Appendix F Impact-Producing Factor Tables and Assessment of Water Quality; Bats; Birds; Sea Turtles; Wetlands and Other Waters of the United States; Demographics, Employment, and Economics; and Land Use and Coastal Infrastructure

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F.1 Impact-Producing Factor Tables

This section presents the Impact-Producing Factor (IPFs) tables for each individual resource that is assessed within the EIS. Each table identifies potential IPFs, issues, and indicators to assess impacts for the resources.

F.1.1 Physical Resources

F.1.1.1 Air Quality

Table F-1. Potential impact producing factors (IPFs) on air quality

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases • Air emissions • Climate change	Compliance with NAAQS	Emissions (U.S. tons per year) during construction, operation, and decommissioning from marine vessels, vehicles, and equipment activity within 25 miles (40 kilometers) of the Lease 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 significance thresholds for criteria pollutants are the NAAQS.
	GHG emissions	GHG emissions (metric tons per year) during construction, operation, and decommissioning; operational GHG emissions reductions due to displacement of fossil-fuel power plants by wind energy. There are currently no significance thresholds for GHG emissions.

GHG = greenhouse gases; NAAQS = National Ambient Air Quality Standards; OCS = Outer Continental Shelf
*All listed IPFs may not necessarily contribute to each individual issue.

F.1.1.2 Water Quality

Table F-2. Potential impact producing factors (IPFs) on water quality

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases • Anchoring • Cable emplacement and maintenance • Discharges Land disturbance • Port utilization • Presence of structures	Runoff, sedimentation, sediment movement, suspension or resuspension, changes to stratification or mixing patterns of sediments, or spills of hazardous materials	Changes to turbidity, nutrients, dissolved oxygen, temperature, salinity, and/or Chlorophyll-a; introduction of new contaminants/oil or changes to sediments, or changes in flow.
	Disturbance or seepage to groundwater resources	Changes to turbidity, nutrients, dissolved oxygen, temperature, salinity, and/or Chlorophyll-a; Introduction of new contaminants/oil or changes to sediments, or changes in flow.

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.2 Biological Resources

F.1.2.1 Bats

Table F-3. Potential impact producing factors (IPFs) on bats

Contributing IPFs*	Issue	Impact Indicator
• Land disturbance • Lighting • Presence of structures • Traffic	Loss of habitat	Acreage loss compared to suitable acreage available in the region for bats.
	Noise duration and extent of exclusion from preferred habitats and normal behaviors	Qualitative estimate of displacement impact.
	Potential collision risk and displacement	Qualitative risk assessment of collision mortality risk for vessels and onshore traffic.
	Potential for concentration of insect prey base	Qualitative estimate of prey availability and analysis of collision mortality associated with lighted structures.

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.2.2 Benthic Resources

Table F-4. Potential Impact Producing Factors (IPFs) on Benthic Resources

Contributing IPFs*	Issue	Impact Indicator
• Discharge and releases • Electromagnetic Fields (EMF) and cable heat • Noise • Presence of structures • Seafloor disturbance • Sediment suspension and deposition • Trash and debris	Crushing, burial, and entrainment	Estimated extent of potential disturbance, injury, and mortality-level effects on fish and invertebrates (including eggs and larvae) from: crushing or burial by construction equipment and materials placement; entrainment by construction equipment; and burial effects from suspended sediment deposition.
	Seabed and water column alteration	Short-term and long-term effects on water column and benthic habitats by habitat displacement by monopiles; habitat modification by placement of scour protection and concrete mattresses; short-term alteration of soft bottom benthic habitat function; and long-term alteration of complex benthic habitat function.
	Water quality impacts	Duration and intensity of suspended sediment impacts (quantitative); also, effects described under seafloor disturbance.
	Underwater noise and vibration	Extent, frequency, and duration of noise above established effects thresholds, and/or other quantifiable effects as follows: • Invertebrates: Varies • Finfish: Varies by hearing group
	Power transmission	Theoretical extent of potentially detectable EMF and substrate heating effects, as follows: • Benthic eggs and larvae, EFH: area exposed to magnetic field effects • >1,000 mG, electrical field effects >500 mV/m Invertebrates: • Benthic infauna: Magnetic fields >1 mG, inhabited substrates exposed to measurable heating effects • Squid: >800 mG • Finfish: Theoretical extent of potentially detectable EMF effects by species group as follows**: • Demersal and pelagic finfish and invertebrates: area exposed to magnetic field effects >1,000 mG, electrical field effects 20 mV/m Electrosensitive species (sturgeon, skates, sharks): area exposed to magnetic field effects >250 mG, electrical field effects 20 mV/m (at 60 Hz)
	Water quality impacts	Accidental spills, releases of trash and debris (qualitative assessment relative to baseline conditions).
	Water quality impacts	Accidental spills, releases of trash and debris (qualitative assessment relative to baseline conditions).

µPa = micropascal; dB = decibel; EFH = Essential Fish Habitat; EMF = electromagnetic field; Hz = hertz; mG = milligauss; mV/m = millivolts per meter

*All listed IPFs may not necessarily contribute to each individual issue.

**EMF sensitivity varies widely, no effect threshold guidance has been established. The minimum EMF levels needed to produce behavioral responses observed in available research are one or more orders of magnitude larger than the anticipated EMF effects likely to result from the Proposed Action. Electrosensitive fish can detect low-frequency bioelectric fields at very weak levels but are unable to detect higher frequency fields >20 Hz (Bedore and Kajiura 2013).

F.1.2.3 Birds

Table F-5. Potential impact producing Factors (IPFs) on birds

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases • Lighting • Noise • Presence of structures • Seafloor disturbance • Sediment suspension and deposition • Traffic	Seafloor pile driving disturbance	Qualitative analysis of seafloor disturbance, loss, or conversion for foraging diving birds.
	Displacement effects of sediment suspension and deposition from pile driving and export cable laying and maintenance	Qualitative analysis on relative impact on prey availability and alteration of habitat supporting prey resources for foraging birds.
	Underwater noise from construction pile driving /conceptual decommissioning	Qualitative analysis of displacement effects on diving birds.
	Airborne noise duration and extent of exclusion from preferred habitats and normal behaviors	Qualitative analysis of displacement on foraging, roosting, and flying birds.
	Habitat loss/displacement	Area of suitable natural nesting, foraging, and roosting habitat converted to developed land.
	Potential toxicity to diving and foraging birds from discharges	Qualitative analysis of potential discharges (fuel, lubricants, chemicals, and cooling water).
	Potential debris entanglement/ingestion	Qualitative analysis of potential effects of trash and debris.
	Vehicle/vessel traffic collision mortality and displacement	Qualitative estimate of potential collision risk/mortality and temporary displacement.
	Potential collision risk by and/or displacement at/by structures	Qualitative analysis of potential collision risk mortality and displacement.

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.2.4 Coastal Habitat and Fauna

Table F-6. Potential impact producing factors (IPFs) on coastal habitat and fauna

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases (pollutants) • Air emissions (pollutants) • Anchoring (sediment disturbance) • Cable emplacement/ maintenance • Discharges (during HDD) • Land disturbance (trenching, HDD, construction) • Lighting (onshore) • Noise (onshore) • Presence of structures (cable infrastructure, onshore converter station • Traffic (onshore and vessels)	Habitat loss, death of faunal individuals/habitat modification	Acres of impacted or modified habitat and/or numbers of individuals killed.
	Disturbance/ displacement	Estimated time to expected recovery/return to habitat; duration and/or extent of activity (accidental release, discharge, cable installation, light, noise) and/or volume (traffic).
	Collision/injury	Qualitative estimate of collision risk.

HDD = horizontal directional drilling
*All listed IPFs may not necessarily contribute to each individual issue.

F.1.2.5 Finfish, Invertebrates, and Essential Fish Habitat

Table F-7. Potential impact producing factors (IPFs) on finish, invertebrates, and essential fish habitat

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases and discharges • Anchoring • Cable emplacement and maintenance • Climate change • Electromagnetic Fields (EMF) and cable heat Gear utilization • Lighting • Noise • Port utilization • Presence of structures • Regulated fishing effort • Seafloor disturbance • Sediment deposition	Underwater noise and vibration	Extent, frequency, and duration of noise above established effects thresholds, and/or other quantifiable effects as follows: • Invertebrates: Varies • Finfish: Varies by hearing group
	Crushing, burial, and entrainment	Estimated extent of potential disturbance, injury, and mortality-level effects on fish and invertebrates (including eggs and larvae) from; crushing or burial by construction equipment and materials placement; entrainment by construction equipment; and burial effects from suspended sediment deposition.
	Seabed and water column alteration	Short-term and long-term effects on water column and benthic habitats by habitat displacement by monopiles; habitat modification by placement of scour protection and concrete mattresses; Short-term alteration of soft- bottom benthic habitat function; and long-term alteration of complex benthic habitat function.
	Water quality impacts	Duration and intensity of suspended sediment impacts (quantitative); accidental spills, releases of trash and debris (qualitative assessment relative to baseline conditions).
	Artificial light	Extent and duration of artificial light effects (qualitative assessment relative to baseline conditions).
	Power transmission	Theoretical extent of potentially detectable EMF and substrate heating effects, as follows: • Benthic eggs and larvae, EFH: area exposed to magnetic field effects > 1,000 mG, electrical field effects > 500 mV/m • Invertebrates: • Benthic infauna: Magnetic fields > 1 mG, Inhabited substrates exposed to measurable heating effects • Squid: > 800 mG • Finfish: Theoretical extent of potentially detectable EMF effects by species group as follows:** • Demersal and pelagic finfish and invertebrates: area exposed to magnetic field effects > 1,000 mG, electrical field effects 20 mV/m • Electrosensitive species (sturgeon, skates, sharks): area exposed to magnetic field effects > 250 mG, electrical field effects 20 mV/m (at 60 Hz)

*All listed IPFs may not necessarily contribute to each individual issue.
**EMF sensitivity varies widely, no effect threshold guidance has been established. The minimum EMF levels needed to produce behavioral responses observed in available research are one or more orders of magnitude larger than the anticipated EMF effects likely to result from the Proposed Action. Electrosensitive fish can detect low-frequency bioelectric fields at very weak levels but are unable to detect higher frequency fields > 20 Hz (Bedore and Kajiura 2013).

F.1.2.6 Marine Mammals

Table F-8. Potential impact producing factors (IPFs) on marine mammals

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases • Electrical and magnetic fields (EMF) and cable heat • Gear utilization • Lighting • Noise • Port Utilization • Presence of structures • Seafloor disturbance • Sediment suspension and deposition • Traffic	Seabed and water column disturbance/alteration	Water column volume and acres of seabed disturbance, loss, or conversion by structure presence.
	Water quality	Quantitative estimate of intensity and duration of suspended sediment effects; qualitative analysis of potential discharges (fuel, lubricants, chemicals, cooling water, trash, and debris) relative to baseline; relative impact on prey availability and alteration of habitat supporting prey resources.
	Noise - Underwater noise from construction/ conceptual decommissioning	Magnitude, duration, and extent of exposure above established effects thresholds, as noted below: Behavioral thresholds (SPL)[1]: • Impulsive and non-impulsive, intermittent sources: 160 dB • Non-impulsive, continuous source: 120 dB Impulsive Injury Thresholds (e.g., impact pile driving, airguns, sonar, etc.): (L_{pk}/SEL_{24h}):[2] • Low-frequency cetaceans: 219 dB/183 dB • Mid-frequency cetaceans: 230 dB/185 dB • High-frequency cetaceans: 202 dB/155 dB • Phocid pinniped: 218 dB/185 dB • Non-impulsive Source Sound Exposure Injury Thresholds: (SEL_{24h}): • Low-frequency cetaceans: 199 dB • Mid-frequency cetaceans: 198 dB • High-frequency cetaceans: 173 dB • Phocid pinniped: 201 dB
	Noise - Non-impulsive underwater noise from operation	Magnitude, duration, and extent of exposure above established effects thresholds, as noted below. • Behavioral effect thresholds (SPL):1 120 dB. • Permanent threshold shift (PTS) thresholds for all species: not expected to be reached, sound levels below "effective quiet".
	Noise - Airborne noise	Magnitude, duration, and extent of exposure above established effects thresholds, as noted below: Behavioral effect thresholds:[3] • Phocid pinniped: 90 dB • Cetaceans: Not applicable
	Power transmission	Theoretical extent of detectable EMF effects.
	Vessel traffic	Qualitative estimate of potential collision risk.
	Artificial light	Intensity, frequency, and duration relative to baseline.
	Visible infrastructure	Qualitative analysis of scale of impact and alterations to habitat and behavior.

* All listed IPFs may not necessarily contribute to each individual issue.

[1] Behavioral effect thresholds for impact and vibratory pile driving defined by the NMFS (NMFS, 2018). SPL = root-mean-square sound pressure level in units of decibels (dB) referenced to (re) 1 micropascal (µPa).

[2] NMFS, 2018 defines a permanent hearing threshold shift as the onset of physical injury from underwater noise exposure. NMFS has identified different PTS thresholds for the low-, mid-, and high-frequency cetacean, and phocid pinnipeds based on group-specific hearing sensitivity. Thresholds are defined using L_{pk} and SEL_{24h} metrics. L_{pk} = peak sound pressure level in units of dB re 1 µPa; SEL_{24h} = sound exposure level over 24 hours in units of dB re 1 μPa^2 s

[3] Airborne exposure threshold (unweighted decibels) defined by NMFS (2018). Distance to phocid pinniped thresholds estimated using methods described by the Washington State Department of Transportation (2020). No airborne PTS threshold established for pinnipeds. No airborne thresholds established for cetaceans. The SPL threshold is defined in units of dB re 20 µPa.

F.1.2.7 Sea Turtles

Table F-9. Potential impact producing factors (IPFs) on sea turtles

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases • Electrical and magnetic fields (EMF) and cable heat • Gear utilization • Lighting • Noise • Port utilization • Presence of structures • Seafloor disturbance • Sediment suspension and deposition • Traffic • Impact pile driving • Geophysical surveys • Vessels • Aircrafts • Cable laying or trenching • Foundation relief drilling • WTG operations • Geophysical surveys • Vessels	Seabed and water column disturbance/alteration	Water column volume and acres of seabed disturbance, loss, or conversion by structure presence.
	Water quality	Quantitative estimate of intensity and duration of suspended sediment effects; qualitative analysis of potential accidental discharges (fuel, lubricants, chemicals, cooling water, trash, and debris) relative to baseline; relative impact on prey availability and alteration of habitat supporting prey resources.
	Noise – Underwater noise from construction/conceptual decommissioning	Extent, frequency, and duration of noise above established effects thresholds relative to species occurrence, as noted below: • Behavioral effects[1]: SPL 175 dB re 1 µPa • PTS (L_{pk}/SEL_{24h})[2]: 232 dB/204 dB • TTS (L_{pk}/SEL_{24h})[2]: 226 dB/189 dB
	Noise – Underwater noise from operation	Extent, frequency, and duration of noise above established effects thresholds relative to species occurrence, as noted below: • Behavioral effects: SPL 175 dB re 1 µPa
	Noise – In-air noise/ disturbance	Biologically significant behavioral response.
	Power transmission	Theoretical extent of detectable EMF effects.
	Vessel traffic	Qualitative estimate of potential collision risk.
	Artificial light	Intensity, frequency, and duration relative to baseline.
	Visible infrastructure	Qualitative analysis of scale of impact and alterations to habitat and behavior.

