be reduced by 7 to 12 acres under Alternatives B-1, B-2, C-1, and D. Alternatives that reduce the number of WTGs would also reduce the risk of interactions between hopper dredges and individual sea turtles due to the reduced length of dredging for installation of inter-array cables.

Traffic: A reduction in the number of monopiles would result in a reduction in the number of construction vessels or the duration of vessels in the Offshore Project area during construction activities that would be required for installation. While unquantifiable, this could reduce the probability of a vessel strike on a sea turtle during Project construction, operation, and decommissioning. A decrease in Project vessels would also slightly reduce the risk of accidental releases (e.g., fuel spills, trash, debris) that could potentially affect sea turtles.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B-1, B-2, C-1, and D to the overall impacts on sea turtles would be similar to those described under the Proposed Action.

3.19.6.1. Conclusions

Alternatives B-1, B-2, C-1, and D would reduce the number of WTGs and their associated inter-array cables, which would result in an incremental reduction in effects on sea turtles from certain construction and installation, O&M, and conceptual decommissioning impacts. BOEM expects that the impacts resulting from the alternatives individually would be similar to those of the Proposed Action and would range from **negligible** to **minor** adverse and could include potentially **minor beneficial** impacts.

In context of other reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B-1, B-2, C-1, and D to the overall impacts on sea turtles would range from undetectable to noticeable. BOEM anticipates that the overall impacts of Alternatives B-1, B-2, C-1, and D when each combined with ongoing and planned activities including offshore wind would be the same level as under the Proposed Action: **minor**.

3.19.7 Impacts of Alternative C-2 on Sea Turtles

Under Alternative C-2, the compressed layout would have the same types of impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action within a smaller construction and operational footprint. Although the area affected by noise, turbidity, and use of construction and operational vessels would be decreased, the number of vessels and monopiles would stay the same. BOEM expects that the impacts resulting from Alternative C-2 would be similar to those of the Proposed Action and would range from negligible to minor adverse and could include potentially minor beneficial impacts.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C-2 to the overall impacts on sea turtles would range from undetectable to noticeable. The overall impacts of Alternative C-2 when combined with ongoing and planned activities including offshore wind would be the same level as under the Proposed Action: minor.

3.19.7.1. Conclusions

Although Alternative C-2 would result in a decreased construction and operational footprint, BOEM expects that the impacts resulting from the alternative would be similar to those of the Proposed Action and range from **negligible** to **minor** and could include potentially **minor beneficial** impacts.

In context of other reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C-2 would be similar to those of the Proposed Action and range from undetectable to noticeable. BOEM anticipates that the overall impacts of Alternative C-2 when combined with ongoing and planned activities including offshore wind would be the same level as under the Proposed Action: **minor**.

3.19.8 Impacts of Alternative E on Sea Turtles

Alternative E would lead to the same types of impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities in the Offshore Project Area as described for the Proposed Action. The reduced acreage of SAV affected by the Oyster Creek export cable emplacement within Barnegat Bay described under Section 3.6, *Benthic Resources*, would reduce potential impacts on adult green sea turtles, as they are the only sea turtles that forage exclusively on aquatic vegetation such as eelgrass. While the number of green sea turtles that would potentially benefit is not quantifiable, the species regularly occurs in Barnegat Bay (Excelon Generation 2012); therefore, minimizing impacts on SAV in Barnegat Bay would avoid the destruction of important green sea turtle foraging habitat. Additionally, SAV provides important nursery habitat for sea turtle prey and is a rich foraging ground. Loggerheads prey on the abundant shellfish found in SAV, especially horseshoe crabs and blue crabs. However, as described in Section 3.13, Alternative E would still require trenching activities and would not significantly change potential impacts. It would therefore produce the same types of direct impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. Impacts within the Offshore Project area would stay the same as under the Proposed Action. Therefore, Alternative E would result in negligible to minor adverse and potentially minor beneficial impacts.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E to the overall impacts on sea turtles would be similar to those described under the Proposed Action: minor.

3.19.8.1. Conclusions

Although Alternative E would result in reduced acreage of SAV affected by cable emplacement, BOEM expects that the impacts resulting from the alternative alone would be similar to those of the Proposed Action and range from **negligible** to **minor** and could include potentially **minor beneficial** impacts.

In context of other reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative E would be similar to those of the Proposed Action and range from undetectable to noticeable. BOEM anticipates that the overall impacts of Alternative E when combined with ongoing and planned activities including offshore wind would be the same level as under the Proposed Action: **minor**.

3.19.9 Proposed Mitigation Measures

BOEM and other federal and state agencies have proposed measures to minimize impacts on marine mammals (Appendix H, Table H-2). If one or more of the measures analyzed below are adopted by BOEM, some adverse impacts would be further reduced.

Marine debris awareness training; Regular gear haul out; Gear identification; and Reporting of lost survey gear: Annual training for marine trash and debris awareness, procedures for regular gear haul out, gear identification, and reporting of lost survey gear would minimize the risk of sea turtle entanglement. While adoption of this measure would decrease the potential impacts on sea turtles from acoustic survey technologies and the use of passive acoustic monitoring equipment, it would not alter the impact determination of minor for sea turtles because the potential for accidental releases of debris would still likely be present.

Passive acoustic monitoring plan: A passive acoustic monitoring plan would describe all proposed equipment, deployment locations, detection review methodology, and other procedures and protocols related to the required use of passive acoustic monitoring. This plan would be reviewed by NMFS, BOEM, and BSEE for concurrence at least 90 days prior to the planned start of pile driving. While adoption of this measure would decrease the risk of impacts on sea turtles during passive acoustic monitoring surveys, it would not alter the impact determination of negligible because there is no lower impact determination level.

Pile driving monitoring plan: BOEM would ensure that Ocean Wind prepares and submits a pile driving monitoring plan for review and concurrence at least 90 days before the start of pile driving. While adoption of this measure could increase the accountability of underwater noise mitigation during construction of the Proposed Action, it would not alter the impact determination of minor for sea turtles.

Protected species observer coverage; Sound field verification; Shutdown zones; and Monitoring zone for sea turtles: BOEM would ensure that protected species observer coverage is sufficient to reliably detect sea turtles at the surface in clearance and shutdown zones in accordance with a sound field verification plan, which would be reviewed and approved 90 days prior to the planned start of pile driving. Determinations that protected species observer coverage is sufficient during construction would be based on review of weekly reports and other information, as appropriate. BOEM and USACE would ensure that Ocean Wind monitors the full extent of the area where noise would exceed the 175 root-mean-square decibels (dB_{RMS}) threshold for sea turtles for the full duration of all pile-driving activities and for 30 minutes following the cessation of pile driving and record all observations to ensure that all take that occurs is documented. These measures would reduce impacts of underwater noise on sea turtles but, given the mobility of sea turtles and the difficulty of detecting them due to sea conditions and the small amount of time turtles spend at the surface, these measures would not eliminate the minor impacts of underwater noise on sea turtles.

Look out for sea turtles and reporting: Ocean Wind would have trained lookouts posted on all vessels during all phases of the Project to observe for sea turtles within a 500-meter vessel strike avoidance zone and communicate any observations with the boat captain. The presence of an experienced endangered species observer or lookout who can advise vessel operators to slow the vessel or maneuver safely when sea turtles are spotted will reduce the potential for sea turtle interaction with vessels. Lookouts will have a low likelihood of detecting individual sea turtles, but observing for indicators sea turtle presence will help avoid or reduce potential vessel strikes. The likelihood of sea turtle vessel strikes would be reduced but it would not alter the impact determination of minor for sea turtles.

Sea turtle disentanglement; Sea turtle identification and data collection; Sea turtle handling and resuscitation guidelines: Ocean Wind would take measures to minimize adverse impacts on any sea turtles captured or entangled in fisheries survey gear by having adequate disentanglement equipment and following standard agency guidelines for sea turtle handling and release. Captured sea turtles would be documented using appropriate equipment and data collection protocols. Biological data, samples, and tagging would occur according to NMFS's standard operating procedures and live, uninjured animals would be returned to the water as quickly as possible after completing the required handling and documentation. While adoption of this measure would decrease the risk of impacts on sea turtles during passive acoustic monitoring surveys, it would not alter the impact determination of negligible because there is no lower impact determination level.