µPa = micropascal; μPa^2 = squared micropascal; dB = decibel(s); L_{pk} = peak sound pressure level in units of dB re: 1 µPa; SPL = root-mean-square sound pressure level in units of dB re: 1 µPa; SEL_{24h} = sound exposure level over 24 hours in units of dB re: 1 μPa^2 second; EMF = electric and magnetic fields; IPF = impact-producing factor; PTS = permanent threshold shift; TTS =temporary threshold shift

*All listed IPFs may not necessarily contribute to each individual issue.

[1] Behavioral disturbance threshold defined by Finneran et al. (2017).

[2] PTS and TTS thresholds defined by (Finneran et al. 2017).

F.1.2.8 Wetland and Other Waters of the United States

Table F-10. Potential impact producing factors (IPFs) on wetlands and other waters of the United States

Contributing IPFs*	Issue	Impact Indicator
• Discharges & Releases • Land disturbance • Sediment • Suspension & Deposition	Habitat loss/modification	Acres of impacted habitat.
	Water quality impacts	Qualitative assessment of potential increased sedimentation into wetlands.
		Qualitative assessment of potential changes in water quality from HDD activity and spills.
		Qualitative assessment of trash and debris relative to baseline condition.

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.3 Socioeconomic Conditions and Cultural Resources

F.1.3.1 Commercial Fisheries and For-Hire Recreational Fishing

Table F-11. Potential impact producing factors (IPFs) on commercial fisheries and for-hire recreational fishing

Contributing IPFs*	Issue	Impact Indicator
• Anchoring • Noise • Port utilization • Presence of structures • Vessel traffic	Port access	Vessel traffic congestion and reduced access to high-demand port services and higher costs for such services; displacement to other primary or landing ports.
	Fishing access	Increased operating costs (e.g., additional fuel to arrive at more distant locations; additional crew compensation due to more days at sea); lower revenue (e.g., less- productive area; less-valuable species); increased conflict among fishermen; avoidance of area by fishermen because of safety concerns or noise.
	Loss of or damage to fishing gear	Costs of gear repair or replacement; lost fishing revenue while gear is being repaired or replaced.
	Change in catch of target species	Change in revenue due to change in catch.

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.3.2 Cultural Resources

Table F-12. Potential impact producing factors (IPFs) on cultural resources

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases • Anchoring • Cable emplacement/ maintenance • Climate change • Gear utilization and dredging • Land disturbance /onshore construction • Lighting (vessels and structures) • Port utilization /expansion • Presence of structures (viewshed)	Seabed disturbance and potential marine cultural resource damage	Qualitative analysis of potential physical damage to known or undiscovered shipwrecks, downed aircraft, and other post-contact historic properties; qualitative analysis of impacts on pre-contact ancient, submerged landforms with high archaeological sensitivity and/or cultural and historic significance to Native American Tribes (Traditional Cultural Properties).
	Terrestrial ground disturbance and impacts to terrestrial cultural resources	Qualitative discussion of potential physical damage to previously recorded or undiscovered terrestrial archaeological sites; qualitative discussion of potential physical damage or viewshed impacts to previously documented or unknown Native American Traditional Cultural Properties.
	Viewshed changes due to presence of structures and lighting resulting in impacts to identified historic properties	Qualitative assessment of viewshed impacts to National Register of Historic Places-listed/eligible sites (historic properties) from which project components are visible; qualitative assessment of viewshed impact on previously documented or unknown Native American Traditional Cultural Properties.

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.3.3 Demographics, Employment, and Economics

Table F-13. Potential impact producing factors (IPFs) on demographics, employment, and economics

Contributing IPFs*	Issue	Impact Indicator
• Cable emplacement and maintenance • Climate change • Energy security/generation • Land disturbance • Lighting • Noise • Port utilization • Presence of structures • Traffic	Impacts on particular sectors of the economy	Qualitative assessment that considers the context and intensity of the particular IPF on the functioning of the economy (e.g., decrease in full-time equivalent jobs, labor income, gross domestic product, and gross output).

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.3.4 Environmental Justice

Table F-14. Potential impact producing factors (IPFs) on environmental justice

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases • Air emissions • Air emissions • Cable emplacement and maintenance • Discharges • Land disturbance • Lighting • Noise • Port utilization • Presence of structures • Traffic	Potential public health and safety impacts (e.g., toxicity of dredged materials, emissions, dust, noise, lighting)	Qualitative assessment of impacts to minority and low-income populations from Project impacts that could affect public health and safety, including air quality, water quality, noise, and land use impacts.
	Potential job and income losses due to disruption of ocean and coastal areas (e.g., commercial fisheries or for-hire recreational fishing, recreation and tourism) **	Assessment of economic impacts to minority and low-income populations due to Project impacts to ocean and coastal areas (e.g., commercial fisheries and for-hire recreational fishing, recreation and tourism).
	Impacts to environmental spatial access (i.e., the ability to enter and use geographic areas for a variety of activities and purposes. Activities may include management or development activities as well as non-consumptive activities: (e.g., recreation, transportation, visiting cultural areas). Impacts may include effects to culture and identity	Assessment of impacts to minority and low-income populations from Project impacts that could affect access to public spaces or the enjoyment of nature.
	Impacts to resource access (i.e., the ability to benefit from the harvest or use of living and non-living resources. May include tribal and subsistence fishing activities and species of historical cultural significance to a community)	Assessment of impacts to minority and low-income populations from Project impacts that could affect sense of place.***

*All listed IPFs may not necessarily contribute to each individual issue.
**This analysis does not assess economic impacts to minority or low-income populations that could occur as a result of employment and income changes in sectors of the ocean economy other than the commercial fishing and for-hire recreational fishing industries. As discussed in Section 3.6.3 (Demographics, Employment, and Economics), Project construction and installation would support new employment and economic activity in the marine construction and transportation sectors. As described in Table G-1 in Appendix G, *Mitigation and Monitoring* where possible, local businesses would be hired to meet labor needs for Project construction. These employment and income benefits are expected to be no greater for minority or low-income populations than those experienced by non-minority or non-low-income members of the general population who also reside in the analysis area. Section 3.6.3.5 also notes that the adverse or beneficial economic impacts of Project construction activities on other sectors in the ocean economy aside from marine construction and transportation and would be temporary and negligible to minor. The adverse or beneficial economic impacts of Project O&M activities on sectors in the ocean economy are also expected to be negligible to minor but long term.
***Sense of place refers to cognitive, affective, functional, and social relationships with and reactions to a spatial setting. It can both evoke and be inspired by place-based concepts of place identity, place attachment, and place dependence (Jorgensen and Stedman, 2001).

F.1.3.5 Land Use and Coastal Infrastructure

Table F-15. Potential impact producing factors (IPFs) on land use and coastal infrastructure

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases and discharges • Land disturbance • Lighting • Port utilization • Presence of structures • Traffic	Public health and safety	Construction- or operation-related volume increases, traffic delays, traffic re-routes, and noise
	Port improvements and operations	Changes to vehicle, vessel traffic volumes, and infrastructure demands
	Land use code and zoning	Qualitative assessment of compliance with local land use regulations

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.3.6 Navigation and Vessel Traffic

Table F-16. Potential impact producing factors (IPFs) on navigation and vessel traffic

Contributing IPFs*	Issue	Impact Indicator
• Anchoring • Cable emplacement and maintenance • Port utilization • Presence of structures • Traffic	Vessel or structural damage due to incident	Increased frequency of strikes/allisions, collisions, and groundings due to restricted vessel movement
	Vessel traffic	Increased vessel traffic or congestion, the core issue is increased navigational complexity, increasing risk of allision/collisions
	Navigation	Changes to navigational patterns and increased risk of navigational hazards, as well as adverse effects on USCG SAR activities.

*All listed IPFs may not necessarily contribute to each individual issue.
SAR = search and rescue; USCG = U.S. Coast Guard

F.1.3.7 Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

Table F-17. Potential impact producing factors (IPFs) on other uses (marine minerals, military use, aviation, scientific research, and surveys)

Contributing IPFs*	Issue	Impact Indicators
• Presence of structures • Traffic	Military and National Security Uses: Reduction in the ability of military and national security vessels and aircraft (including USCG SAR resources) to access and use the site due to construction vessel traffic and the installation and presence of wind turbine generators	Level of interruption to military exercises and national security operations
	Reduced availability of offshore energy (oil/gas) production at the site	Acreage of oil and gas activities excluded due to WTGs or offshore export cables or postponed due to increased traffic
	Reduced access to sand and minerals on the Outer Continental Shelf	Acreage of mineral extraction area excluded due to WTGs or offshore export cables or postponed due to increased traffic
	Aviation and Air Traffic: Risk to aviation traffic	Qualitative assessment of risk to flight vectors to regional airports
	Radar Systems: Impact on land-based radar (air traffic control, National Oceanic and Atmospheric Administration weather, high-frequency ocean observation radar)	Qualitative assessment of potential for radar shadow
	Impacts to other renewable energy projects, particularly if there is overlap in ports to be used; transit lane orientation	Qualitative assessment of potential for exclusion of other renewable energy projects
	Cables and Pipelines: Impact on any proposed/approved pipelines; electricity/telecom transmission lines	Qualitative assessment of potential for exclusion of or damage to other undersea cables
	Scientific Research and Surveys: Impacts to scientific research and surveys	Qualitative assessment of potential for reduced or eliminated survey opportunities
	Impact on dredged material ocean disposal sites	Project overlap with ocean disposal sites

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.3.8 Recreation and Tourism

Table F-18. Potential impact producing factors (IPFs) on recreation and tourism

Contributing IPFs*	Issue	Impact Indicator
• Anchoring • Cable emplacement and maintenance • Lighting • Noise • Port utilization • Presence of structures • Traffic	Changes to recreation access and opportunity	Qualitative assessment of changes to the following: • Vehicle/vessel traffic volume • Viewshed • Navigation hazards • Access restrictions
	Changes to recreational fishing	Qualitative assessment of impacts on the following: • Loss or damage to fishing gear • Change in distribution and catch of target species • Loss of recreational fishing access sites • Impacts on recreational fishing businesses and expenditures

*All listed IPFs may not necessarily contribute to each individual issue.

F.1.3.9 Visual Resources

Table F-19. Potential impact producing factors (IPFs) on visual resources

Contributing IPFs*	Issue	Impact Indicator
• Accidental releases • Anchoring • Cable emplacement and maintenance • Land disturbance • Lighting • Noise • Port utilization • Presence of structures • Traffic	Change in scenic quality of the landscape and seascape	Visual contrast and dominance of Project component structures and activities onshore and offshore visible in the viewshed
	Impacts to the physical elements and features that make up an ocean, seascape or landscape and the aesthetic, perceptual, and experiential aspects of the ocean, seascape or landscape that contribute to its distinctive character. Impacts to the "feel," "character," or "sense of place" of an area of ocean, seascape or landscape.	Public sensitivity for the settings and tolerance for change: susceptibility to impact, and perceived social value
	Changes to the view from adding wind energy project components into the viewshed as seen from a particular key viewing location and how the change affects people who are likely to be at the viewpoint	Magnitude of change: the combination of visual contrast, size and scale of the change to existing conditions caused by the project, the geographic extent of the area subject to the project's effects, and the effects' duration and reversibility
	Changes to the view from adding wind energy project lighting into the viewshed	Sensitivity to luminance and illuminance from Project component lighting sources onshore and offshore visible in the viewshed related to frequency, color, timing, brightness, etc.

*All listed IPFs may not necessarily contribute to each individual issue.

F.2 Assessment of Resources with Minor (or Lower) Impacts

To focus on the impacts of most concern in the main body of the EIS, BOEM included the analysis of resources with no greater than **minor** adverse impacts in this Appendix F in the Final EIS. This included water quality; bats; birds; coastal habitat and fauna; sea turtles; and demographics, employment, and economics. References for these resource analyses are provided in Appendix K.

3.4.2 Water Quality

This section discusses potential impacts on water quality from the Project, action alternatives, and ongoing and planned activities in the water quality geographic analysis area (Figure 3.4.2-1). The water quality geographic analysis area 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 primary ports that may be used by the Project, including Baltimore (Sparrows Point), Maryland; Ocean City, Maryland; Gulf of Mexico (Ingleside, Texas or Houma, Louisiana or Harvey, Louisiana), Brewer, Maine, Lewes, Delaware, Hampton Roads area (Portsmouth), Virginia; and Port of New York/New Jersey. In addition, the geographic analysis area has an onshore component that includes any sub-watershed that is intersected by the Onshore Project area. The offshore geographic analysis area accounts for limited 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/installation and operational activities of the Project.

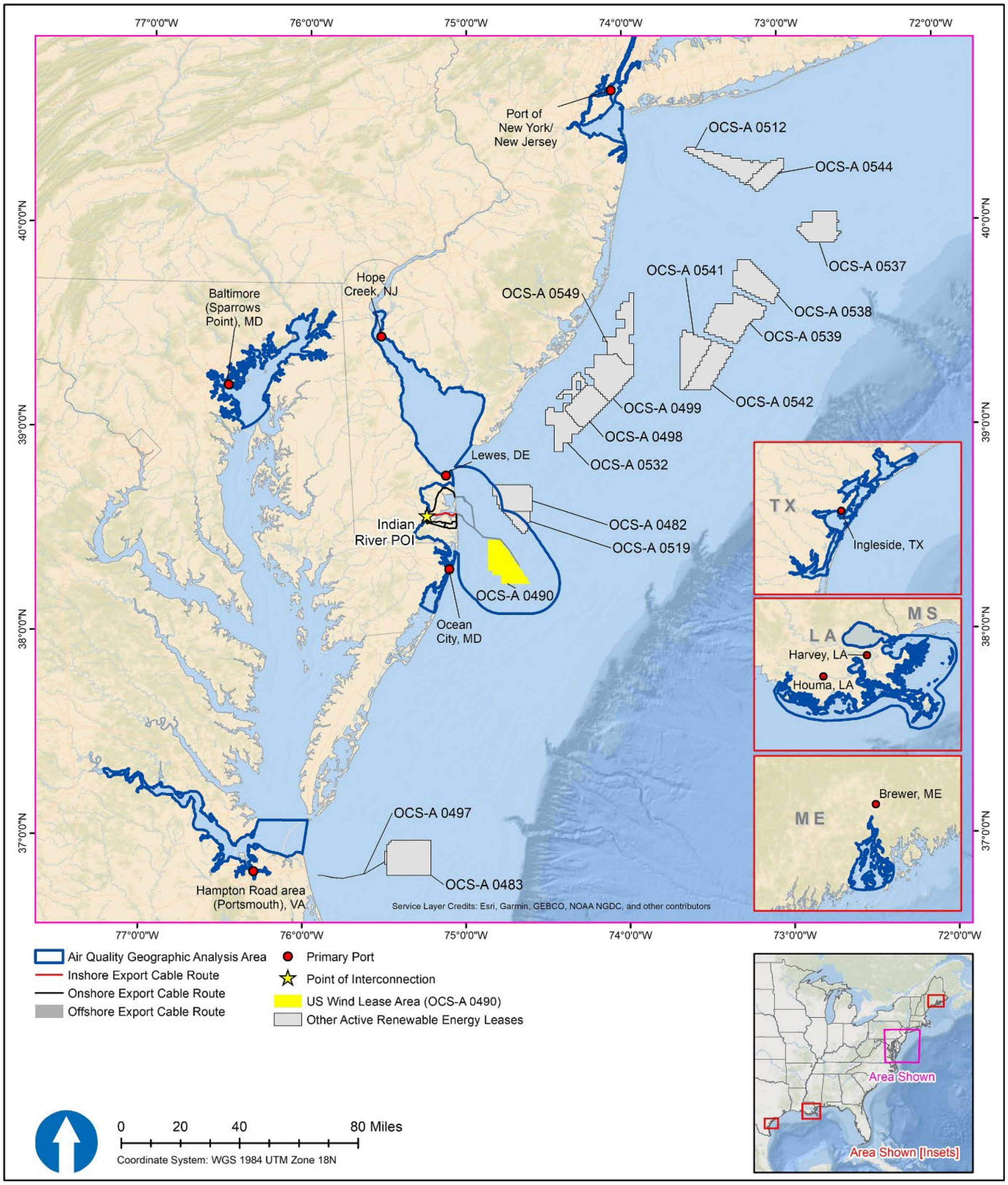

Figure 3.4.2-1. Water quality geographic analysis area

3.4.2.1 Description of the Affected Environment

Waters in the geographic analysis area include both inland and marine waters. The marine waters include the Atlantic Ocean within the Project area and along the Offshore Export Cable Route, and coastal waters include vessel routes to/from the port facilities. Inland waters include the Indian River and Indian River Bay along the Inshore Export Cable Route from the Delaware coast to the proposed landfall at the Indian River substation.

Table 3.4.2-1 identifies key parameters that characterize water quality, with several of these being accepted proxies for ecosystem health (e.g., dissolved oxygen, nutrient levels). Temperature and salinity delineate coastal onshore waters from coastal marine waters. States assess a variety of water quality parameters as part of state requirements to evaluate and list state waters as impaired under Section 303(d) of the CWA. A waterbody is classified as non-attainment per Section 303(d) requirements when a designated beneficial use (e.g., recreation, fish consumption) is impaired by an exceedance of one or more water quality parameters.

Table 3.4.2-1. Water quality parameters and characterizing descriptions

Parameter	Characterizing Description
Temperature	Water temperature strongly affects species distribution in the ocean with large-scale changes that may impact seasonal phytoplankton blooms.
Salinity	Salinity, or salt concentration, also affects species distribution. Seasonal variation is smaller than year-to-year variation and less predictable than temperature changes (Kaplan 2011).
Dissolved oxygen	Dissolved oxygen concentrations should be above 5 mg/L to maintain a stable environment; lower levels may affect sensitive organisms (USEPA 2000).
Chlorophyll *a*	Chlorophyll *a* is an indicator of primary productivity. The USEPA (USEPA 2021a) considers estuarine and marine levels of chlorophyll *a* less than 5 µg/L to be good, 5 to 20 µg/L to be fair, and more than 20 µg/L to be poor.
Turbidity	Turbidity is a measure of water clarity. High turbidity reduces light penetration and ecological productivity and provides attachment places for other pollutants (USGS 2018). Marine waters generally have less turbidity than estuaries.
Nutrients	Phytoplankton (the foundation of the marine food chain) and their associated growth rates depend on nutrient (e.g., nitrogen, phosphorus, carbon, calcium, silicon, various micronutrients) availability in the water. Excess nutrients (from natural or human-derived sources) can cause problematic algal blooms that significantly lower dissolved oxygen concentrations in ambient waters.

µg/L = micrograms per liter; mg/L = milligrams per liter; USEPA = United States Environmental Protection Agency; USGS = United States Geological Survey

Deeper Atlantic waters, including the Offshore Export Cable Route and Lease Area, exhibit little variation in salinity and temperature, although a vertical variation occurs on a seasonal basis during stratification (World Ocean Database 2021). Stratification typically reaches a maximum in the summer when surface waters are warmer (77.18°F [25.10°C]) and somewhat less saline (31.60 practical salinity units [PSU]) than bottom waters (49.14°F [9.52°C]; 32.78 PSU); well-mixed and more uniform vertical salinity and temperature profiles are evident in the fall (71.08°F to 61.07°F [21.71°C to 16.15°C]; 31.99 to 33.39 PSU) (COP, Volume II, Section 4.1.1, Table 4-1; US Wind 2024). Coincident with this stratification is a reduction in dissolved oxygen from supersaturated conditions near the surface to less well-oxygenated (near 80 percent saturation) waters at the bottom (COP, Volume II, Section 4.1.1; US Wind 2024). Suspended sediment concentrations/turbidity can vary by an order of magnitude at a single location over time, from less than 1 milligram per liter (mg/L) to several hundred milligrams per liter, where the higher values are associated with storm events (COP, Volume II, Section 4.1.1; US Wind 2024). Sediment resuspension can reintroduce anthropogenic contaminants back into the water column. With increasing distance from shore, oceanic circulation patterns play an increasingly larger role in dispersing and diluting anthropogenic contaminants (e.g., nutrients) and determining water quality.

The onshore geographic analysis area that includes the coastal Indian River Bay Watershed in Sussex County, Delaware, along the Delmarva peninsula is underlain by the Northern Atlantic Coastal Plain aquifer. This is a large aquifer system that extends from New Jersey through North Carolina, containing multiple aquifers and confining units (USGS 1997). The Indian River Bay Watershed is situated above an unconfined surficial aquifer that is the uppermost aquifer in the system. A substantial proportion of the total freshwater flux to the Delmarva coastal bays comes from groundwater flowing through the surficial aquifer (Krantz et al. 2006).

Beneath Indian River Bay are fresh groundwater subsurface zones alternating with zones dominated by the flow of saltwater down into the surficial aquifer. Through geophysical and geotechnical data, Krantz et al. (2006) showed advective flow produces plumes of fresh groundwater 1,312 to 1,969 feet (400 to 600 meters) wide and 65.6 feet (20 meters) thick that may extend more than 0.6 miles (1 kilometers) beneath the bay where incised valleys are filled with 3.3 to 6.6 feet (1 to 2 meters) of silt and peat that act as a semi-confining layer to restrict the downward flow of saltwater. In Delaware, the surficial aquifer is used for groundwater withdrawals (USGS 1997).

The Delaware Department of Natural Resources and Environmental Control (DNREC) Groundwater Protection Branch oversees groundwater protection efforts through technical review of permit applications for non-hazardous waste sites and groundwater quality investigations due to public complaints of domestic water wells. Additionally, DNREC oversees the Coastal Sussex Saltwater Monitoring Network and the Potomac Aquifer Saltwater Monitoring Network, the Source Water Assessment and Protection Program, and the Wellhead Protection Plan. Stormwater runoff is an increasingly important driver of nutrients into the Indian River Bay Watershed.

The Lower Indian River Bay was found to be impaired/nonattaining for fish, aquatic life, and wildlife due to copper and nutrient concentrations, while dissolved oxygen, total suspended solids, and zinc were listed as good (USEPA 2022a). While the Upper Indian River Bay was listed as impaired by the DNREC, it is not listed under the CWA Section 303(d) requirements for nonattainment. Issues were identified with fish, aquatic life, and wildlife for nutrients, temperature, and total suspended solids. The Indian River is listed as impaired/nonattaining under the CWA Section 303(d) requirements for fish, aquatic life, and wildlife (due to copper, dissolved oxygen, nutrients, temperature, and total suspended solids) as well as primary contact recreation (*Enterococcus* bacteria) (USEPA 2022b). No probable sources of impairment were identified for either waterbody. The DNREC has restoration plans in place for most of the identified issues within the respective areas.

The USEPA monitors water quality trends over time through a national coastal condition assessment. This assessment establishes a water quality index to describe the water quality of various coastal areas by assigning three condition levels (good, fair, and poor) for several water quality parameters. Table 3.4.2-2 lists the USEPA Region 3 condition levels by parameter from 2005, 2010, and 2015 (USEPA 2021b); Region 3 includes the coastal waters in the geographic analysis area. Since 2005, the percentage of "good" ratings has increased for all analyzed parameters (e.g., water clarity ratings within the good category have increased from 41.7 percent in 2005 to 52.5 percent in 2015). The sole exception to this trend is dissolved phosphorus, which has steadily decreased (i.e., phosphorous ratings within the good category have decreased from 64.8 percent in 2005 to 52.5 percent in 2015). Overall, coastal water quality is in good condition.

Table 3.4.2-2. Water quality index for the USEPA Region 3 stations, based on data collected in 2005, 2010, and 2015

Parameter	2005	2010	2015
Dissolved oxygen	Fair (20%), good (62%)	Fair (10.7%), good (62.5%)	Fair (14.3%), good (65.4%)
Chlorophyll *a*	Fair (56%), good (7.3%)	Fair (88%), good (5.6%)	Fair (71.2%), good (9.4%)
Water clarity	Fair (31.3%), good (41.7%)	Fair (28.7), good (49.1%)	Fair (18.3%), good (52.5%)
Dissolved nitrogen	Fair (14.8%), good (76.2%)	Fair (11.3%), good (83.4%)	Fair (7.4%), good (89.1%)
Dissolved phosphorous	Fair (23.6%), good (64.8%)	Fair (29.4%), good (60.4%)	Fair (37.6%), good (52.5%)

Source: USEPA 2021b

A series of ports have been identified for the Project, including the primary ports for construction and O&M in Baltimore (Sparrows Point), Maryland; Ocean City, Maryland; Gulf of Mexico (Ingleside, Texas or Houma, Louisiana or Harvey, Louisiana, Brewer, Maine, Lewes, Delaware, Hampton Roads area (Portsmouth), Virginia; Hope Creek, New Jersey, and Port of New York/New Jersey. Brewer, Maine and Gulf of Mexico (Ingleside, Texas or Houma, Louisiana or Harvey, Louisiana) have been identified has primary ports for the Met Tower Foundation and OSS Topside construction activities though these are not out of character for these ports and will include a limited number of vessels. The waterbodies along the Maryland, Virginia, and Delaware coasts are part of the USEPA Region 3 assessment provided in Table 3.4.2-2. New Jersey coastal waters are part of USEPA Region 2. Within Region 2, levels of dissolved oxygen, water clarity, and dissolved nitrogen increased from 2005 to 2015 in the percentage of "good" ratings but decreased in dissolved phosphorus. The chlorophyll *a* "good" rating decreased from 2010 to 2015.

The current conditions and trends based on ongoing activities within the geographic analysis area that contribute to impacts on water quality resources are diverse and numerous, generally associated with weather/natural events; other offshore wind energy development activities; undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; global climate change; oil and gas activities; onshore development activities; and research, monitoring, and survey activities.

As one of the key drivers of water quality change over time, climate change (e.g., warming sea temperatures, rising sea levels, ocean acidification) can affect water quality, causing variability within the ecosystem. Regional ocean temperatures have warmed faster than the global ocean over the last two decades according to NOAA (2021).

3.4.2.2 Impact Level Definitions for Water Quality

Definitions of impact levels for water quality are provided in Table 3.4.2-3. Section F.1 identifies potential IPFs, issues, and indicators to assess impacts to water quality.

Table 3.4.2-3. Impact level definitions for water quality

Impact Level	Impact Type	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.

3.4.2.3 Impacts of Alternative A – No Action on Water Quality

3.4.2.3.1 Impacts of Alternative A – No Action

Under Alternative A, the Project would not be built; thus, the impacts associated with the Project would not occur, and water quality would continue to follow current regional trends and respond to current and future environmental and societal activities. When analyzing the impacts of Alternative A on water quality, BOEM considered the impacts of ongoing non-offshore wind activities and other offshore activities, including onshore development activities (e.g., urbanization, forestry practices, municipal waste discharges, agriculture), marine transportation-related discharges, dredging and port improvement projects, commercial fishing, military use, new submarine cables and pipelines, and climate change. These activities would continue regardless of offshore development over the 30-year Project period and are expected to continue on existing trends based on current regulations. Impacts to water quality from ongoing and future non-offshore wind activities would still occur, but the exact impact depends on the temporal and geographical nature of the activities and associated IPFs.

While water quality impacts may be temporary and localized, with state and federal statutes, regulations, and permitting requirements (e.g., CWA Section 402) implemented to avoid or minimize these impacts, issues with water quality can still persist. BOEM anticipates the impacts of future activities (e.g., increasing vessel traffic, new submarine cables and pipelines, increasing onshore construction, marine surveys, marine minerals extraction, port expansion, installation of new offshore structures) other than offshore wind would be temporary and minor. BOEM expects the combination of ongoing activities previously stated and future activities other than offshore wind to result in moderate impacts on water quality, primarily driven by large-volume, catastrophic accidental releases.

3.4.2.3.2 Cumulative Impacts of Alternative A – No Action

The water quality geographic analysis area overlaps with most, but not all, of the Delaware/Maryland wind projects (Skipjack Wind I [part of OCS-A 0519], GSOE [OCS-A 0482], and Skipjack Wind II [part of OCS-A 0519]), with a total of 110 WTGs (Appendix D, *Planned Activities Scenario*, Table D2-1). These lease areas would be constructed during years that would have some overlap with each other. BOEM conservatively assumed in its analysis of water quality impacts that all the estimated WTGs for these lease areas would be sited within the water quality geographic analysis area.

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

Accidental releases: Future offshore wind activities could expose coastal and offshore waters to contaminants (e.g., fuel; sewage; solid waste; chemicals, solvents, oils, or grease from equipment) in the event of a spill or release during routine vessel use, collisions and allisions, or equipment failure of a WTG or OSS. All future offshore wind projects would comply with regulatory requirements related to the prevention and control of accidental spills administered by the USCG and Bureau of Safety and Environmental Enforcement (BSEE). OSRPs are required for every project and would provide for rapid spill response, cleanup, and other measures to minimize potential impacts on affected resources from spills. BOEM assumes all projects and activities would comply with laws and regulations to minimize releases.