Nighttime pile driving monitoring plan: BOEM would require Ocean Wind to submit a nighttime pile driving monitoring plan prior to initiating impact pile-driving activities. The purpose of the plan is to demonstrate that Ocean Wind can meet the visual monitoring criteria with the technologies Ocean Wind is proposing to use for monitoring during nighttime impact pile driving. The monitoring distances and visual monitoring criteria will be detailed in the Final EIS. If, during nighttime pile driving, undetected animals are found in the clearance or shutdown zones, nighttime impact pile-driving activities would cease as soon as possible in consideration of human safety, and NMFS and BOEM would be notified immediately. Nighttime impact pile driving would not restart until approval is provided by NMFS and BOEM.

Adoption of this measure could increase the ability of Ocean Wind to detect sea turtles during pile driving but, given the small amount of time that turtles spend at the surface, these measures would not eliminate the minor impacts of pile driving noise on sea turtles.

3.21. Water Quality

This section discusses potential impacts on water quality from the proposed Project, alternatives, and ongoing and planned activities in the water quality geographic analysis area. The water quality geographic analysis area, as shown on Figure 3.21-1, includes coastal waters within a 10-mile (16-kilometer) buffer around the Offshore Project area and a 15.5-mile (25-kilometer) buffer around the ports that may be used by the Project. In addition, the geographic analysis area includes an onshore component that includes any sub-watershed that is intersected by the Onshore Project area. The offshore geographic analysis area accounts for some transport of water masses due to ocean currents. The onshore geographic analysis area was chosen to capture the extent of the natural network of waterbodies that could be affected by construction and operational activities of the proposed Project.

3.21.1 Description of the Affected Environment for Water Quality

Surface waters in the geographic analysis area include: (1) coastal onshore waterbodies that generally include freshwater ponds, streams, and rivers; and (2) coastal marine waters that generally include saline and tidal/estuarine waters, such as Barnegat Bay, Manahawkin Bay, Delaware Bay, Delaware River, Charleston Harbor, Chesapeake Bay, James River, and the Atlantic Ocean. Surface waters within most of the geographic analysis area and all of the Onshore Project area are coastal marine waters.

The following key parameters characterize water quality. Some of these parameters are accepted proxies for ecosystem health (e.g., dissolved oxygen [DO], nutrient levels), while others delineate coastal onshore waters from coastal marine waters (e.g., temperature, salinity):

- *Nutrients*: Key ocean nutrients include nitrogen and phosphorous. Photosynthetic marine organisms need nutrients to thrive (with nitrogen being the primary limiting nutrient), but excess nutrients can cause problematic algal blooms. Algal blooms can significantly lower DO concentration, and toxic algal blooms can contaminate human food sources. Both natural and human-derived sources of pollutants contribute to nutrient excess.
- *Dissolved oxygen*: The amount of DO in water determines the amount of oxygen that is available for marine life to use. Temperature strongly influences DO content, which is further influenced by local biological processes. For a marine system to maintain a healthy environment, DO concentrations should be above 5 mg/L; lower levels may affect sensitive organisms (USEPA 2000).
- *Chlorophyll a*: Chlorophyll *a* is a measure of how much photosynthetic life is present. Chlorophyll *a* levels are sensitive to changes in other water parameters, making it a good indicator of ecosystem health. USEPA considers estuarine and marine levels of chlorophyll *a* under 5 micrograms per liter (µg/L) to be good, 5 to 20 µg/L to be fair, and over 20 µg/L to be poor (USEPA 2015).
- *Salinity*: Salinity, or salt concentration, also affects species distribution. In general, seasonal variation in the region is smaller than year-to-year variation and less predictable than temperature changes (Kaplan 2011).
- *Water temperature*: Water temperature heavily affects species distribution in the ocean. Large-scale changes to water temperature may affect seasonal phytoplankton blooms.

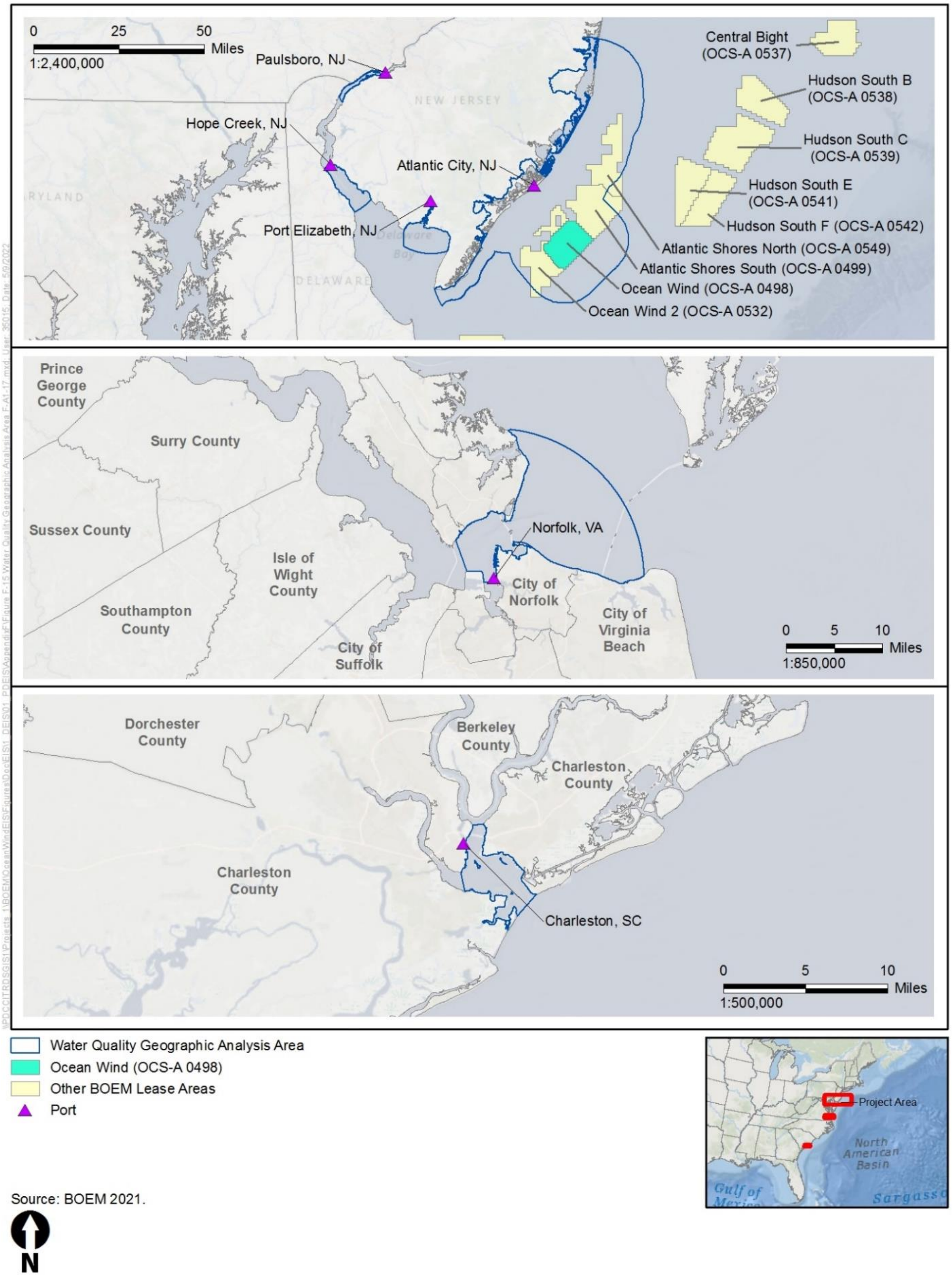

Figure 3.21-1 Water Quality Geographic Analysis Area

- *Turbidity*: Turbidity is a measure of water clarity, which is typically expressed as a concentration of total suspended solids in the water column, but can also be expressed as nephelometric turbidity units. Turbid water lets less light reach the seafloor, which may be detrimental to photosynthetic marine life (CCS 2017). In estuaries, a turbidity level of 0 to 10 nephelometric turbidity units is healthy while a turbidity level over 15 nephelometric turbidity units is detrimental (NOAA 2018). Marine waters generally have less turbidity than estuaries.

States also assess a variety of other water quality parameters as part of state requirements to evaluate and list state waters as impaired under CWA Section 303(d) requirements. Other water quality parameters assessed typically include, but are not limited to, concentrations of metals, pathogens, bacteria, pesticides, biotoxins, PCBs, and other chemicals. If a surface water is considered non-attaining under the assessment, this means a designated beneficial use (e.g., recreation, fish consumption) is impaired by an exceedance of one or more water quality parameters.

Water Quality Geographic Analysis Area: Coastal Marine Waters

Nutrients, DO, Chlorophyll *a*: Table 3.21-1 summarizes water quality parameters for coastal waters at specific point locations in the water quality geographic analysis area, including nutrients, chlorophyll *a*, and DO, for the Atlantic Ocean and various locations in the coastal marine waters between the barrier islands and the mainland around the Proposed project. Nutrient concentrations, as approximated by phytoplankton concentration as chlorophyll *a*, have also been measured via remote sensing techniques. In water closer to the shore, chlorophyll *a* and nutrient values are higher compared to the offshore areas due to input of nutrients from anthropogenic sources. The most recent phytoplankton blooms occur during the fall and winter seasons when stratification decreases due to frequent storms and seasonal overturn. Phytoplankton blooms are also common during the summer months when winds blow surface waters away from the coast and the deeper, cooler, nutrient-rich waters well up from the depths, a phenomenon known as upwelling. When upwelling occurs, these nutrients combined with sunlight lead to phytoplankton blooms along the shorelines in New Jersey (Ocean Wind 2022).

NJDEP conducts annual assessments of the state’s waterways for water quality parameters. Two sites within Barnegat Bay were non-attaining for DO. For Manahawkin Bay and Upper Little Egg Harbor, 50 percent of the 18 sampling stations were below the higher-than-5-mg/L DO target. For samples taken from 15 stations in Lower Little Egg Harbor, 44 percent were below the higher-than-5-mg/L DO target (Ocean Wind 2022).

Table 3.21-1 Water Quality of Coastal Waters in the Geographic Analysis Area

Water Quality Parameter	Unit	Mean	Maximum	Number 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
Total Phosphorus	µg/L	41	96	95
Chlorophyll a	µg/L	2	19	124
DO	mg/L	7	9	190
Little Egg Harbor				
Ammonia	µg/L	--	--	--
Nitrate	µg/L	21	369	409
Total Nitrogen	µg/L	413	1981	434

Water Quality Parameter	Unit	Mean	Maximum	Number of Samples
Total Phosphorus	µg/L	44	140	271
Chlorophyll a	µg/L	4	27	311
DO	mg/L	8	10.9	448
Great Bay				
Ammonia	µg/L	50	535	407
Nitrate	µg/L	37	396	409
Total Nitrogen	µg/L	375	1815	402
Total Phosphorus	µg/L	46	304	217
Chlorophyll a	µg/L	3	27	255
DO	mg/L	7.5	11.3	404
Manahawkin Bay				
Ammonia	µg/L	26	131	146
Nitrate	µg/L	20	214	148
Total Nitrogen	µg/L	544	1896	148
Total Phosphorus	µg/L	50	144	94
Chlorophyll a	µg/L	6	260	108
DO	mg/L	7.8	9	152
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
DO	mg/L	7.7	15.1	1188

Source: Connell 2010.

Salinity: BOEM and NOAA funded an assessment of benthic communities within offshore lease areas, including the Ocean Wind 1 Lease Area. Salinity measured in the Lease Area for the period of 2003–2016 was 32.2 practical salinity units, with a full range spanning 29.4 to 34.4 practical salinity units (n=4,205). This range is within the euhaline range (30–40 practical salinity units), which is the typical salinity range for seawater (Venice salinity classification system). In general, the average salinity increases in the offshore direction off New Jersey, with lower-salinity waters near the shoreline due to the seasonal river discharge and wind variations (Ocean Wind 2022).

Water temperature: Boat-based surveys were conducted to collect various water quality parameters, including temperature, within the Lease Area and surrounding Atlantic Ocean. The minimum sea surface temperature value collected was 36°F (2°C) during winter and the maximum sea surface temperature value collected was 79°F (26°C) during summer. Within the water column, data collected in the New Jersey OCS WEAs over the period of 2003 to 2016 showed seasonal fluctuations 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. Actual surface and bottom temperatures varied substantially from year to year, particularly during the fall. Surface to bottom temperature gradients were warmer at the surface and cooler at the bottom, with a stratified condition in spring and summer and isothermal condition following the fall turnover during winter (Ocean Wind 2022).

Turbidity: Waters along the Northeast Coast, which includes the geographic analysis area around the Project, average 5.6 mg/L of total suspended solids, which is considered low. There are notable exceptions, including estuaries, which averaged 27.4 mg/L, although total suspended solids sampling throughout nine assessment units in and around Barnegat Bay did not record total suspended solids levels above 16 mg/L (USEPA 2012; Ocean Wind 2022). While most ocean waters had total suspended solids concentrations under 10 mg/L, which is the 90th percentile of all measured values, most estuarine waters (65.7 percent of the Northeast Coast area) had total suspended solids concentrations above this level. Near-bottom total suspended solids concentrations were similar to those near the water surface, averaging 6.9 mg/L. With the exception of the entrance to Delaware Bay, all other coastal ocean stations had near-bottom levels of total suspended solids less than or equal to 16.3 mg/L (USEPA 2012).

NJDEP conducts annual assessments of the state's waterways for water quality parameters. Five sampling sites within Barnegat Bay were non-attaining for turbidity. Manahawkin Bay, Upper Little Egg Harbor, and Lower Little Egg Harbor Bay water quality was designated as fully supporting recreation and shellfish, but not supporting wildlife due, in part, to increased turbidity (Ocean Wind 2022).

303(d) listed impaired waters: Nearly all water quality assessment units of Barnegat Bay and associated tidal tributaries in the geographic analysis area are listed as 303(d) impaired (see Appendix I, Figure I-4) (USEPA 2020). These waters are non-attaining for fish consumption, ecological function, or recreation, with causes including pathogens, turbidity, oxygen depletion, pesticides, and PCBs. Waters along all the ocean-side barrier island shorelines in the geographic analysis area are non-attaining for ecological function due to oxygen depletions (USEPA 2020).

Water Quality Specific to Proposed Ports

Four areas in the water quality analysis area are not in the immediate vicinity of the Project and generally include the Delaware River/Bay up to Philadelphia; the Maurice River up to Port Elizabeth; the confluence of the James River with Chesapeake Bay around Norfolk, Virginia; and Charleston Harbor, South Carolina.

USEPA (2012) assessed water quality conditions along the coasts of the United States and developed a water quality index (good, fair, or poor) that evaluated five water quality parameters: nitrogen, phosphorus, chlorophyl *a*, water clarity (total suspended solids or turbidity), and DO. The overall water quality condition of the Northeast Coast, which includes the Delaware River/Bay and Chesapeake Bay/James River, is considered fair. Phosphorus, chlorophyll *a*, DO, and water clarity ratings are all considered fair, while nitrogen rating is considered good (USEPA 2012). Delaware Bay has a water quality index of fair to poor, with poor water quality indices on the northern side of the bay and fair on the southern side of the bay. The Delaware River has a mostly poor water quality index all the way upstream to Philadelphia. Delaware Bay also has naturally high turbidity compared to most other waters in the Northeast Coast area. The water quality index around Norfolk, Virginia where the James River empties into Chesapeake Bay is generally considered fair for all five water quality parameters, with just a few sample locations considered poor, where two or more of the parameters did not meet standards. The overall water quality condition of the Southeast Coast, which includes Charleston Harbor, is generally considered fair; phosphorus, chlorophyll *a*, and DO water quality ratings are all considered fair, while nitrogen is considered good and water clarity is considered poor. Charleston Harbor has a water quality index of generally fair for all five parameters.

The Delaware River/Bay up to Philadelphia, Maurice River (to Port Elizabeth), James River, Chesapeake Bay, and associated waters around Norfolk, Virginia, and Charleston Harbor, South Carolina are all listed as impaired 303(d) waters that are non-attaining for at least one use with causes that vary including, but not limited to, mercury, PCBs, dioxins, oxygen depletion, noxious aquatic plants, pathogens, and copper (see Appendix I, Figure I-4) (USEPA 2020; South Carolina Department of Health and Environmental Control 2018).

Water Quality Geographic Analysis Area: Coastal Onshore Waters

As previously stated, surface waters within most of the geographic analysis area and all of the Onshore Project area are coastal marine waters. Coastal onshore waters in the geographic analysis area generally occur west of the Oyster Creek Onshore Project area and include Oyster Creek, Waretown Creek, Lochiel Creek, Long Branch, Cave Cabin Branch, Forked River (south, middle and north branch), and associated tributaries to these waters. The assessment units listed as impaired and 303(d) listed by NJDEP cover Waretown/Lochiel Creek, North Forked River (above old railroad grade), and associated tributaries (see Appendix I, Figure I-4). The Waretown/Lochiel Creek assessment unit is non-attaining for drinking water use caused by mercury and other metals. The North Forked River assessment unit is non-attaining for ecological use and recreation use caused by oxygen depletion, pathogens, and unknown causes. There are no coastal onshore waters around the BL England Onshore Project area, as all waters in and around the Project area include saline or tidal/estuarine waters.