Vessel activity would increase during construction/installation, thus increasing the potential for vessel allisions/collisions and fuel spills and would decrease to lower levels during O&M, coinciding with a reduction in the potential for vessel allisions/collisions and fuel spills. The probability of a fuel spill would be minimized by preventive measures, such as onboard containment measures and OSRPs, during routine vessel operations, including fuel transfer. The extent and persistence of water quality impacts from a fuel spill would depend on the meteorological and oceanographic conditions at the time, the effectiveness of spill response measures, and the volume and chemical characteristics of the spilled material.

Using the assumptions in Appendix D, *Planned Activities Scenario*, Table D2-3, approximately 597,969 gallons (2,263,558 liters) of coolants and 4.9 million gallons (18.5 million liters) of oils and lubricants would be contained in the construction/installation of the WTGs and OSSs for the wind energy projects within the water quality geographic analysis. 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 on facilities. BOEM conducted extensive modeling to determine the likelihood and effects of a chemical spill at offshore wind facilities (Bejarano et al. 2013). The modeling effort revealed the most likely type of spill is a non-routine event, which could occur at the WTGs at a volume of 90 to 440 gallons (341 to 1,666 liters) and at an occurrence frequency of one time in 1 to 5 years. The next most likely type of spill is a diesel fuel spill of up to 2,000 gallons (7,571 liters) at an occurrence frequency of one time in 91 years. The likelihood of a spill occurring from multiple WTGs and OSSs at the same time is very low; therefore, the potential impacts from a spill larger than 2,000 gallons (7,571 liters) are largely discountable. BOEM anticipates the likelihood of a non-routine catastrophic, or maximum-case scenario, release of all oils and chemicals to be very low (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/OSSs, or incidents such as toppling during a storm or earthquake.

The use of heavy equipment onshore could result in spills during use or refueling activities. Onshore construction/installation activities and associated equipment would involve fuel and lubricating and hydraulic oils.

Trash and debris accidentally released into the marine environment can harm marine animals through entanglement and ingestion. Vessel operators will adhere to the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) Annex V requirements as well as USEPA, USCG, and BSEE regulations.

An accidental release generally would be localized, short term, and result in little change to regional water quality. In the unlikely event of a large spill, impacts on water quality would be short to long term, depending on the type and volume of material released, the specific conditions (e.g., depth, currents, weather) at the spill location, and the effectiveness of spill response measures. Due to the low likelihood of a spill occurring and the expected size of the most likely spill, the overall impact of accidental releases is anticipated to be short term and localized, resulting in little change to water quality. As such, accidental releases from future offshore wind development would not be expected to contribute appreciably to overall impacts on water quality.

Anchoring: Anchoring associated with future offshore wind activities could contribute to changes in water quality through resuspension of sediments during the construction/installation, O&M, and conceptual decommissioning stages. Disturbances to the seafloor 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 *Cable emplacement and maintenance* IPF discussion below) and unlikely to have an impact beyond the immediate vicinity. Due to the current ambient conditions and the localized area of disturbance around each anchor, the overall impact of increased sediment and turbidity from vessel anchoring is anticipated to be localized and short term, resulting in little change to ambient water quality. Therefore, anchoring would not be expected to appreciably contribute to overall impacts on water quality.

Cable emplacement and maintenance: Using the assumptions in Appendix D, *Planned Activities Scenario*, Table D2-2, cable emplacement from future offshore wind activities would result in seafloor disturbance of about 149,433 acres (60,473 hectares). This would result in increased suspended sediments and turbidity. The sediment transport model for the Project predicted that sediment deposition thicker than 0.008 inches (0.2 millimeters [mm]) would occur within 300 feet (91 meters) of the cable route, with the fluidized sediments quickly settling back to the seafloor (COP, Volume II, Appendix B2; US Wind 2024). The suspended sediment concentrations are predicted to be less than 200 mg/L at distances greater than 450 feet (137 meters) from the cable route, with the plume persisting for up to 24 hours. The inshore sediment transport assessment stated sediments disturbed by jet plow operations in Indian River Bay will quickly return to the installation trench (less than 5 hours), with sediment deposition greater than 0.04 inches (0.5 millimeters) occurring within 1,968 feet (600 meters) of jet plow operations (COP, Volume II, Appendix B1; US Wind 2024). The flushing time of a sediment plume within Indian River Bay was predicted based on position along the proposed cable route and distance from the inlet. Results indicated that at a distance of 1,640 feet (500 meters), the flushing time is approximately 3 days. Therefore, flushing within Indian River Bay is long relative to the anticipated suspended sediment plume duration (less than 5 hours), and it is unlikely the suspended sediment will leave through the inlet. BOEM anticipates future offshore wind projects would use dredging only when necessary and rely on other cable-laying methods for reduced impacts (e.g., jet or mechanical plow), where feasible. Due to the current ambient conditions, localized areas of disturbance, and range of variability within the water column, the overall impacts of increased sediments and turbidity from cable emplacement and maintenance is anticipated to be localized and short term, resulting in little change to 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 likely would 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: Future offshore wind activities could increase port utilization, possibly including port expansion/modification, resulting in greater potential for increased turbidity, sedimentation, and accidental releases (e.g., fuel spills, trash/debris). However, any port expansions/modifications would comply with all applicable permit requirements, and vessels would adhere to all USCG and MARPOL 73/78 Annex V requirements and, as applicable, the National Pollutant Discharge Elimination System (NPDES) vessel general permit. Due to construction/installation time frames and decreased operational traffic, the overall impact of accidental spills and sedimentation during port utilization is anticipated to be localized and short to long term, resulting in little change to water quality. Port utilization would not be expected to appreciably contribute to overall impacts on water quality.

Presence of structures: Using the assumptions in Appendix D, *Planned Activities Scenario*, Table D2-2, future offshore wind activities would result in 401 structures in the water, 364 acres (147.3 hectares) of impact from installation of foundations and scour protection, and 240 acres (97.1 hectares) of impact from hard protection for the offshore export and inter-array cables. These structures would result in some alteration of local water current leading to increased movement, suspension, and deposition of sediments, but significant scour is not expected in deepwater locations where most structures would be located. Scouring that leads to impacts on water quality through the formation of sediment plumes generally occurs in shallow areas with tidally dominated currents (Harris et al. 2011). Structures may reduce wind-forced mixing of surface waters, whereas water flowing around the foundations may increase vertical mixing.

Offshore wind facilities have the potential to impact atmospheric and oceanographic processes through the presence of structures and the extraction of energy from the wind. There has been extensive research into characterizing and modeling atmospheric wakes created by wind turbines in order to design the layout of wind facilities and hydrodynamic wake/turbulence related to predicting seabed scour but relatively few studies have analyzed the hydrodynamic wakes coupled with the interaction of atmospheric wakes with the sea surface. Further, even fewer studies have analyzed wakes and their impact on regional scale oceanographic processes and potential secondary changes to primary production and ecosystems. Studies thus far in this topic have focused on ocean modeling rather than field measurement campaigns.

The general understanding of offshore wind–related impacts on hydrodynamics is derived primarily from European based studies. A synthesis of European studies by Van Berkel et al. (2020) summarized the potential effects of wind turbines on hydrodynamics, the wind field, and fisheries. Local to a wind facility, the range of potential impacts include increased turbulence downstream, remobilization of sediments, reduced flow inside wind farms, downstream changes in stratification, redistribution of water temperature, and changes in nutrient upwelling and primary productivity. Human-made structures, especially tall vertical structures such as foundations, alter local water flow at a fine scale by potentially reducing wind-driven mixing of surface waters or increasing vertical mixing as water flows around the structure (Carpenter et al. 2016; Cazenave et al. 2016; Segtnan and Christakos 2015). When water flows around the structure, turbulence is introduced that influences local current speed and direction. Turbulent wakes have been observed and modeled at the kilometer scale (Cazenave et al. 2016; Vanhellemont and Ruddick 2014). While impacts on current speed and direction decrease rapidly around monopiles, there is a potential for hydrodynamic effects out to a kilometer from a monopile (Li et al. 2014). Direct observations of the influence of a monopile extended to at least 984 feet (300 meters); however, changes were indistinguishable from natural variability in a subsequent year (Schultze et al. 2020). The range of observed changes in current speed and direction 984 to 3,281 feet (300 to 1,000 meters) from a monopile is likely related to local conditions, wind farm scale, and sensitivity of the analysis. In strongly stratified locations, the mixing seen at monopiles is often masked by processes forcing toward stratification (Schultze et al. 2020), but the introduction of nutrients from depth into the surface mixed layer can lead to a local increase in primary production (Floeter et al. 2017)

A hydrodynamic model was run for four different WTG build-out scenarios of offshore Rhode Island and Massachusetts lease areas. The hydrodynamic model showed offshore wind projects could alter local and regional physical oceanic processes (e.g., currents, temperature, and stratification) via their influence on currents from WTG foundations and by extracting energy from the wind (BOEM 2021). The model demonstrated that introduction of the wind structures into the offshore area 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 energy from the wind by the turbines. Changes in currents and mixing would fluctuate seasonally and regionally and affect water quality parameters (e.g., temperature, dissolved oxygen, salinity). WTGs and OSSs associated with reasonably foreseeable offshore wind projects would be placed in average water depths of 100 to 200 feet (30.5 to 61.0 meters) where current speeds are relatively low. Offshore cables would be buried where possible, and cable armoring would be used where burial is not possible (e.g., hard-bottom areas). BOEM anticipates developers would implement best management practices (BMPs) to minimize seafloor disturbance from foundations, scour, and cable installation. As a result, adverse impacts on offshore water quality would be localized, short term, and minor. The 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 in the absence of protective measures. Corrosion is a general problem for offshore infrastructure, and corrosion protection systems are necessary to maintain structural integrity. Protective measures for corrosion (e.g., coatings, cathodic protection systems) are routinely in direct contact with seawater and have different potentials for emissions (e.g., galvanic anodes emitting metals such as aluminum, zinc, and indium; organic coatings releasing organic compounds due to weathering or leaching). The current understanding is that chemical emissions for offshore wind structures appear to be low, suggesting a low environmental impact, especially compared to other offshore activities. However, 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: WTGs and OSSs are typically self-contained and do not generate discharges under normal operating conditions. Future offshore wind activities would result in a small increase in vessel traffic, with a short-term peak during construction/installation. Vessel activity associated with future offshore wind construction/installation activities is expected to occur regularly in the New York and New Jersey lease areas beginning in 2023 and continuing through 2030, with subsequent reductions to near existing levels during operation. Increased vessel traffic would be localized near affected ports and offshore construction/installation areas. Future offshore wind activities would result in an increase in regulated discharges from vessels, particularly during construction/installation 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 all vessels/facilities will comply with federal and state regulations on effluent discharges, including the requirement for an NPDES permit. All future offshore wind projects would comply with regulatory requirements related to the prevention and control of discharges and nonindigenous species. All vessels would comply with USCG ballast water management requirements outlined in 33 CFR 151 and 46 CFR 162. Under 33 CFR 151, allowable vessel discharges such as bilge and ballast water would be restricted to uncontaminated or properly treated liquids. Therefore, due to the minimal number of allowable discharges from vessels associated with future offshore wind projects, BOEM expects impacts on water quality resulting from vessel discharges to be localized, minimal, and not exceeding background levels over time.

Due to (1) the staggered increase in vessels from various projects; (2) the current regulatory requirements administered by the USEPA, USACE, USCG, and BSEE; and (3) the restricted allowable discharges, the overall impacts of discharges from vessels are anticipated to be localized and short term. Based on the above, the level of impact in the water quality geographic analysis area from future offshore wind development would be similar to existing conditions and not expected to appreciably contribute to overall impacts on water quality.

Land disturbance: Future offshore wind activities could include onshore components (e.g., substations) that contribute to water quality impacts through sedimentation and accidental spills of fuels and lubricants during construction/installation. Any onshore construction/installation near waterbodies may involve ground disturbance, which could lead to unvegetated or otherwise unstable soils. During precipitation events, the soils could be eroded, resulting in sedimentation of nearby surface waters and subsequent increased turbidity. BOEM assumes each project would avoid and minimize water quality impacts through BMPs; erosion and sedimentation controls; spill prevention, control, and countermeasure (SPCC) plans; stormwater pollution prevention plans (SWPPPs); and compliance with applicable permit requirements. 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 future offshore wind activities that are far from waterbodies and that implement erosion and sediment control measures would be less likely to affect water quality. Impacts on water quality would be localized, short term, and limited to periods of onshore construction/installation and periodic maintenance over the life of the Project. Land disturbance from future offshore wind development is not expected to appreciably contribute to overall impacts on water quality.

3.4.2.3.3 Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, water quality would continue to follow current regional trends (Appendix D, *Planned Activities Scenario*,) and respond to current and future environmental and societal activities. BOEM expects ongoing and non-offshore wind activities to have temporary and **minor** impacts on water quality, primarily through accidental releases and sediment suspension related to vessel traffic, port utilization, presence of structures, discharges, and land disturbance. In addition to ongoing activities, future activities other than offshore wind activities may contribute to impacts on water quality that include increasing vessel traffic, new submarine cables and pipelines, increasing onshore construction, marine surveys, marine minerals extraction, port expansion, and installation of new offshore structures. BOEM anticipates the overall impacts of other offshore wind activities in the geographic analysis area, including sediment resuspension during construction/installation and decommissioning, discharges, sediment contamination, sediment plumes due to scour, and erosion and sedimentation from onshore construction/installation would be minor.

Cumulative Impacts of Alternative A – No Action. In the context of other reasonably foreseeable environmental trends in the area, cumulative impacts on water quality resulting from ongoing and planned activities, in the geographic analysis area, would result in **minor** impacts on water quality. 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 such a release is very low.

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

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out would result in impacts similar to or less than those described in the subsections below. The following Project design parameters could influence the magnitude of impacts on water quality:

- The amount of vessel use during construction/installation, O&M, and conceptual decommissioning;
- The number of WTGs and OSSs and the amount of cable laid, which determines the area of seafloor and volume of sediment disturbed by installation. The PDE (Appendix C, Table C-2) for the Proposed Action includes up to 121 WTGs (PDE), 4 OSSs, approximately 125.6 mi (204.2 kilometer) of inter-array cables, 142.5 mi (229.3 kilometer) of offshore export cables, and 42.3 mi (68.1 kilometer) of inshore export cable;
- Installation methods chosen and installation duration;
- Proximity to sensitive groundwater or surface water sources and mitigation measures used for onshore Project activities; and
- The quantity and type of oil, lubricants, chemicals, or other trash/debris contained in the WTGs, vessels, and other Project equipment in the event of a non-routine event, such as a spill.

3.4.2.5 Impacts of Alternative B – Proposed Action on Water Quality

Alternative B would contribute to impacts on water quality through all the IPFs named in Section 3.4.2.3. The most impactful IPFs would likely include new cable emplacement and maintenance that could cause noticeable, temporary impacts during construction/installation through increased suspended sediments and turbidity, the presence of structures altering local water currents, and discharges or accidental releases introducing contaminants to the water column.

3.4.2.5.1 Impacts of Alternative B – Proposed Action

Construction and Installation

Onshore Activities and Facilities

Accidental releases: The onshore construction/installation site size and overall weather conditions can affect the total volume of stormwater discharge. The DNREC regulates construction/installation activities that result in land disturbance equal to or greater than 1 acre (0.4 hectares) that discharge stormwater to Waters of the State through the NPDES Construction General Permit, effective March 11, 2021 (COP, Volume II, Section 4.2.1; US Wind 2024) as well as the regulated beach area to preserve the natural resource of the beach. Construction involving clearing and soils disturbance at the onshore substation and landfall will adhere to the SWPPP for construction/installation activities, as appropriate.

Proper spill containment gear and absorption materials would be maintained for immediate use in the event of any inadvertent spills or leaks. Any Project substation equipment would be equipped with full containment for any components containing HDD fluids (i.e., bentonite). In addition, all waste generated onshore would comply with applicable federal and state regulations. As a result, BOEM anticipates the Project would result in minor, temporary, and localized impacts on surface water and groundwater quality as a result of releases from heavy equipment during construction/installation and other cable installation activities.

Land disturbance: Onshore components would include construction/installation of substations, associated laydown area and access roads, and an O&M Facility. During construction the Project is anticipated to permanently alter approximately 10.3 acres (4.2 hectares) at the onshore substation location associated with the three proposed substations. Construction of the interconnection facilities also includes the temporary construction laydown area of 4.02 acres (1.63 hectares), and a temporary access road of 0.76 acres (0.31 hectares) and 0.69 acres (0.23 hectares) at the landfall (see Appendix C, Project Design Envelope and Maximum-Case Scenario, Table C-2).

Onshore construction would require temporary ground-disturbing activities including surficial digging, land clearing, trenching, HDD, use of equipment and vehicles, and installation of permanent onshore infrastructure. Onshore construction activities upgradient of surface waterbodies would expose soils and sediments, resulting in potential erosion and sedimentation into onshore surface waters and changes to flows that could affect water quality. HDD is expected to be used at the landfall site to minimize land disturbance near the shoreline. Dredged material from the installation of the Inshore Export Cable will be piped via temporary dredge pipeline to a dewatering staging area at the US Wind substations, within the planned limits of construction disturbance. Dredged materials will be dewatered and placed in trucks for disposal/placement at an upland landfill location. This dredge material dewatering will occur within the disturbance footprint of the proposed substations. Limited sediment releases could occur during HDD, but impacts would be localized and short term.

There are no onshore construction activities under the Proposed Action that would require ground disturbance at depths at or near groundwater resources, and all activities would meet permit and regulatory requirements to continue protecting groundwater as drinking water resources. Proper erosion and sedimentation controls would be maintained to avoid and minimize unstable soils that could be moved by wind and runoff into surface waters and increase turbidity. As such, impacts on water quality from land disturbance during construction/installation would be minor.

Offshore and Inshore Activities and Facilities

Accidental releases: Accidental releases during construction/installation could involve fuel, oil, and lubricants. The Proposed Action would have up to about 158,460 gallons (636,521 liters) of coolants, oils, lubricants, and diesel fuel in its 121 WTG foundations (PDE) and about 339,888 gallons (1,286,596 liters) of coolants, oils, lubricants, and diesel fuel in its 4 OSS foundations (COP, Volume I, Appendix A, Tables 7 and 8; US Wind 2024). As discussed previously, the risk of a spill from any offshore structure would be low, and effects likely would be localized. BOEM conducted modeling that indicated the most likely type of spill would be a non-routine event with an estimated spill size of 90 to 440 gallons (341 to 1,666 liters), which would have brief, localized impacts on water quality (Bejarano et al. 2013). Increased vessel activity during construction/installation would increase the potential for vessel collisions/allisions and fuel spills. However, collisions/allisions are unlikely based on the following factors that would be considered for the Project: USCG requirement for lighting on vessels, NOAA vessel speed restrictions, proposed spacing of WTGs and OSSs, Project-specific lighting and marking plan, and inclusion of Project components on navigation charts. Implementation and adherence to the Project's SPCC Plan and OSRP (COP, Volume II, Section 4.2.1; US Wind 2024) 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 a collision or allision involving vessels or components associated with the Project resulted in a large spill, impacts from the Project alone on water quality would be short to long term, depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather) at the location of the spill. Overall, the probability of an oil or chemical spill large enough to affect water quality is extremely low, and the degree of impact on water quality would depend on the spill volume. This risk and impact would be localized, short term, and minor, with the unlikely event of a large accidental release potentially causing a moderate and short– to long-term impact.

Trash and debris could be accidentally released; however, such releases would be infrequent and negligible because operators would comply with federal and international requirements for management of shipboard trash, and the extent of an accidental release would be limited to the localized area.

Anchoring: A six-point anchoring system may be used for installation of the inshore export cable with the use of an anchor-handling tug and spud legs that are deployed to secure the cable-laying vessel while its anchors are being repositioned (COP, Volume I, Section 3.6.3.1; US Wind 2024). It is expected that the barges used for cable installation will be moved along the Inshore Export Cable Route using a six-point anchor system, assisted by an anchor handling tug, in combination with spud piles. To install the cable close to shore, small boats and flotation may be used to pull the offshore export cables through HDD conduits installed at the landfall site. Anchoring can cause resuspension and deposition of sediments in the immediate area of disturbance. Disturbed sediments would be limited to a localized area and would settle within 24 hours (COP, Volume II, Appendix B2; US Wind 2024). Therefore, impacts on water quality from anchoring would be minor.

Cable emplacement and maintenance: The Inshore Export Cable Route could be installed using different methods (e.g., vibro-injector, trenching) if jet plowing is not feasible. The Inshore Export Cable Route would result in a potential temporary construction disturbance area (anchoring) of 250 feet (76 meter) extending from either side of the route. Temporary seafloor disturbance due to the cable installation in Indian River Bay would be 168.3 acres (68.10 hectares) (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2).

To achieve the target burial depth, US Wind and its contractors have determined dredging for barge access in locations along the Inshore Export Cable Routes would be necessary preceding cable installation (US Wind, Maryland Offshore Wind Project, Indian River Bay, Export Cables Dredging Plans, January 16, 2024). Maximum dredging disturbance is assumed to be within 249 foot (76 meter) wide corridor along the Inshore Export Cable Route. The maximum volume of dredging, assuming all four cables were installed within the southern Inshore Export Cable Routes is estimated to approximately 73,676 cubic yards (56,329 cubic meters). Based on feedback from DNREC, US Wind will implement the following time of year restrictions to minimize impacts of sediment disturbance, including, no in-water work (e.g., cable installation, HDDs, dredging) within Indian River Bay between March 1 and September 30, and no HDD activities at the beach landfall from April 15 through September 15. Temporary benthic disturbance due to dredging for barge access in Indian River Bay would be 39 acres (15.8 hectares) (COP, Vol 1, Section 1.3, US Wind 2024).

Dredged material will be piped via temporary dredge pipeline to a dewatering staging area at the US Wind substations, within the planned limits of construction disturbance. Dredged materials will be dewatered and placed in trucks for disposal/placement at an upland landfill location.

The suspended sediment concentrations would vary with methods other than jet plowing, but this variability is anticipated to be temporary and localized. Sediment transport modeling for a jet plow installation through Indian River Bay indicated that impacts would include a temporary increase in suspended sediment concentrations and the deposition of sediments over parts of Indian River Bay

(COP, Volume II, Appendix B1, US Wind 2024). The duration of the suspended sediment plume is likely to last up to 24 hours with suspended sediment concentrations greater than 50 mg/L above ambient conditions dissipating in less than 12 hours. Concentrations of suspended sediment (>200 mg/L or deposition thicknesses >0.2 inches [5 millimeters]) are likely to occur within a 95 feet (30 meters) corridor around the proposed cable route. Suspended sediment concentrations are predicted to be less than 200 mg/L at distances greater than 4,600 feet (1,400 meters) from the cables. All suspended sediment concentrations greater than 50 mg/L above ambient conditions are predicted to dissipate in less than 12 hours after the passage of the jet plow. Suspended sediment plumes greater than 10 mg/L are predicted to disappear within 24 hours after the completion of jetting operations (COP, Volume II, Appendix B1, US Wind 2024). Dredging, which may also occur along the proposed cable route when crossing federal and state navigation channels, would produce similar effects, but with plumes likely to last longer and extend farther out. Dredging and any other in-water work would require a USACE Department of the Army permit to ensure the in-water work complies with state water quality standards. Impacts on water quality in Indian River Bay from construction/installation due to cable emplacement and resulting suspension of sediment and turbidity would be short term and minor.

Offshore export and inter-array cable installation would include insertion of gravity cells, if required; route clearance activities would including a pre-installation survey and grapnel run (to remove marine debris that could impact cable lay and burial); and cable installation via jet plow or mechanical trenching, which can cause temporary increases in turbidity and sediment resuspension. The offshore sediment transport model for the Project predicted that sediment deposition thicker than 0.008 inches (0.2 millimeters) would occur within 300 feet (91 meters) of the cable route with the fluidized sediments quickly settling back to the seafloor (COP, Volume II, Appendix B2; US Wind 2024). The suspended sediment concentrations are predicted to be less than 200 mg/L beyond 450 feet (137 meters) from the cable route, with the plume persisting for up to 24 hours after the completion of jetting operations. The inshore sediment transport assessment stated sediments disturbed by jet plow operations in Indian River Bay will quickly return to the installation trench (less than 5 hours), with sediment deposition greater than 0.04 inches (0.5 millimeters) occurring within 1,968 feet (600 meters) of the jet plow operations (COP, Volume II, Appendix B1; US Wind 2024). Flushing within Indian River Bay is long (approximately 3 days) relative to the anticipated suspended sediment plume duration (less than 5 hours); therefore, it is unlikely the suspended sediment will leave through the inlet.

The Proposed Action could result in temporary seafloor disturbance from installation of the offshore export (34 acres [13.76 hectares]) and inter-array cables (29.98 acres [12.13 hectares]), in a phased approach from 2025 through 2027 (Appendix C, *Project Design Envelope and Maximum-Case Scenario,* Table C-2). Impacts on water quality from construction/installation due to cable emplacement and resulting suspension of sediment and turbidity would be short term and minor.

Port utilization: The ports of Baltimore (Sparrows Point) and Ocean City, Maryland have been identified for the Project construction/installation staging activities, although not all ports would be used at the same time. Brewer, Maine and Gulf of Mexico (Ingleside, Texas or Houma, Louisiana or Harvey, Louisiana) have been identified has primary ports for the Met Tower Foundation and OSS Topside construction activities though these are not out of character for these ports and will include a limited number of vessels. Each port facility under consideration already has sufficient existing infrastructure or an area where entities intend to develop infrastructure with the capacity to support offshore wind activity, including the Project. As discussed in Section 3.6.5.1.3, *Port Facilities,* as part of the Proposed Action, US Wind has entered into an agreement with Tradepoint Atlantic (TPA) to facilitate funding of, and form a new venture to operate, a facility for the production of monopiles and other steel components for the offshore wind industry. Port improvements would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. The increase in vessel activity during the construction/installation stage would be limited, and multiple authorities regulate water quality impacts from port activities. Therefore, construction/installation-related impacts on water quality from port utilization would be negligible.

Presence of structures: Project impacts on water quality due to the presence of structures would be additive, with the impacts of structures associated with offshore wind activities combined with impacts resulting from activities other than offshore wind that occur within the water quality geographic analysis area that would remain in place during the life of the Project.

The permanent area displaced by WTGs (PDE of up to 121) under the Proposed Action is expected to be 2.84 acres, with an additional 22.7 acres for scour protection, totaling 25.5 acres (10.3 hectares) (Appendix C, *Project Design Envelope and Maximum-Case Scenario,* Table C-2). Four OSSs would be installed, and though the foundation has not yet been decided the total area of seafloor disturbance is up to 1.7 acres (0.7 hectares), assuming they are also monopile foundations, creating the maximum footprint. The Met Tower would displace an additional 435 square feet (40.41 square meters). In total, about 27.21 acres (10.61 hectares) of seafloor habitat would be permanently affected by the construction and installation of the WTGs, OSSs, and Met Tower foundations for the Proposed Action (Appendix C, Table C-2).

As described in Section 3.4.2.3, a hydrodynamic model study found offshore wind projects could 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 (BOEM 2021). These disturbances would be localized but, depending on the hydrologic conditions, could impact water quality through altering mixing patterns and forming sediment plumes.

The seafloor sediments, as noted previously, are prone to scour, and scouring has been confirmed at seafloor obstructions such as wrecks (COP, Volume II, Appendix A1; US Wind 2024). The addition of scour protection would minimize the potential for local sediment transport and subsequent impacts.

In addition, the exposure of offshore wind structures to the marine environment can result in emissions of metals and organic compounds from corrosion protection systems (Section 3.4.2.3). However, the current understanding is that chemical emissions from offshore wind structures appear low, suggesting a low environmental impact (Kirchgeorg et al. 2018).

Impacts from construction/installation on water quality from the presence of structures would be long term but minor.

Discharges: Up to 18 vessels would operate in the geographic analysis area under the Project. The precise total number of round trips per vessel type per project activity can be found in Appendix C, Table C-2, with the highest being 1,056 round trips. Vessels are permitted to routinely discharge certain liquid wastes to marine waters, including domestic water, uncontaminated bilge water, treated deck drainage and sumps, uncontaminated ballast water, and uncontaminated fresh water or seawater from vessel air conditioning. Other waste such as sewage; solid waste or chemicals; solvents; and oils and greases from equipment, vessels, or facilities are required to be stored and transported to shore for appropriate disposal or incinerated offshore. All vessels would comply with regulatory requirements related to the prevention and control of discharges and accidental releases. All vessels would comply with USCG ballast water management requirements outlined in 33 CFR 151 and 46 CFR 162, USCG bilge water regulations in 33 CFR 151, and the NPDES vessel general permit (as applicable). Allowable vessel discharges such as bilge and ballast water would be restricted to uncontaminated or properly treated liquids. The WTGs and OSSs are self-contained and do not generate discharges under normal operating conditions. No discharges are proposed associated with OSSs or other components; therefore, no NPDES permit is expected to be required.

Sediment resuspension during dredging would also result in release of sediment contaminants to the water column. The release of contaminants would be minimized using the same measures described to minimize sediment resuspension (i.e., gravity cells, BMPs during dredging). A field investigation was previously conducted by US Wind for the purpose of collecting and analyzing environmental sediment core samples (COP Appendix II-A7). Seventeen environmental vibracores were collected from Indian River Bay displaying predominately medium-fine-grained sand and silt with little organic matter. From these cores, fifteen exhibited concentrations of selected target analytes that exceeded one or more of the Delaware Ecological Marine Sediment Screening Levels. Two samples exceeded the screening levels and threshold effect levels (TEL) for one or both of the PAHs acenaphthene and naphthalene.