Groundwater Quality

The Onshore Project area is 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. Several aquifers compose this larger aquifer system and include 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. Depth to groundwater in the aquifer system at several groundwater wells in the vicinity of the Onshore Project area range from 39.9 feet to 102.8 feet below the ground surface (COP Volume II, Table 2.1.2-12; Ocean Wind 2022). 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 characteristics measured in each well-water sample include pH, specific conductivity, DO, temperature, alkalinity, major ions, trace elements, nutrients, gross-alpha particle activity, VOCs, total dissolved solids, and pesticides. In southern New Jersey, shallow groundwater has a more acidic pH and lower total dissolved solids levels, reflecting the coastal plain origin. 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 are all higher in the urban areas of Southern New Jersey compared to undeveloped areas (Ocean Wind 2022).

The Onshore Project area does not overlap with any NJDEP-designated wellhead protection areas (NJDEP 2018).

3.21.2 Environmental Consequences

3.21.2.1. Impact Level Definitions for Water Quality

Definitions of impact levels are provided in Table 3.21-2. There are no beneficial impacts on water quality.

Table 3.21-2 Impact Level Definitions for Water Quality

Impact Level	Impact Level	Definition
Negligible	Adverse	Changes would be undetectable.
Minor	Adverse	Changes would be detectable but would not result in degradation of water quality in exceedance of water quality standards.
Moderate	Adverse	Changes would be detectable and would result in localized, short-term degradation of water quality in exceedance of water quality standards.
Major	Adverse	Changes would be detectable and would result in extensive, long-term degradation of water quality in exceedance of water quality standards.

3.21.3 Impacts of the No Action Alternative on Water Quality

When analyzing the impacts of the No Action Alternative on water quality, BOEM considered the impacts of ongoing and planned non-offshore wind activities and other offshore activities.

3.21.3.1. Ongoing and Planned Non-offshore Wind Activities

Under the No Action Alternative, baseline conditions for water quality would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing activities within the geographic analysis area that contribute to impacts on water quality generally relate to or include terrestrial runoff, ground disturbance (e.g., construction) and erosion, terrestrial point- and nonpoint-source discharges, and atmospheric deposition. The deposition of contaminated runoff into surface waters and groundwater can result in exceedances of water quality standards that can affect the beneficial uses of the water (e.g., drinking water, aquatic life, recreation). While water quality impacts may be temporary and localized (e.g., construction) and state and federal statutes, regulations, and permitting requirements (e.g., CWA Section 402) avoid or minimize these impacts, issues with water quality can still persist.

Other planned non-offshore wind activities that affect water quality include onshore development activities (including urbanization, forestry practices, municipal waste discharges, and agriculture); marine transportation-related discharges; dredging and port improvement projects; commercial fishing; military use; new submarine cables and pipelines; and climate change (see Section F.2 in Appendix F for a description of ongoing and planned activities). Water quality impacts from these activities, especially from dredging and harbor, port, and terminal operations, are expected to be localized and temporary to permanent, depending on the nature of the activities and associated IPFs. Similar to under ongoing activities, the deposition of contaminated runoff into surface waters and groundwater can result in exceedances of water quality standards that can affect the beneficial uses of the water (e.g., drinking water, aquatic life, recreation). State and federal water quality protection requirements and permitting would result in avoiding and minimizing these impacts. See Table F1-23 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for water quality.

3.21.3.2. Offshore Wind Activities (without Proposed Action)

The water quality geographic analysis area overlaps with most, but not all, of the Atlantic Shores South (OCS-A 0499) and Atlantic Shores North (OCS-A 0549) lease area and the Ocean Wind 2 (OCS-A 0532) lease areas. BOEM conservatively assumed in its analysis of water quality impacts that all 468 WTGs estimated for the Atlantic Shores South, Atlantic Shores North, and Ocean Wind 2 lease areas would be sited within the water quality geographic analysis area. BOEM anticipates that the Atlantic Shores South, Atlantic Shores North, and Ocean Wind 2 offshore project components would be constructed during years that would have some overlap with each other (Table F2-1).

BOEM expects offshore wind activities to affect water quality through the following primary IPFs.

Accidental releases: Other offshore wind activities could expose surface waters to contaminants (such as fuel, solid waste, or chemicals, solvents, oils, or grease from equipment) in the event of a spill or release during routine vessel use. Offshore wind projects would result in a small incremental increase in vessel traffic, with a short-term peak during construction. Vessel activity associated with construction is expected to occur regularly in the New York and New Jersey lease areas beginning in 2023 and continuing through 2030 and then lessen to near-baseline levels during operational activities. Increased vessel traffic would be localized near affected ports and offshore construction areas. Increased vessel traffic in the region associated with offshore wind construction could increase the probability of collisions and allisions, which could result in oil or chemical spills.

Based on the estimated construction schedules (see Table F2-1), offshore wind projects could occur with some overlapping construction schedules between 2023 and 2030. This EIS estimates that up to approximately 1,527,193 gallons of coolants, 2,121,777 gallons of oils, and 471,492 gallons of diesel fuel could be stored within WTG foundations and the OSS within the water quality geographic analysis area. Other chemicals, including grease, paints, and sulfur hexafluoride, would also be used at the offshore wind projects, and black and gray water may be stored in sump tanks on facilities. BOEM has conducted extensive modeling to determine the likelihood and effects of a chemical spill at offshore wind facilities at three locations along the Atlantic Coast, including an area near the proposed Project area (Maryland WEA) (Bejarano et al. 2013). Results of the model indicated a catastrophic, or maximum-case scenario, release of 129,000 gallons (488,318 liters) of oil mixture has a “Very Low” probability of occurring, meaning it could occur one time in 1,000 or more years. In other words, the likelihood of a given spill resulting in a release of the total container volume (such as from a WTG, OSS, or vessel) is low. The modeling effort also revealed the most likely type of spill (i.e., non-routine event) to occur is from the WTGs at a volume of 90 to 440 gallons (341 to 1,666 liters), at a rate of one time in 1 to 5 years, or a diesel fuel spill of up to 2,000 gallons (7,571 liters) at a rate of one time in 91 years. The likelihood of a spill occurring from multiple WTGs and OSS at the same time is very low and, therefore, the potential impacts from a spill larger than 2,000 gallons (7,571 liters) are largely discountable. The modeling effort was conducted based on information collected from multiple companies and projects and would therefore apply to the other projects in the water quality geographic analysis area. For the purposes of this discussion, small-volume spills equate to the most likely spill volume between 90 and 440 gallons (341 to 1,666 liters) of oil mixture or up to 2,000 gallons (7,571 liters) of diesel fuel, while large-volume spills are defined as a catastrophic release of 129,000 gallons (488,318 liters) of material, based on modeling conducted by Bejarano et al. (2013). Small-volume spills could occur during maintenance or transfer of fluids, while low-probability small- or large-volume spills could occur due to vessel collisions, allisions with the WTGs/OSS, or incidents such as toppling during a storm or earthquake.

All offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by USCG and BSEE. Oil Spill Response Plans are required for each project and would provide for rapid spill response, cleanup, and other measures that would help to minimize potential impacts on affected resources from spills. Vessels would also have their own onboard containment measures that would further reduce the impact of an allision. A release during construction or operation would generally be localized and short term and result in little change to water quality. In the unlikely event an allision or collision involving project vessels or components resulted in a large spill, impacts on water quality would be adverse and short term to long term, depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill.

Accidental releases of trash and debris would be infrequent and negligible because operators would comply with federal and international requirements for management of shipboard trash. All vessels would also need to comply with the USCG ballast water management requirements outlined in 33 CFR 151 and 46 CFR 162; allowed vessel discharges such as bilge and ballast water would be restricted to uncontaminated or properly treated liquids.

In summary, there is potential for moderate water quality impacts due to a maximum-case scenario accidental release; however, due to the very low likelihood of a maximum-case scenario release occurring, the expected size of the most likely spill to be small, and the expected occurrence to be of low frequency, the overall impact of accidental releases is anticipated to be short term, localized, and minor, resulting in little change to water quality. As such, accidental releases from offshore wind development in the water quality geographic analysis area would not be expected to contribute appreciably to overall impacts on water quality.