However, the detected concentrations were not significantly elevated relative to the screening levels; therefore, it is anticipated that these contaminants are bound to the organic materials and would not become more available to aquatic organisms within the water column. Furthermore, the detected PAH concentrations did not exceed screening values that are more indicative of adverse biological impacts, such as probable effect levels (PELs). The mean arsenic and nickel concentration from all of the sediment cores were below the applicable DNREC screening levels and TELs and did not exceed the screening values that are more indicative of adverse ecological impacts, such as PELs. The total suspended sediments and associated contaminant concentrations generated by the in-water activities would be temporary and would result in minor short-term impacts on water quality.

Dredged material will be piped via temporary dredge pipeline to a dewatering staging area at the US Wind substations, within the planned limits of construction disturbance. Dredged materials will be dewatered and placed in trucks for disposal/placement at an upland landfill location within 100 miles (161 kilometers) of the US Wind substations area. Dewatering will be achieved by a passive method using large geobags which would allow dredged material to dewater over approximately 30-60 days prior to removal and placed into dump trucks. Alternatively, mechanical dewatering using a temporary system of separators (shakers), clarifiers, mixing tanks, and belt presses could be sized to meet target daily dredge production and continuously remove material to one or more upland disposal facilities. A combination of passive and mechanical dewatering methods may be used, pending final design.

Based on the BMPs proposed for the Project and compliance with applicable vessel and permit requirements, BOEM anticipates the impacts on water quality from discharges during construction/installation would be short term and minor.

Operations and Maintenance

Onshore Activities and Facilities

IPFs during the onshore activities and facilities O&M stage includes accidental releases and land disturbance. Water quality impacts from operations would be similar to construction/installation, but to a much lesser degree. The avoidance, minimization, and mitigation measures listed for construction/installation would be followed during operations, limiting impacts on water quality. Therefore, the impact of the Project operations on water quality would be temporary and minor.

Offshore and Inshore Activities and Facilities

IPFs during the offshore activities and facilities O&M stage includes accidental releases, anchoring, cable maintenance, discharges, presence of structures, and port utilization. Water quality impacts from operations would be similar to construction/installation, but to a much lesser degree. Vessel activity would be significantly less during operations than construction/installation, decreasing the potential for accidental releases, discharges, anchoring, and port utilization. The avoidance, minimization, and mitigation measures listed for construction/installation would be followed during operations, limiting impacts on water quality.

The presence of structures could continue to disrupt bottom current patterns, leading to increased movement, suspension, and deposition of sediments. The seafloor sediments have been identified as poorly graded fine, fine to medium, and medium sand that is prone to scour, and scouring has been confirmed at seafloor obstructions such as wrecks (COP, Volume II, and Appendix A1; US Wind 2024). The WTGs, OSSs, and cables would have scour protection installed to minimize the potential for, and resulting impacts from, local sediment transport. The extent of the changes in the currents and mixing would fluctuate seasonally and regionally and would affect water quality parameters (e.g., temperature, dissolved oxygen, salinity). Changes to water quality would be detectable but would not result in degradation of water quality that would exceed water quality standards. Therefore, the impact on water quality of the Project operations would be temporary and minor.

Conceptual Decommissioning

Onshore Activities and Facilities

Onshore components are expected to be retired in place or potentially retained for future use. Therefore, decommissioning impacts on water quality would be negligible.

Offshore and Inshore Activities and Facilities

Decommissioning of the Project would include removing the WTGs, OSSs, Met Tower, scour protection, cable protection, and components of the submarine cable system to 15 feet (4.6 meters) below the mudline. To the extent feasible and appropriate, the avoidance, minimization, and mitigation measures discussed for construction/installation would be followed in the conceptual decommissioning stage regarding discharges (e.g., draining all fluid chemicals from the WTGs and OSSs), accidental release prevention, and port utilization. Short-term and localized sediment resuspension and deposition can occur from the removal of offshore export cables and scour protection and from vessel anchoring, similar to impacts resulting from infrastructure installation. The sediment transport model for the Project, conducted to characterize installation activities, predicted that sediment deposition thicker than 0.008 inches (0.2 millimeters) would occur within 300 feet (91 meters) of the cable route, with the fluidized sediments quickly settling back to the seafloor (COP, Volume II, Appendix B2; US Wind 2024). The suspended sediment concentrations are predicted to be less than 200 mg/L at distances greater than 450 feet (137 meters) from the cable route, with the plume persisting for up to 24 hours. The inshore sediment transport assessment stated sediments disturbed by jet plow operations in Indian River Bay will quickly return to the installation trench (less than 5 hours), with sediment deposition greater than 0.04 inches (0.5 millimeters) occurring within 1,968 feet (600 meters) of the jet plow operations (COP, Volume II, Appendix B1; US Wind 2024). Flushing within Indian River Bay is long (approximately 3 days) relative to the anticipated suspended sediment plume duration (less than 5 hours); therefore, it is unlikely the suspended sediment will leave through the inlet. Over the life of the Project, technological advances in methods and equipment may result in increased efficiency and reduction of impacts at the time of decommissioning. Therefore, decommissioning impacts on water quality would be minor.

3.4.2.5.2 Cumulative Impacts of Alternative B – Proposed Action

In the context of reasonably foreseeable environmental trends, BOEM expects cumulative impacts of Alternative B – Proposed Action to affect water quality through the following primary IPFs.

Land Disturbance: Cumulative land disturbance impacts on water quality from ongoing and planned actions would likely be localized, short term, and minor due to the low likelihood that construction of onshore components would overlap in time or space as well as the minimal amount of expected erosion into nearby waterbodies.

Accidental releases: Cumulative accidental release impacts on water quality from ongoing and planned actions are anticipated to be short term and minor due to the low risk and localized nature of the most likely spills as well as the use of the Project's SPCC Plan and OSRP. These impacts would occur primarily during construction/installation. In the unlikely event that a collision or allision involving Project vessels or components resulted in an oil or chemical spill, a small spill would have minor temporary impacts, while a larger spill could have increased temporary short- to long-term impacts. Given the low probability of such a spill occurring, BOEM does not expect ongoing and planned activities to contribute to impacts on water quality resulting from oil and chemical spills.

Anchoring: Cumulative anchoring impacts on water quality from ongoing and planned actions are anticipated to be localized, short term, and minor.

Cable emplacement and maintenance: Cumulative new cable emplacement impacts on water quality from ongoing and planned actions would likely be short term and range from minor to moderate.

Port utilization: Due to the lack of need for port modifications or expansions and the small increase in ship traffic, the overall cumulative port utilization impact on water quality from ongoing and planned actions likely would be localized, short term, and negligible.

Presence of Structures: The cumulative structure placement impacts on water quality from the Proposed Action would contribute an undetectable amount to ongoing and planned actions and likely would be constant over the life of the future activities, localized, and minor.

Discharges: BOEM expects the cumulative discharge impacts on water quality from ongoing and planned actions would be short term, localized, and minor.

3.4.2.5.3 Conclusions

Impacts of Alternatives B – Proposed Action. In the construction/installation, O&M, and conceptual decommissioning stages, there would be sediment resuspension and deposition, an increased potential for accidental releases, and changes to water mixing patterns that could affect water quality. Operational impacts would be smaller than construction/installation and decommissioning impacts. BOEM anticipates the impacts resulting from the Project would be negligible to minor, although the impact of the unlikely event of a large accidental release could be moderate. Therefore, BOEM expects the overall impact on water quality from Alternative B to be **minor** because the impact would be detectable but would not exceed water quality standards, and the resource would be expected to recover completely without remedial or mitigating action after decommissioning.

Cumulative Impacts of Alternatives B – Proposed Action. In the context of reasonably foreseeable environmental trends and planned actions, the cumulative impacts on water quality resulting from Alternative B would range from negligible to moderate. BOEM anticipates the overall impacts associated with Alternative B when combined with past, present, and future activities would be minor and would not alter the overall character of water quality in the geographic analysis area. The main drivers for this impact rating are the short-term, localized effects of increased turbidity and sedimentation due to anchoring and cable emplacement during construction/ installation, 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.

Thus, the likely overall impacts on water quality would qualify as **minor** because measurable impacts are anticipated, but the impacts would be limited with no exceedances of water quality standards, and the resource would recover completely without remedial or mitigating action. The Project would contribute to, but does not change, this overall impact rating, primarily through the temporary and localized nature of the impacts.

3.4.2.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes Alternative on Water Quality

3.4.2.6.1 Impacts of Alternative C

Alternative C has been identified to reduce impacts on Indian River Bay. This alternative includes an Onshore Export Cable Route from the landfall and avoid installation of a cable crossing Indian River Bay and Indian River (Inshore Export Cable Route). Alternative C-1 would make cable landfall at Towers Beach, a location 5 miles (7.7 kilometers) north of the Indian River Inlet within Delaware Seashore State Park in an existing parking lot utilizing the DelDOT ROWs. By using pre-existing vaults to re-route the onshore export cable around Indian River Bay, the IPFs of accidental releases and land disturbance described under Alternative B would be reduced through all stages of the Project.

Alternative C-2 includes landing the offshore export cable at the 3R’s Beach landfall; while this alternative is similar to Alternative B, only terrestrial-based Onshore Export Cable Routes would be considered. As in Alternative C-1, using only a terrestrial-based Onshore Export Cable Route through pre-existing ROWs would reduce the accidental releases and seafloor disturbance within Indian River Bay and the Indian River associated with Alternative B. This reduction for seafloor disturbance in Alternatives C-1 and C-2 would remove the potential 398.85 acres of total temporary area affected Indian River Bay as proposed in Alternative B. All other project components would be the same as Alternative B, which would result in the same impacts on water quality and not alter the significance rating of impacts.

3.4.2.6.2 Cumulative Impacts of Alternative C

With the combined scope of Alternative C-1 and C-2, the cumulative impacts on water quality are not expected to be materially different than Alternative B and would be minor, however impacts to water quality in Indian River Bay would not occur.

3.4.2.6.3 Conclusions

Impacts of Alternative C. The modifications to the onshore export cable routes in Alternatives C-1 and C-2 would not significantly change the potential impacts on onshore water quality because land disturbance during cable emplacement up to that point would be limited, and mitigation measures, such as the use of an SPCC Plan and SWPPP, would be implemented. Due to the scope of these alternatives (relative to Alternative B), no changes to offshore water quality are expected to be materially different and would remain **minor**, however impacts to water quality in Indian River Bay would not occur.

Cumulative Impacts of Alternative C. Impacts on water quality resulting from Alternative C, when combined with impacts from ongoing and planned activities, including other offshore wind activities, would be the same as the Proposed Action (**minor**), though impacts to water quality in Indian River Bay would not occur.

3.4.2.7 Impacts of Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative on Water Quality

3.4.2.7.1 Impacts of Alternative D

Alternative D has been identified to exclude 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer) of shore associated with the future development phase compared to Alternative B. All other Project components and activities involved in construction/installation, operation, and decommissioning would be identical to Alternative B.

Under this alternative, onshore activities are not anticipated to be different than Alternative B; therefore, all impacts on water quality for the onshore activities IPFs accidental releases and land disturbance indicated in Section 3.4.2.5 would be the same. Reducing the number of WTGs would result in decreased impacts on offshore water quality during all Project phases due to reduced vessel activities, fewer installed structures, and potentially less inter-array cable installation. This may reduce the potential impacts to water quality via reductions in associated discharges, the probability of accidental releases, amount of port utilization, degree of sediment resuspension and deposition due to anchoring, the number (and associated presence) of structures, and the number of new cables requiring emplacement/maintenance.

3.4.2.7.2 Cumulative Impacts of Alternative D

In the context of reasonably foreseeable environmental trends, the cumulative impacts on water quality from Alternative D would contribute an undetectable amount to ongoing and planned actions and likely would be constant over the life of the future activities, localized, and minor.

3.4.2.7.3 Conclusions

Impacts of Alternative D. Alternative D would result in similar, but not materially different than Alternative B, **minor** impacts on water quality from sediment disturbance and turbidity and onshore ground disturbance. While the reduction of structures in Alternative D may slightly reduce localized water quality impacts during construction/installation and operation, the difference in impacts compared to the Proposed Action would not be materially different.

Cumulative Impacts of Alternative D. In the context of reasonably foreseeable environmental trends and planned actions, Alternative D would occur within the same overall environment (e.g., ongoing and planned activities). Therefore, the overall impact of Alternative D on water quality, when combined with ongoing and planned activities, would be **minor**. The impacts would be limited, and the resource would be expected to recover completely.

3.4.2.8 Impacts of Alternative E – Habit Impact Minimization Alternative on Water Quality

3.4.2.8.1 Impacts of Alternative E

Alternative E has been identified to reduce impacts on offshore benthic habitats compared with Alternative B. Under Alternative E, BOEM could approve fewer WTG locations (remove 11 WTGs) and realignment of the offshore export cables. Micrositing of WTGs and cables may be necessary to avoid

AOCs (i.e., sensitive benthic habitat). All other Project components and activities involved in construction/installation, operation, and decommissioning would be identical to Alternative B.

Under this alternative, onshore activities are not anticipated to be different than Alternative B; therefore, all impacts on water quality for onshore activities IPFs (accidental releases and land disturbance) indicated in Section 3.4.2.5 would be the same. Similar to Alternative D, reducing the number of WTGs would result in decreased impacts on offshore water quality during all Project phases due to reduced vessel activities, fewer installed structures, and potentially less inter-array cable installation. This may reduce the potential impacts to water quality via reductions in associated discharges, the probability of accidental releases, amount of port utilization, degree of sediment resuspension and deposition due to anchoring, the number (and associated presence) of structures, and the number of new cables requiring emplacement/maintenance.

Repositioning the Offshore Export Cable Route could increase or decrease the extent of sediment resuspension compared with Alternative B.

3.4.2.8.2 Cumulative Impacts of Alternative E

In the context of reasonably foreseeable environmental trends, the cumulative impacts on water quality from Alternative E would likely be short term and minor due to sediment disturbance and turbidity.

3.4.2.8.3 Conclusions

Impacts of Alternative E. Similar to Alternative D, the reduction of structures in Alternative E may slightly reduce localized water quality impacts, however, it would result in similar, but not materially different than Alternative B, **minor** impacts on water quality from sediment disturbance and turbidity and onshore ground disturbance.

Cumulative Impacts of Alternative E. In the context of reasonably foreseeable environmental trends and planned actions, Alternative E would occur within the same overall environment (e.g., ongoing and planned activities) and would have only slightly different water quality impacts compared with Alternative B. Therefore, the overall impact of Alternative E on water quality, when combined with past, present and reasonably foreseeable activities, would be **minor**. The impact would be limited, and the resource would be expected to recover completely.

3.4.2.9 Comparison of Alternatives

Impacts of Alternatives. As described in Section 3.4.2.5, the potential impacts associated with the Proposed Action in combination with ongoing activities would likely be **minor**, with the unlikely event of a large accidental release potentially causing a moderate impact when compared to the impacts expected under the No Action Alternative. The Proposed Action would impact water quality through accidental releases, anchoring, new cable emplacement/maintenance, presence of structures, port utilization, discharges, and land disturbance. Under the No Action Alternative, these impacts would not occur.