Anchoring: Offshore wind activities would contribute to changes in offshore water quality from resuspension and deposition of sediments from anchoring during construction, installation, maintenance, and decommissioning of offshore components. BOEM estimates that approximately 284 acres (1.15 km^2) of seabed could be affected by anchoring within the water quality geographic analysis area. Disturbances to the seabed during anchoring would temporarily increase suspended sediment and turbidity levels in and immediately adjacent to the anchorage area. The intensity and extent of the additional sediment suspension effects would be less than that of new cable emplacement (see new cable emplacement and maintenance IPF discussion below) and would therefore be unlikely to have an incremental impact beyond the immediate vicinity. If more than one project is being constructed during the same period, the impacts would be greater than for one project, and multiple areas would experience water quality impacts from anchoring but, due to the localized area for sediment plumes, the impacts would likely not overlap each other geographically. The overall impact of increased sediment and turbidity from vessel anchoring is anticipated to be adverse, localized, and short term, resulting in a minor impact on ambient water quality. Anchoring would not be expected to appreciably contribute to overall impacts on water quality.

Cable emplacement and maintenance: Emplacement of submarine cables would result in increased suspended sediments and turbidity. Using the assumptions in Table F2-2, offshore wind development in the water quality geographic analysis area would result in approximately 1,858 acres (7.5 km^2) of seabed impact. As described under anchoring above, these activities would contribute to changes in offshore water quality from the resuspension and deposition of sediment. Sediment dispersion modeling conducted for three other offshore wind projects (the Vineyard Wind 1 Project in Massachusetts, the Block Island Wind Farm in Rhode Island, and the Virginia Offshore Wind Technology Advancement Project of Virginia) were reviewed and evaluated, and general sediment conditions and hydrodynamics are similar to those in the Project area (see COP Volume II, Section 2.1.2.2.1 for detailed descriptions; Ocean Wind 2022). The sediments within each project area were predominantly sands and current velocities were within similar ranges, indicating that the results of each modeling effort would be expected to be representative of the Project site. Turbidity concentrations greater than 10 mg/L would be short in duration up to 6 hours and limited to within approximately 50 to 200 meters of the trench in the offshore area. BOEM anticipates that offshore wind projects would use dredging only when necessary and rely on other cable laying methods for reduced impacts (such as jet plow or mechanical plow) where feasible. Due to the localized areas of disturbances and range of variability within the water column, the overall impacts of increased sediments and turbidity from cable emplacement and maintenance are anticipated to be localized, short term, and adverse, resulting in a minor impact on ambient water quality. If multiple projects are being constructed at the same time, the impacts would be greater than those identified for one project and would likely not overlap each other geographically due to the localized natures of the plumes. New cable emplacement and maintenance activities would not be expected to appreciably contribute to overall impacts on water quality.

Port utilization: Offshore wind development would use nearby ports and could also require port expansion or modification, resulting in increased vessel traffic or increased suspension and turbidity from any in-water work. These activities could also increase the risk of accidental spills or discharge. However, these actions would be localized and port improvements would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. As a result, port utilization impacts on water quality would be minor and not expected to appreciably contribute to overall impacts on water quality.

Presence of structures: Using the assumptions in Table F2-2, reasonably foreseeable offshore wind projects are estimated to result in no more than 482 structures by 2030 within the water quality geographic analysis area. These structures could disturb up to 366 acres (1.5 km^2) of seabed within the water quality geographic analysis area from foundation and scour protection installation and disrupt bottom current patterns, leading to increased movement, suspension, and deposition of sediments. Scouring, which could lead to impacts on water quality through the formation of sediment plumes (Harris et al. 2011), would generally occur in shallow areas with tidally dominated currents. Structures may reduce wind-forced mixing of surface waters, whereas water flowing around the foundations may increase vertical mixing (Carpenter et al. 2016; Cazenave et al. 2016). Results from a recent BOEM (2021c) hydrodynamic model of four different WTG build-out scenarios of the offshore Rhode Island and Massachusetts lease areas found that offshore wind projects have the potential to alter local and regional physical oceanic processes (e.g., currents, temperature stratification),via their influence on currents from WTG foundations and by extracting energy from the wind. The results of the hydrodynamic model study show that introduction of the offshore wind structures into the offshore WEA modifies the oceanic responses of current magnitude, temperature, and wave heights by (1) reducing the current magnitude through added flow resistance, (2) influencing the temperature stratification by introducing additional mixing, and (3) reducing current magnitude and wave height by extracting of energy from the wind by the offshore wind turbines. Alterations in currents and mixing would affect water quality parameters such as temperature, DO, and salinity, but would vary seasonally and regionally. WTGs and the OSS associated with reasonably foreseeable offshore wind projects would be placed in average water depths of 100 to 200 feet where current speeds are relatively low, and offshore cables would be buried where possible. Cable armoring would be used where burial is not possible, such as in hard-bottomed areas. BOEM anticipates that developers would implement BMPs to minimize seabed disturbance from foundations, scour, and cable installation. As a result, adverse impacts on offshore water quality would be localized, short term, and minor. Presence of structures would not be expected to appreciably contribute to overall impacts on water quality.

The exposure of offshore wind structures, which are mainly made of steel, to the marine environment can result in corrosion without protective measures. Corrosion is a general problem for offshore infrastructures and corrosion protection systems are necessary to maintain the structural integrity. Protective measures for corrosion (e.g., coatings, cathodic protection systems) are often in direct contact with seawater and have different potentials for emissions, e.g., galvanic anodes emitting metals, such as aluminum, zinc, and indium, and organic coatings releasing organic compounds due to weathering and leaching. The current understanding of chemical emissions for offshore wind structures is that emissions appear to be low, suggesting a low environmental impact, especially if compared to other offshore activities, but these emissions may become more relevant for the marine environment with increased numbers of offshore wind projects and a better understanding of the potential long-term effects of corrosion protection systems (Kirchgeorg et al. 2018). Based on the current understanding of offshore wind structure corrosion effects on water quality, BOEM anticipates the potential impact to be minor.

Discharges: Other offshore wind projects would result in a small incremental increase in vessel traffic, with a short-term peak during construction. Vessel activity associated with offshore wind project construction is expected to occur regularly in the New York and New Jersey lease areas beginning in

2023 and continuing through 2030, and then lessen to near-baseline levels during operation. Increased vessel traffic would be localized near affected ports and offshore construction areas. Offshore wind development would result in an increase in regulated discharges from vessels, particularly during construction and decommissioning, but the events would be staggered over time and localized. Offshore permitted discharges would include uncontaminated bilge water and treated liquid wastes. BOEM assumes that all vessels operating in the same area will comply with federal and state regulations on effluent discharge. All offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of discharges and of nonindigenous species. All vessels would need to comply with the USCG ballast water management requirements outlined in 33 CFR Part 151 and 46 CFR Part 162. Furthermore, each project's vessels would need to meet USCG bilge water regulations outlined in 33 CFR Part 151, and allowable vessel discharges such as bilge and ballast water would be restricted to uncontaminated or properly treated liquids. Therefore, due to the minimal amount of allowable discharges from vessels associated with offshore wind projects, BOEM expects impacts on water quality resulting from vessel discharges to be minimal and to not exceed background levels over time.

The WTGs and OSS are self-contained and do not generate discharges under normal operating conditions. In the event of a spill related to an allision or other unexpected or low-probability event, impacts on water quality from discharges from the WTGs or OSS during operation would be temporary. During decommissioning, all offshore wind structures would be drained of fluid chemicals via vessel, dismantled, and removed. BOEM anticipates decommissioning to have temporary impacts on water quality, with a return to baseline conditions.

Due to the staggered increase in vessels from various projects; the current regulatory requirements administered by USEPA, USACE, USCG, and BSEE; and the restricted allowable discharges, the overall impact of discharges from vessels is anticipated to be localized and short term. Based on the above, BOEM anticipates discharges to have a minor impact on water quality, as the level of impact in the water quality geographic analysis area from offshore wind development would be similar to that under existing conditions and would not be expected to appreciably contribute to overall impacts on water quality.

Land disturbance: Other offshore wind development could include onshore components that would lead to increased potential for water quality impacts resulting from accidental fuel spills or sedimentation during the construction and installation of onshore components (e.g., equipment, substation). Construction and installation of onshore components near waterbodies may involve ground disturbance, which could lead to unvegetated or otherwise unstable soils. Precipitation events could potentially erode the soils, resulting in sedimentation of nearby surface waters and subsequent increased turbidity. It is assumed that a SWPPP and erosion and sedimentation controls would likely be implemented during the construction period to minimize impacts, resulting in infrequent and temporary erosion and sedimentation events.

In addition, onshore construction and installation activities would involve the use of fuel and lubricating and hydraulic oils. Use of heavy equipment onshore could result in potential spills during active use or refueling activities. It is assumed that a Spill Prevention, Control, and Countermeasure Plan would be prepared for each project in accordance with applicable regulatory requirements, and would outline spill prevention plans and measures to contain and clean up spills if they were to occur. Additional mitigation and minimization measures (such as refueling away from wetlands, waterbodies, or known private or community potable wells) would be in place to decrease impacts on water quality. Impacts on water quality would be limited to periods of onshore construction and periodic maintenance over the life of each project.

Overall, the impacts from onshore activities that occur near waterbodies could result in temporary introduction of sediments or pollutants into coastal waters in small amounts where erosion and sediment controls fail. Land disturbance for offshore wind developments that are at a distance from waterbodies and that implement erosion and sediment control measures would be less likely to affect water quality. In addition, the impacts would be localized to areas where onshore components were being built near waterbodies. While it is possible that multiple projects could be under construction at the same time, the likelihood that construction of the onshore components overlaps in time or space is minimal, and the total amount of erosion that occurs and impacts on water quality at any one given time could be minimal. Land disturbance from offshore wind development is anticipated to be localized, short term, and minor, and would not be expected to appreciably contribute to overall impacts on water quality.

3.21.3.3. Conclusions

Under the No Action Alternative, water quality would continue to follow current regional trends and respond to current and future environmental and societal activities. BOEM expects ongoing and planned non-offshore wind activities to have temporary impacts on water quality primarily through accidental releases and sediment suspension related to vessel traffic, port utilization, presence of structures, discharges, and land disturbance.

Ongoing activities, such as vessel traffic, military use and survey, commercial activities, recreational activities, and land disturbance, would likely result in minor impacts on water quality. Planned activities other than offshore wind may also contribute to minor impacts on water quality. Planned activities other than offshore wind include increasing vessel traffic, new submarine cables and pipelines, increasing onshore development, marine surveys, port improvement, and the installation of new offshore structures. BOEM anticipates that the impacts of ongoing and planned non-offshore wind activities would be minor on water quality.

BOEM anticipates that the overall impacts of other offshore wind activities in the geographic analysis area, including sediment resuspension during construction and decommissioning (both from regular cable laying and from prelaying); vessel discharges; sediment contamination; discharges from the WTGs and OSS during operation; sediment plumes due to scour; and erosion and sedimentation from onshore construction would be minor. Construction and decommissioning activities associated with other offshore wind activities would lead to increases in sediment suspension and turbidity in the offshore lease areas during the first 6 to 10 years of construction of projects and in the latter part of the 30-year life spans of offshore wind projects due to decommissioning activities. However, sediment suspension and turbidity increases would be temporary and localized and BOEM anticipates the impact to be minor. BOEM has considered the possibility of impacts resulting from accidental releases; a moderate impact could occur if there was a large-volume, catastrophic release. However, the probability of catastrophic release occurring is very low, the expected size of the most likely spill would be very small, and such a spill would occur infrequently.

Under the No Action Alternative, existing environmental trends and activities would continue, and water quality would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **minor** impacts on water quality. BOEM anticipates that the No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor** impacts because any potential detectable impacts are not anticipated to exceed water quality standards.

3.21.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed-Project design parameters (Appendix E) would influence the magnitude of the impacts on water quality:

- The amount of vessel use during installation, operations, and decommissioning
- The number of WTGs and OSS and the amount of cable laid determines the area of seafloor and volume of sediment disturbed by installation. Representing the maximum-case scenario, a maximum of 98 WTGs installed, three OSS, 190 miles (300 kilometers) of inter-array cable, 19 miles (30 kilometers) of OSS interconnector cable, and 174 miles (281 kilometers) of offshore export cable (Appendix E).
- Installation methods chosen and the duration of installation
- Proximity to sensitive water sources and mitigation measures used for onshore proposed-Project activities
- In the event of a non-routine event such as a spill, the quantity and type of oil, lubricants, or other chemicals contained in the WTGs, vessels, and other proposed-Project equipment

Variability of the proposed-Project design as a result of the PDE includes the exact number of WTGs and OSS (determining the total area of foundation footprints); the number of monopile foundations and jacket foundations (OSS only); the total length of inter-array cable; the total area of scour protection needed; and the number, type, and frequency of vessels used in each phase of the proposed Project. Changes in the design may affect the magnitude (number of structures and vessels), location (WTG and other Project element layouts), and mechanism (installation method, non-routine event) of water quality impacts.

Ocean Wind has committed to measures to minimize impacts on water quality. Turbidity reduction measures would be implemented to the extent practicable to minimize impacts on hard-bottom habitats, including seagrass communities, from construction activities (WQ-01). All vessels will be certified to conform to vessel operations and maintenance protocols designed to minimize the risk of fuel spills and leaks (WQ-02) (COP Volume II, Table 1.1-2; Ocean Wind 2022).

3.21.5 Impacts of the Proposed Action on Water Quality

The Proposed Action would contribute to impacts through all of the IPFs named in Section 3.21.3.2. The most impactful IPFs would likely include new cable emplacement and maintenance that could cause noticeable temporary impacts during construction through increased suspended sediments and turbidity, the presence of structures that could result in alteration of local water currents and lead to the formation of sediment plumes, and discharges that could result in localized turbidity increases during discharges or bottom disturbance during dredged material disposal.

Accidental releases: Similar to under other offshore wind projects, chemicals (e.g., coolants, oils, diesel fuel, other chemicals) would be used and stored in facilities and black and gray water may be stored in sump tanks on facilities. The Proposed Action would have a maximum of 39,690 gallons of coolants, 426,671 gallons of oils and lubricants, and 236,216 gallons of diesel stored within WTG foundations and OSS within the water quality geographic analysis area. As discussed previously, the risk of a spill from any single offshore structure would be low, and any effects would likely be localized. A reduction in the number of WTGs required due to increased capacity would result in a smaller total amount of materials being stored offshore. Modeling conducted for an area near the proposed Project area (Maryland WEA) indicates that the most likely type of spill (i.e., non-routine event) to occur during the life of a project is 90 to 440 gallons (341 to 1,666 liters), which would have brief, localized impacts on water quality (Bejarano et al. 2013). One difference between the Proposed Action and the Maryland WEA is that there would be fewer WTGs under the Proposed Action (98 instead of 125), which would lead to a decreased likelihood of spill events compared to the Bejarano et al. (Bejarano et al. 2013) model. There is potential for moderate water quality impacts due to a maximum-case scenario accidental release; however, due to the very low likelihood of a maximum-case scenario release occurring, the expected size of the most likely spill to be small, and the expected occurrence to be of low frequency, the overall impact is anticipated to be short term, localized, and minor, resulting in little change to water quality.

Increased vessel traffic in the region associated with the Proposed Action could increase the probability of collisions and allisions, which could possibly result in oil or chemical spills. However, collisions and allisions are anticipated to be unlikely based on the following factors that would be considered for the proposed Project: USCG requirement for lighting on vessels, NOAA vessel speed restrictions, the proposed spacing of WTGs and OSS, the lighting and marking plan that would be implemented, and the inclusion of proposed Project components on navigation charts. Ocean Wind would implement its Oil Spill Response Plan (COP Volume III, Appendix A; Ocean Wind 2022), which would provide for rapid spill response, cleanup, and other measures to minimize any potential impact on affected resources from spills and accidental releases, including spills resulting from catastrophic events. In the unlikely event an allision or collision involving vessels or components associated with the Proposed Action resulted in a large spill, impacts from the Proposed Action alone on water quality would be short term to long term depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill. In addition, Ocean Wind has committed to a mitigation measure requiring that vessels conform to O&M protocols designed to minimize risk of fuel spills and leaks (WQ-02; COP Volume II, Table 1.1-2; Ocean Wind 2022). With implementation of this mitigation measure, risk of fuel spills and leaks from vessels would be minimized and the impact considered minor.

Onshore construction activities would require heavy equipment use or HDD activities, and potential spills could occur as a result of an inadvertent release from the machinery or during refueling activities. Ocean Wind would develop and implement a Spill Prevention, Control, and Countermeasure Plan to minimize impacts on water quality (prepared in accordance with applicable regulations such as NJDEP Site Remediation Reform Act, Linear Construction Technical Guidance, and Spill Compensation and Control Act). In addition, all wastes generated onshore would comply with applicable federal regulations, including the Resource Conservation and Recovery Act and the Department of Transportation Hazardous Material regulations. Therefore, BOEM anticipates the Proposed Action would result in minor, temporary, and long-term impacts on water quality as a result of releases from heavy equipment during construction and other cable installation activities.