Alternative C would have the same number of WTGs and OSSs as the Proposed Action, which would result in the same impacts on water quality and not alter the significance rating of impacts. The cable route options that would be constructed under these action alternatives are already covered under the Proposed Action as part of the PDE approach. The impact reduction would be limited to within the Indian River Bay by rerouting the cable on land along existing ROWs and avoiding the potential of 398.85 acres (161.41 hectares) of total temporary seafloor area affected within Indian River Bay and Indian River as proposed in Alternative B. Cable emplacement up to that point would still result in short-term, localized sediment suspension and limited land disturbance; mitigation measures, such as the use of an SPCC Plan and SWPPP, would be implemented. Therefore, Alternative C would have temporary to short term and **minor** impacts on water quality, with the unlikely event of a large accidental release potentially causing a moderate impact.

Alternatives D and E would not materially change the analysis compared to the Proposed Action due to the reduction of WTGs and OSSs associated with these action alternatives. While the reduction of structures may slightly reduce localized water quality impacts during construction/installation and operations, the difference in impacts compared to the Proposed Action would not be materially different. Therefore, Alternatives D and E would have temporary to short term and **minor** impacts on water quality, with the unlikely event of a large accidental release potentially causing a moderate impact.

Cumulative Impacts of Alternatives. In the context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur under the same scenario (Appendix D, *Planned Activities Scenario*). Therefore, cumulative impacts would only vary if the alternative's contributions differ. BOEM expects individual impacts ranging from minor to moderate impacts on water quality and would have only slightly different water quality impacts than the Proposed Action. The overall impact of any action alternative on water quality when combined with past, present, and reasonably foreseeable activities would be **minor**, with the unlikely event of a large accidental release potentially causing a moderate impact. The overall impact would be small, and the resource would be expected to recover completely.

US Wind's existing commitments to mitigation measures (as described in Section 3.4.2.5 for the Proposed Action) and BOEM's potential additional mitigation measures could further reduce impacts from the action alternatives but would not significantly change the impact ratings.

3.4.2.10 Proposed Mitigation Measures

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

3.5.1 Bats

This section discusses the potential impacts on bat populations from the Project, action alternatives, and ongoing and planned activities in the bat geographic analysis area (Appendix D, *Planned Activities Scenario*). The bat geographic analysis area (Figure 3.5.1-1) comprises the U.S. shoreline from Maine to Florida and extends 100 miles (161 kilometers) offshore and 5 miles (8 kilometers) inland. The offshore boundary was identified to capture the migratory movements of most species in this group, while the inland boundary covers onshore habitats used by species that may be affected by both onshore and offshore Project components.

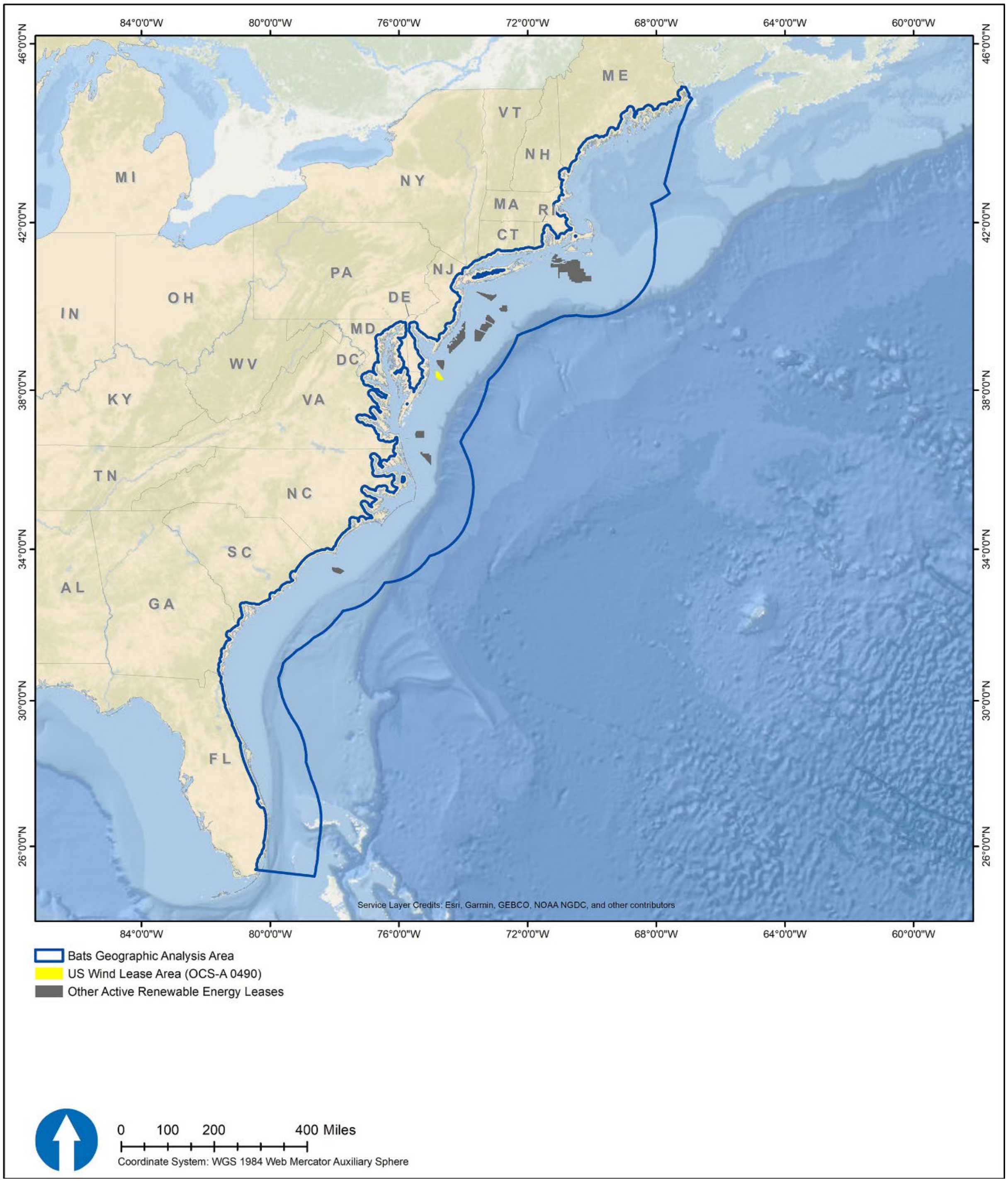

Figure 3.5.1-1. Bats geographic analysis area

3.5.1.1 Description of the Affected Environment

Ten species of bats occur within Delaware and Maryland, nine of which may be present in the onshore portions of the Project area (Table 3.5.1-1). Bat species consist of two distinct groups based on their overwintering strategy: cave-hibernating bats (cave bats) and migratory tree bats (tree bats).

Table 3.5.1-1. Bat species potentially present in Delaware and Maryland

Common Name	Scientific Name	Delaware Status	Maryland Status	Federal Status
Cave Bats				
Big brown bat	*Eptesicus fuscus*	Not Listed	Not Listed	Not Listed
Eastern small-footed bat	*Myotis leibii*	Not Listed	Endangered	Not Listed
Little brown bat	*Myotis lucifugus*	Endangered	Endangered	Under Review
Northern long-eared bat	*Myotis septentrionalis*	Endangered	Endangered	Endangered[1]
Indiana bat[2]	*Myotis sodalis*	Endangered	Endangered	Endangered
Tri-colored bat	*Perimyotis subflavus*	Not Listed[3]	Not Listed	Not Listed[4]
Tree Bats				
Silver-haired bat	*Lasionycteris noctivagans*	Not Listed	Not Listed	Not Listed
Eastern red bat	*Lasiurus borealis*	Not Listed	Not Listed	Not Listed
Hoary bat	*Lasiurus cinereus*	Not Listed	Not Listed	Not Listed
Evening bat	*Nycticeius humeralis*	Not Listed	Not Listed	Not Listed

Sources: MDNR 2021; DNREC 2023; USFWS 2023

DNREC = Delaware Department of Natural Resources and Environmental Control; MDNR = Maryland Department of Natural Resources; USFWS = United States Fish and Wildlife Service

[1] The USFWS recently listed the northern long-eared bat as endangered (November 29, 2022; 87 *Federal Register* 73488).

[2] The Indiana bat does not occur in Delaware or eastern Maryland

[3] The tri-colored bat is proposed for state listing as endangered in Delaware

[4] The USFWS has proposed to list the tri-colored bat as endangered

Bats are terrestrial species that spend their lives on or over land. On occasion, tree bats may occur offshore during spring and fall migration and under specific conditions like low wind and high temperatures. Recent studies, combined with historical anecdotal accounts, indicate tree bats sporadically travel offshore during spring and fall migration, with 80 percent of acoustic detections occurring in August and September (Hatch et al. 2013; Pelletier et al. 2013; Stantec 2016; Dowling et al. 2017). However, unlike tree bats, detecting a cave bat is substantially less likely in offshore areas (Pelletier et al. 2013).

The occurrence of bats has been recorded in the offshore marine environment in the U.S. (Cryan and Brown 2007; Hatch et al. 2013; Pelletier et al. 2013; Dowling et al. 2017). Bats have been documented temporarily roosting on structures such as lighthouses and on nearshore islands, and there is evidence of eastern red bats (*Lasiurus borealis*) migrating offshore in the Atlantic. During spring and fall 2009 and 2010, a mid-Atlantic bat acoustic study conducted over 86 nights found the maximum distance bats were detected from shore was 13.6 miles (21.9 kilometers), and the mean distance was 5.2 miles (8.4 kilometers) (Sjollema et al. 2014). Bats also have been detected on Maine islands up to 25.8 miles (41.6 kilometers) from the mainland (Peterson et al. 2014). In the mid-Atlantic acoustic study, the eastern red bat represented 78 percent of all bat findings offshore, and bat activity decreased as wind increased (Sjollema et al. 2014). Additionally, eastern red bats were detected in the mid-Atlantic up to 27.3 miles (44 kilometers) offshore by high-definition video aerial surveys (Hatch et al. 2013). Currently, there is some uncertainty regarding the level of bat use of the OCS. However, available data indicate bat activity levels are usually lower offshore compared to onshore (Stantec 2018; Hein et al. 2021; Dominion Energy 2022). A study on bat migration in the North Sea off Belgium found the quantity of bat detections was up to 24 times higher at onshore sites as compared to offshore sites (Brabant et al. 2021).

Cave bats overwinter in regional caves, mines, and cave-like structures (e.g., buildings) and feed mostly on insects in terrestrial and freshwater habitats. These species generally display lower activity in the offshore environment than tree bats (Sjollema et al. 2014), with movements mainly during the fall. The maximum distance *Myotis* cave bats were detected offshore in the mid-Atlantic was 7.2 miles (11.5 kilometers) (Sjollema et al. 2014). A recent nano-tracking investigation on Martha's Vineyard documented little brown bat (*Myotis lucifugus*) movements off the island in late August and early September, with one individual traveling from Martha's Vineyard to Cape Cod (Dowling et al. 2017). Big brown bats (*Eptesicus fuscus*) were also recorded migrating from the island as late as October through November (Dowling et al. 2017). These findings were supported by an acoustic study conducted on islands and buoys off the Gulf of Maine that demonstrated the highest percentage of activity occurs between July and October (Peterson et al. 2014). Given the use of coastlines as migratory routes is likely limited to the fall migration period for cave bats, that acoustic studies indicate lower use of the offshore environment, and that cave bats do not habitually feed on insects over the ocean, exposure to wind projects offshore of the mid-Atlantic states is not likely for cave bats (Sjollema et al. 2014).

Tree bats migrate to overwinter and have been recorded in the offshore environment (Hatch et al. 2013). Eastern red bats have been detected migrating from Martha's Vineyard in late fall, with one individual tracked as far south as Maryland. These outcomes are supported by past observations of eastern red bats offshore and recent acoustic and survey results (Hatch et al. 2013; Peterson et al. 2014; Sjollema et al. 2014).

Regionally, bat acoustic data have been collected during the recent Mid-Atlantic Baseline Studies (MABS), which included the Lease Area. A total of 12 presumed eastern red bats were observed offshore Delaware, New Jersey, and Virginia in September. Most data regarding offshore bat activity in the Mid-Atlantic comes from the New Jersey Ecological Baseline Study of the New Jersey offshore lease areas. A total of 54 bat echolocation calls were identified from May to October 2009, with most (n = 37) recorded between August and October (Geo-Marine Inc. 2010). Additional acoustic data were collected in 2010. Between 2009 and 2010, 166 bat echolocation calls were recorded. Many of these (43 percent) were not identifiable to species. The remainder of the calls were dominated by eastern red bats (44 percent), followed by big brown/silver-haired bats (6.6 percent), *Myotis* spp. (4.2 percent), and hoary bats (1.8 percent) (Sjollema et al. 2014). Given these data, some migratory tree bats might encounter offshore facilities during spring and fall migration. BOEM expects this exposure risk to be limited to the relatively few individual tree bats and to occur, if at all, during migration, particularly fall migration.

Onshore coastal areas throughout the geographic analysis area provide an assortment of habitats that support bat species, including coastal wetlands, forested wetlands, forested uplands, forested lowlands, barrier beaches, and bay island habitats. Regionally, five species of bats (eastern red, big brown, hoary, tri-colored, and silver-haired bats) have been documented using Assateague Island National Seashore, with eastern red, hoary, and silver-haired bats using the barrier island during migration (Johnson et al. 2010). Additionally, the DNREC installed acoustic detectors in six locations around Indian River Bay and collected acoustic data during the 2019–2021 summer maternity season (DNRC 2021). Based on an analysis of the recorded data, northern long-eared bats may be present in the vicinity of the Project substation area.

Disease and climate change could influence bat population trends. Cave bats are vulnerable to white-nose syndrome (*Pseudogymnoascus destructans*), a deadly fungal disease that can cause up to 90 percent mortality of a bat colony. Global warming may shorten winters, thus shortening hibernation periods and enabling bats to forage for longer periods in the year or in more temperate areas even skip hibernation. Migratory bats in some areas may forgo migration to be year-round residents.

There is one bat species listed as endangered and one bat species proposed as endangered under the ESA that may be present in the Project area: northern long-eared and tri-colored bats (MDNR 2021; USFWS 2022; DNREC 2023). These species are not expected to be exposed to the Offshore Project area. As noted above, these species could be exposed to Onshore Project area. The Biological Assessment (BA) for the Proposed Action provides a detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2023).

3.5.1.2 Impact Level Definitions for Bats

Definitions of impact levels are provided in Table 3.5.1-2. There are no beneficial impacts on bats. Table F-3 in this Appendix identifies potential IPFs, issues, and indicators to assess impacts to bats.