Ocean Wind proposes to use an onshore O&M facility in Atlantic City, New Jersey. Construction of the O&M facility would be separately reviewed and authorized by USACE and local authorities, as needed. BOEM anticipates that use of the facility would result in minor impacts on water quality because a potential release at the facility would likely be relatively small and would be cleaned up in accordance with federal and state regulations.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined accidental release impacts on water quality from ongoing and planned activities including offshore wind, which would likely be short term and minor due to the low risk and localized nature of the most likely spills, and the use of an Oil Spill Response Plan for projects. These impacts would occur primarily during construction but also during operation and decommissioning, to a lesser degree. In the unlikely event that an allision or collision involving Project vessels or components resulted in an oil or chemical spill, it would be expected that a small spill would have minor temporary impacts, while a larger spill would have potentially increased temporary impacts. Given the low probability of these spills occurring, BOEM does not expect ongoing and planned activities, including the Proposed Action, to appreciably contribute to impacts on water quality resulting from oil and chemical spills.

Anchoring: There would be increased vessel anchoring during the construction, installation, O&M, and decommissioning of offshore components of the Proposed Action. Anchoring would cause increased turbidity levels. Impacts on water quality from the Proposed Action alone due to anchoring would be localized, short term, and minor during construction and decommissioning. Anchoring during operation would decrease due to fewer vessels required during operation, resulting in reduced impacts. Ocean Wind anticipates between 20 and 65 vessels operating simultaneously during construction, depending upon the activity. The number of vessels is anticipated to result in 14 acres (0.05 km^2) of impact from anchoring, which would be additive with the impact(s) of any and all other anchoring activities, including offshore wind activities that occur within the water quality geographic analysis area during the same timeframe, resulting in a total of 298 acres (1.2 km^2) of seabed impact from anchoring.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined anchoring impacts on water quality from ongoing and planned activities including offshore wind, which are anticipated to be localized, short term, and minor, primarily during construction and decommissioning. In context of reasonably foreseeable environmental trends, during operations, the Proposed Action would contribute an undetectable increment to the combined anchoring impacts on water quality from ongoing and planned activities including offshore wind, which would likely be localized, short term, and negligible.

Cable emplacement and maintenance: The installation of array cables and offshore export cables would include site preparation activities (e.g., sandwave clearance, boulder removal) and cable installation via jet plow, mechanical plow, or mechanical trenching, which can cause temporary increases in turbidity and sediment resuspension. Other projects using similar installation methods (e.g., jet plowing, pile driving) have been characterized as having minor impacts on water quality due to the short-term and localized nature of the disturbance (Latham et al. 2017). As described in Section 3.21.3.2, sediment dispersion modeling was conducted for three other offshore wind projects with conditions representative of the Wind Farm Area (see COP Volume II, Section 2.1.2.2.1 for detailed descriptions; Ocean Wind 2022). The modeling indicated sediments resuspended 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 meters of the center of the trench. Jet plow activities in near-shore areas such as Barnegat Bay for the Project would be similar to the modeling results for other shallow water areas where the mostly fine sediment (silts and clays) were projected to persist for 2 days at very low levels of 10 mg/L above background (Ocean Wind 2022 citing Normandeau 2015). These impacts on water quality for finer sediments are anticipated to be localized adjacent to the trench and temporary in nature. Therefore, given the known hydrodynamic conditions within the area of the Project and the expected BMPs associated with jet plowing technologies, no long-term impacts on water quality are anticipated following cable installation activities. BOEM anticipates the Proposed Action alone would have negligible, long-term impacts on water quality via this mechanism. Overall, impacts on water quality from the Proposed Action due to cable emplacement and resulting suspension of sediment and turbidity would be short term and minor.

The impacts contributed from the Proposed Action to increased sediment concentration and turbidity would be additive with the impact(s) of any and all other cable installation activities, including offshore wind activities, that occur within the water quality geographic analysis area and that would have overlapping timeframes during which sediment is suspended. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined impacts from ongoing and planned activities including offshore wind, which would likely be short term and minor. There could be limited overlap in construction schedules for cable installation for the proposed Project and the Atlantic Shores South offshore wind project in the water quality geographic analysis area. These impacts would not occur during operation.

Port utilization: The current bearing capacity of existing ports was considered suitable for WTGs, requiring no port modifications for supporting offshore wind energy development (DOE 2014). During construction, several ports may be used, including Atlantic City, New Jersey; Paulsboro, New Jersey;

Norfolk, Virginia; Hope Creek, New Jersey; or Charleston, South Carolina. During proposed Project operations, a retired marine terminal in Atlantic City would be used as the O&M facility. The impacts on water quality could include accidental fuel spills or sedimentation during port use. The incremental increases in ship traffic at the ports would be small; multiple authorities regulate water quality impacts from these operations (BOEM 2019). Therefore, the impacts of the Proposed Action alone on water quality from port utilization would be negligible.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined port utilization impact on water quality from ongoing and planned activities including offshore wind, which would likely be localized, short term, and minor due to the need for minimal port modifications or expansions and the small increase in ship traffic.

Presence of structures: Existing stationary facilities that present allision risks are limited in the open waters of the geographic analysis area. Dock facilities and other structures are concentrated along the coastline. The Proposed Action would add up to 98 WTGs, three OSS, and related Project elements, which would increase seabed disturbance and potential water quality impacts. In the water quality geographic analysis area, offshore wind activities including the Proposed Action would result in 446 acres (1.8 km^2) of impact from installation of foundations and scour protection and 141 acres (0.57 km^2) of impact from hard protection for offshore cables and inter-array cables. As described in Section 3.21.3.2, results from a recent BOEM (2021c) hydrodynamic model of four different WTG build-out scenarios of the offshore Rhode Island and Massachusetts lease areas found that offshore wind projects have the potential to alter local and regional physical oceanic processes (e.g., currents, temperature stratification) via their influence on currents from WTG foundations and by extracting energy from the wind.

The proposed Project's contribution to impacts on water quality due to the presence of structures would be additive with the impacts of any and all structures, including those of offshore wind activities, that occur within the water quality geographic analysis area and that would remain in place during the life of the proposed Project. These disturbances would be localized but, depending on the hydrologic conditions, have the potential to affect water quality through altering mixing patterns and the formation of sediment plumes. Significant scour is not expected even without scour protection due to the low current speeds and minimal seabed mobility in the Wind Farm Area (COP Volume II, Table 2.1.2-13; Ocean Wind 2022). The addition of scour protection would further minimize effects on local sediment transport. The impacts from the Proposed Action on water quality due to the presence of structures would be negligible to minor during construction, O&M, and conceptual decommissioning. In addition, as described in Section 3.21.3.2, the exposure of offshore wind structures to the marine environment can result in emissions of metals and organic compounds from corrosion protection systems. However, the current understanding of chemical emissions for offshore wind structures is that emissions appear to be low, suggesting a low environmental impact (Kirchgeorg et al. 2018). In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the combined structure placement impacts on water quality from ongoing and planned activities including offshore wind, which would likely be minor and constant over the lifespans of the reasonably foreseeable activities.

Discharges: During construction of the Proposed Action, vessel traffic would increase in and around the Wind Farm Area, leading to potential discharges of uncontaminated water and treated liquid wastes. COP Table 8.2-1 lists types of waste potentially produced by the Proposed Action (COP Volume I, Section 8.2; Ocean Wind 2022). Ocean Wind would only be allowed to discharge uncontaminated water (e.g., uncontaminated ballast water and uncontaminated water used for vessel air conditioning) or treated liquid wastes overboard (e.g., treated deck drainage and sumps). Other waste such as sewage; and solid waste or chemicals, solvents, oils, and greases from equipment, vessels, or facilities would be stored and properly disposed of on land or incinerated offshore.

Ocean Wind expects substantially less vessel use during routine O&M than during construction. Vessel use would consist of scheduled inspection and maintenance activities, with corrective maintenance as needed. In a year, the Proposed Action would generate a maximum of 908 crew vessel trips, 102 jack-up vessel trips, 104 supply vessel trips, and 2,278 helicopter trips, crew transfer vessel trips, or service operations vessel trips (COP Volume I, Section 6.1.3.5, Table 6.1.2-11; Ocean Wind 2022). The proposed Project would require all vessels to comply with regulatory requirements related to the prevention and control of discharges, accidental spills, and nonindigenous species. All vessels would need to comply with waste and water management regulations described in Section 3.21.3.2, including USCG ballast water management requirements and USCG bilge water regulation. The bilge water from the proposed Project would either be retained onboard vessels in a holding tank and discharged to an onshore reception facility or treated onboard with an oily water separator, after which the treated water could be discharged overboard. In addition, bilge water would not be allowed to be discharged into the sea unless the oil content of the bilge water without dilution is less than 15 parts per million (33 CFR 151.10). For vessels operating within 3 nm from shore, bilge water regulations under USEPA's National Pollutant Discharge Elimination System program apply to any of the proposed Project's vessels that are covered by a Vessel General Permit (those that are 79 feet [24 meters] or greater in length). Bilge discharges within 3 nm from shore are subject to the rules in Section 2.2.2 of the Vessel General Permit and must occur in compliance with 40 CFR Parts 110, 116, and 117, and 33 CFR Part 151.10. Ocean Wind has also committed to developing and implementing a waste management plan for the Project (COP Volume II, Table 1.1-2, GEN-10; Ocean Wind 2022). With implementation of these APMs and the regulatory requirements described above, the temporary impact of routine vessel discharge is expected to be minor.

The WTGs and OSS are self-contained and do not generate discharges under normal operating conditions. In the event of a spill related to an allision or other unexpected or low-probability event, impacts on water quality from discharges from the WTGs or OSS during operation would be temporary. During decommissioning, Ocean Wind would drain all fluid chemicals from the WTGs and OSS and dismantle and remove them. BOEM anticipates decommissioning to have temporary impacts on water quality, with a return to baseline conditions.

Overall, the impacts on water quality from the Proposed Action would be short term and minor during construction and, to a lesser degree, during decommissioning. During operations, the number of vessels in use would decrease even more, resulting in fewer impacts.

Impacts on water quality from the Proposed Action due to discharges would be additive with the impact(s) of any and all discharges, including those of offshore wind activities, that occur within the water quality geographic analysis area during the same timeframe. Vessel traffic (e.g., fisheries use, recreational use, shipping activities, military uses) in the region would overlap with vessel routes and port cities expected to be used for the Proposed Action and vessel traffic would increase under the Proposed Action. Discharge events would mostly be staggered over time and localized, and all vessels would be required to comply with regulatory requirements related to prevention and control of discharges, accidental spills, and nonindigenous species administered by USEPA, USACE, USCG, and BSEE. Therefore, in context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined discharge impacts on water quality from ongoing and planned activities including offshore wind, which would likely be short term, localized, and minor primarily during construction and to a lesser extent during decommissioning and operations.

Land disturbance: Construction of the Oyster Creek cable corridor would require up to 32 acres of total ground disturbance, with a total permanent corridor disturbance of 19 acres. Construction of the BL England cable corridor would require up to 48 acres of total ground disturbance, with a total permanent corridor disturbance of 29 acres. The BL England and Oyster Creek substation sites would require approximately 13 and 31.5 acres, respectively, to accommodate the area for the substation equipment and buildings, energy storage, stormwater management, and landscaping. During construction, up to 3 acres would be required for temporary workspace. Construction and installation of onshore components (e.g., substations, cable installation) would expose bare soils until permanent stabilization is achieved. Precipitation events could potentially erode the soils and discharge sediment-laden runoff into nearby surface waters, leading to increased turbidity. Ocean Wind would implement erosion and sedimentation controls during the construction period. Construction would lead to an increased potential for surface water quality impacts resulting from accidental fuel spills or sedimentation in waterbodies. The incremental increases in land disturbance from the Proposed Action would be small and mitigation measures, such as the use of a Spill Prevention, Control, and Countermeasure Plan and SWPPP, would be implemented. As such, impacts from the Proposed Action on surface water quality from land disturbance would be negligible to minor.

Onshore construction would disturb the ground with depths of up to 8 feet (e.g., trenching for onshore cable installation), which has the potential to interact with groundwater if groundwater were shallow enough to interact with the disturbance. However, as mentioned in Section 3.21.1, groundwater depths in the aquifer beneath the Onshore Project area (including those associated with the sole-source aquifer) are approximately 40 feet or more below the surface, which is too deep to have any direct interaction with or be affected by construction activities. Any contaminants spilled during construction would be localized, contained, and cleaned up per permitting requirements and Ocean Wind's Spill Prevention, Control, and Countermeasure Plan and, therefore, would not be anticipated to reach groundwater or have any effect on groundwater quality. Due to the depths of groundwater, BOEM does not anticipate any impact from construction, O&M, or decommissioning.

In context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable increment to the combined land disturbance impacts on water quality from ongoing and planned activities including offshore wind, which would likely be localized, short term, and minor due to the low likelihood that construction on onshore components would overlap in time or space, and the minimal amount of expected discharge of sediment-laden runoff into nearby waterbodies.

3.21.5.1. Conclusions

BOEM anticipates the impacts on water quality resulting from the Proposed Action would be **minor**. Impacts from routine activities including sediment resuspension during construction and decommissioning, both from regular cable laying and from prelaying; dredging; vessel discharges; sediment contamination; discharges from the WTGs or OSS during operation; sediment plumes due to scour; and, erosion and sedimentation from onshore construction, would be negligible to minor. Impacts from non-routine activities, such as accidental releases, would be minor from small spills. While a larger spill could have moderate impacts on water quality, the likelihood of a spill this size is very low. The impacts associated with the Proposed Action are likely to be temporary or small in proportion to the geographic analysis area and the resource would recover completely after decommissioning.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the overall impacts on water quality would likely range from undetectable to noticeable. BOEM anticipates that the overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be **minor**. The main drivers for this impact rating are the short-term, localized effects from increased turbidity and sedimentation due to anchoring and cable emplacement during construction, and alteration of water currents and increased sedimentation during operations due to the presence of structures. BOEM has considered the possibility of a **moderate** impact resulting from accidental releases; this level of impact could occur if there was a large-volume, catastrophic release. While it is an impact that should be considered, it is unlikely to occur. The Proposed Action would contribute to the overall impact rating primarily through the increased turbidity and sedimentation due to anchoring and cable emplacement during construction, and alteration of water currents and increased sedimentation during operation due to the presence of structures.

3.21.6 Impacts of Alternatives B, C, D, and E on Water Quality

The impacts resulting from individual IPFs under all action alternatives would be either the same or less than those described under the Proposed Action due to the same (Alternatives C-1, C-2, and E) or reduced (Alternatives B-1, B-2, and D) number of WTGs in the Wind Farm Area. While the reduced number of structures may slightly reduce localized water quality impacts during construction and operations, the difference in impacts compared to the Proposed Action would not be materially different. BOEM expects that the modifications to the Oyster Creek export cable route to avoid impacts on SAV in Barnegat Bay under Alternative E would not significantly change the potential impacts on water quality because cable emplacement would still result in short-term and localized sediment suspension, land disturbance would be small, and mitigation measures, such as the use of a Spill Prevention, Control, and Countermeasure Plan and SWPPP, would be implemented. Therefore, BOEM does not anticipate the impacts from the action alternatives to be materially different than those described under the Proposed Action.

In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the action alternatives to the overall water quality impacts from ongoing and planned activities including offshore wind would be similar to those of the Proposed Action.

3.21.6.1. Conclusions

The expected **minor** impacts associated with the Proposed Action would not change substantially under the action alternatives. The same construction and installation, O&M, and conceptual decommissioning activities would still occur, albeit at differing scales in some cases. Alternatives B-1, B-2, and D may result in slightly less, but not materially different, negligible to minor impacts on water quality due to a reduced number of WTGs that would need to be constructed and maintained. Alternatives C-1 and C-2 would have the same WTG number as the Proposed Action and, therefore, would have similar negligible to minor impacts on water quality. Alternative E would result in similar, but not materially different, negligible to minor impacts on water quality in relation to sediment disturbance and turbidity and onshore ground disturbance. Therefore, the **minor** impacts would be the same across all action alternatives.

In context of reasonably foreseeable environmental trends, incremental impacts contributed by the action alternatives to the overall impacts on water quality would range from undetectable to noticeable. BOEM anticipates that the overall impacts of the action alternatives on water quality when each combined with impacts from ongoing and planned activities including offshore wind would be **minor**. BOEM has considered the possibility of a **moderate** impact resulting from accidental releases; this level of impact could occur if there was a large-volume, catastrophic release. While it is an impact that should be considered, it is unlikely to occur. The majority of the water quality impacts within the geographic analysis area would come from other offshore wind development because the number of foundations from other offshore wind development in the geographic analysis represents about 80 percent of all foundations, which does not change between alternatives. However, the differences in impacts among action alternatives would still apply when considered alongside the impacts of other ongoing and planned activities. Therefore, impacts on water quality would be about the same under Alternatives C-1, C-2, and E and slightly lower but not materially different under Alternatives B-1, B-2, and D.

3.21.7 Proposed Mitigation Measures

No measures to mitigate impacts on water quality have been proposed for analysis.

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