Table 3.5.1-2. 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.

3.5.1.3 Impacts of Alternative A – No Action on Bats

3.5.1.3.1 Impacts of Alternative A – No Action

Under the No Action Alternative, baseline conditions for bats 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 bats are commonly associated with onshore impacts, including onshore construction and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and could affect bat species through temporary and permanent habitat removal and temporary noise impacts related to construction activities. These impacts could cause avoidance behavior and displacement. Mortality of individual bats may occur, but population-level effects would not be expected. Impacts associated with climate change could decrease reproductive output and increase individual mortality and disease incidence.

3.5.1.3.2 Impacts of Alternative A - No Action on ESA-Listed Species

As previously mentioned, there are two species of bats currently listed or proposed as endangered under the ESA that may occur within the Project area. An additional state-listed bat species, the little brown bat, may occur in the onshore portions of the Project area.

These species may face distinct impacts from ongoing anthropologic activity as well as projected impacts from future offshore wind activity, in addition to those outlined earlier. Tree clearing during the summer maternity season (generally April 1 to October 31) could impact bats using those trees for roosting. Even more impactful would be removal of occupied roosts when pups are unable to flush from the roost.

Although the loss of one or a limited number of individuals to at-risk bat populations would represent an adverse impact, conservation measures identified during the ongoing ESA Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) would lessen adverse impacts on federally listed bat species. Therefore, adverse effects from the Project on ESA-listed species are expected to be negligible. The BA provides a more detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2023).

Impacts from reasonably foreseeable offshore wind activities on ESA-listed species will be discussed in detail in later project-specific analysis documents. As is the case with this Project, each proposed Project will be required to address ESA-listed species, cumulatively, at the individual project level.

3.5.1.3.3 Cumulative Impacts of Alternative A - No Action

Other planned non-offshore wind activities that could 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 (Appendix D, *Planned Activities Scenario*). These activities could result in short-term and permanent onshore habitat impacts and short-term or permanent displacement and injury or mortality of individual bats, but population-level effects would not be expected. Appendix D, Table D1-2, summarizes potential impacts on bats associated with ongoing and future non-offshore wind activities by IPF.

The following sections summarize the potential impacts of other offshore wind activities on bats during the various phases of the projects. BOEM expects future offshore wind development activities to affect bats through the following primary IPFs.

Climate change: In addition to increasing storm severity and frequency, climate change can increase disease frequency in bats. Storms during breeding and roosting season can reduce productivity and increase mortality. Disease can weaken individuals, lower reproductive output, and cause mortality of individuals. Additionally, some tropical diseases could move northward. Currently, five of the ten species with potential to occur in the Project area (big brown bat, little brown bat, northern-long eared bat, Indiana bat, and tri-colored bat) are experiencing severe population decline due to the white-nose syndrome fatal disease (Cheng et al. 2021). The extent and intensity of this impact is highly speculative, and is thus set at minor, absent specific data.

Land disturbance: A small quantity of infrequent construction impacts associated with onshore power infrastructure would be required over the next 35 years, consistent with the expected life of the Project, to connect offshore wind energy projects to the electrical grid. Usually, this would require a minimal amount of habitat removal, if any, and would generally occur in formerly disturbed areas. Short-term, negligible impacts associated with habitat loss or avoidance during construction may occur; however, no injury or mortality of individuals would be expected. As such, onshore construction activities associated with offshore wind development would not be expected to significantly contribute to overall impacts on bats.

In addition to electrical infrastructure, some amount of habitat alteration could result from port development activities required to meet the demands for fabrication, construction, transportation, and installation of wind energy structures. The overall 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 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).

Noise: Anthropogenic noise related to offshore wind development, including noise from pile-driving and construction activities, could affect bats on the OCS. In addition, onshore construction noise could affect bats. BOEM expects these impacts would be temporary and highly localized.

In the Planned Activities Scenario (Appendix D), the construction of 3,081 WTG and OSS foundations (other than the Proposed Action) would generate noise and could temporarily affect some migrating tree bats, if conducted at night during spring or fall migration. The greatest impact of noise is likely to be produced by pile-driving activities during construction. Construction activity would be temporary and localized in any given location and would occur during daylight hours. Auditory impacts are not anticipated, as recent research suggests bats are less susceptible to temporary or permanent hearing loss from exposure to intense sounds than other terrestrial mammals (Simmons et al. 2016). Habitat-related impacts (i.e., displacement from potentially suitable habitats) may occur as a result of construction activities, which could generate sufficient noise to cause avoidance behavior by individual 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 loss of hearing would be expected (Simmons et al. 2016). These impacts are very unlikely to occur, as little use of the OCS by bats is expected, and only during spring and fall migration periods.

Short-term, localized habitat impacts arising from onshore construction noise could occur, though no auditory impacts on bats would be anticipated. Work performed during nighttime hours may be required on an as-needed basis. Some short-term displacement or avoidance of potentially suitable foraging habitat could occur, but these impacts would not be expected to be biologically substantial. Some bats roosting near construction activities may be disturbed during construction but would be expected to move to a different roost away from construction noise. This would not be expected to result in any impacts, as frequent roost substitution is common among bats (Whitaker 1998; Hann et al. 2017).

Activities outside of normal routine that are associated with offshore wind facilities would normally require intense, temporary activity to address emergency conditions. The noise produced by onshore construction equipment or offshore repair vessels could temporarily discourage bats from approaching the location of a non-routine event. Impacts on bats, if any, would be temporary and localized.

Given the temporary nature of potential impacts and the anticipated 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 3,081 WTG and OSS foundations on the OCS that may result in potential impacts on bats. Cave bats (including northern long-eared and tri-colored bats) do not tend to fly offshore (even during fall migration); 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 (Pelletier et al. 2013; BOEM 2015).

However, tree bats may cross the offshore wind lease areas during fall migration, with limited potential for migrating bats to encounter vessels during construction and decommissioning of WTGs, OSSs, and offshore export cables, even though structure and vessel lights may attract bats due to increased prey availability. As previously discussed, 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 area. Several studies discuss numerous hypotheses as to why bats may be attracted to WTGs. Many of these, including the creation of linear corridors, transformed habitat conditions, or thermal inversions, would not apply to WTGs on the Atlantic OCS (Kunz et al. 2007; Cryan and Barclay 2009; Cryan et al. 2014). With regards to bat attraction to WTGs, other hypotheses associated with the Atlantic OCS include bats perceiving the WTGs as potential roosts, potentially increased prey base, visual attraction, confusion due to electromagnetic fields (EMFs) or decompression, or attraction due to mating strategies (Kunz et al. 2007; Arnett et al. 2008; Cryan 2008). However, there has been no definitive answer as to why, if at all, bats are attracted to WTGs, despite intensive studies at onshore wind facilities. As such, it is likely that some bats may encounter, or perhaps be attracted to, OSSs and non-operational WTG towers to opportunistically roost or forage. However, bats' echolocation abilities and agility make it unlikely that these immobile objects (i.e., OSSs 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 structures (Choi et al. 2020).

Tree bat species that may encounter 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 offshore habitats during fall migration. While migrating tree bats could come across operating WTGs during fall migration, the general occurrence of bats on the OCS is low (Stantec 2016). Additionally, unlike with terrestrial migration routes, there are no landscape features that would concentrate bats and thereby increase exposure to the offshore wind lease areas (Fiedler 2004; Baerwald and Barclay 2009; Cryan and Barclay 2009; Hamilton 2012; Smith and McWilliams 2016). Given the expected occasional 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 distribution of anticipated projects and the proposed spacing between offshore wind structures, 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. Furthermore, the potential collision risk to migrating tree bats differs with climatic conditions; for example, bat activity is associated with relatively warm temperatures and low wind speeds (Fiedler 2004; Kerns et al. 2005; Arnett et al. 2008; Cryan and Brown 2007). Given the relatively low numbers of tree bats in the offshore environment, and the intermittence of projects on the OCS, the likelihood of collisions is expected to be low, so impacts on bats would be negligible. Furthermore, bats have been shown to suppress activity during periods of strong winds, low temperatures, and rain (Erickson et al. 2002; Arnett et al. 2008). While this is the case for terrestrial habitats, if adverse weather were to arise suddenly, there is some potential for migrating individuals to be attracted to WTGs as a potential roost site during such conditions. However, given the limited number of individuals that have been documented over open water habitats the likelihood of a migrating individual encountering one or more operating WTGs during adverse weather conditions is extremely low. While the likelihood of encountering an operating WTG is low, bats may have to make one or more course corrections to avoid operating WTGs, which could have energetic consequences on migrating individuals.

3.5.1.3.4 Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, baseline conditions for bats would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities. These ongoing activities (excluding the Proposed Action) are expected to have continuing temporary and permanent impacts (disturbance, displacement, and habitat conversion) on bats. These effects are primarily through onshore construction impacts, and climate change. Ongoing activities, including climate change, would likely result in **negligible** impacts on bats.

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.

Cumulative Impacts of Alternative A – No Action. Ongoing and planned activities other than offshore wind development would also contribute to cumulative impacts on bats due to habitat loss from increased onshore construction. BOEM expects ongoing activities other than offshore wind development to result in **negligible** impacts on bats. Offshore wind activities other than the Proposed Action are not expected to materially contribute to impacts on bats. Due to the infrequent and limited anticipated use of the OCS by tree bats during spring and fall migration and given that cave bats do not typically occur on the OCS, the presence of additional offshore wind structures would not appreciably contribute to overall cumulative 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. BOEM anticipates 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.

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

The geographic analysis area for bats was established to capture most of the movement range for migratory species. Northern long-eared bats and other cave bats do not typically occur on the OCS. Tree bats are long-distance migrants; their range includes most of the East Coast from Florida to Maine. Although these species have been documented traversing the open ocean and could encounter WTGs, use of offshore habitat is thought to be limited and generally restricted to spring and fall migration. The onshore limit of the geographic scope is intended to cover most of the onshore habitat used by the species that may encounter the Project during most of their life cycle.

The following Project design parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenario)* would influence the magnitude of impacts on bats:

- One or two new onshore substations, which could require the removal of forested habitat that is potentially suitable for roosting and foraging;
- The number, size, and location of WTGs; and
- The time of year during which construction occurs.

Variability of the Project design exists as outlined in Appendix C. 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.
- Inshore and Onshore Export Cable Routes and substation footprints: The chosen route (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 April through October. Construction outside of this window would have a smaller impact on bats than construction during the active season.

3.5.1.5 Impacts of Alternative B – Proposed Action on Bats

This section identifies potential impacts of Alternative B on bats. BOEM prepared a BA for the potential impacts on USFWS federally listed species, which found that Alternative B was not likely to affect, or had no effect, on listed species or designated critical habitat (BOEM 2023).

3.5.1.5.1 Impacts of Alternative B – Proposed Action

Construction and Installation

Onshore Activities and Facilities

Land disturbance: Impacts associated with construction of onshore elements 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. BOEM assumes tree clearing activities would occur during the hibernation period (October 1 through March 31), thus limiting the potential for direct injury or mortality from the removal of occupied roost trees.

Should tree clearing be required when bats may be using trees within the geographic analysis area, species-specific presence/probable absence surveys would be conducted to determine if the species is present, and additional consultation with the USFWS would occur. Habitat impacts on bats could occur due to the loss of potentially suitable roosting and foraging habitat. However, during construction the Project would disturb approximately 15.08 acres (6.1 hectares) at the onshore substation location of which 10.3 (4.2 hectares) is comprised of contiguous, moderate quality habitat that would be permanently altered. Furthermore, large contiguous blocks of potentially suitable habitat are located in the immediate vicinity of the site(s) where forested habitat would be removed. BOEM anticipates negligible impacts, if any, would occur with adherence to USFWS northern long-eared bat conservation measures, and these impacts would not result in individual fitness or population level effects, given the limited amount of habitat removal and the presence of contiguous blocks of potentially suitable habitat in the vicinity.

While the significance level of impacts would remain the same, BOEM could reduce potential impacts by implementing the following mitigation and monitoring measure conditioned as part of the COP approval (Appendix G):

- Require that trees (greater than 3 inches [7.6 centimeters] in diameter at breast height) not be cleared from April 1 to October 31. Should presence/probable absence surveys be conducted pursuant to current USFWS protocols and no northern long-eared bats be documented, this measure may not be necessary for ESA compliance relative to this species.

Noise: Onshore construction noise associated with the Project would result in negligible impacts. Construction activity would be short term, temporary, and highly localized. Auditory impacts on individuals roosting in the vicinity of construction are not expected (Simmons et al. 2016). Impacts, if any, would be limited to behavioral avoidance of construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016). There is some potential for impacts such as reduced reproductive success or juvenile recruitment as a consequence of behavioral avoidance, especially if it occurs during the maternity season. However, these potential impacts would not be expected to be biologically significant due bat home range size the use of multiple roost locations during any given maternity season. Cumulative noise impacts on bats from ongoing actions, including the Proposed Action, would be negligible.

Offshore and Inshore Activities and Facilities

Noise: Noise associated with pile driving and construction of offshore facilities would result in impacts that would be short term, temporary, and highly localized. The impacts would be expected to be limited to behavioral avoidance of the construction areas, and no permanent auditory impacts would be expected (Simmons et al. 2016).

Operations and Maintenance

Onshore Activities and Facilities

Onshore activities associated with O&M would not require tree clearing or new noise sources. Therefore, onshore O&M would not result in any impacts on bats.

Offshore and Inshore Activities and Facilities

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 3.5.1.3. The structures associated with the Project, and the consequential negligible impacts, would remain at least until decommissioning of the Project is complete. At this time, there is some uncertainty regarding the level of bat use of the OCS, and the ultimate population-level consequences of individual mortality, if any, associated with operating WTGs. Given the drastic reduction in cave bat populations in the region, the biological significance of mortality resulting from Alternative B, if any, may be increased. However, as described in Section 3.5.1.3, existing data from meteorological buoys provide the best opportunity to further define bat use of open-water habitat far from shore where US Wind would site the Project WTGs. Relatively few (372) bat passes were detected at meteorological buoy sites in the Gulf of Maine and in the Mid-Atlantic, and use was sporadic when compared to sites on offshore islands (Stantec 2016). While the significance level of impacts would remain the same, BOEM could reduce potential impacts by implementing the following mitigation and monitoring measure conditioned as part of the COP approval (Appendix G).

- Deploy acoustic bat detectors on a subset of WTGs and OSSs to improve understanding of bat use of the OCS and offshore portions of the Project area. Deployment configuration and number of detectors would be determined in consultation with applicable stakeholders.

Conceptual Decommissioning

The impacts of Proposed Action decommissioning on bats would be similar to—and would have a similar or lower impact magnitudes as—the impacts described for construction. For the expected temporary impacts, including the effects of conceptual onshore decommissioning activities, it is likely that a portion, possibly a majority, of such impacts from ongoing actions would not overlap temporally or spatially with Alternative B. Decommissioning impacts are expected to be the same as described earlier and would be negligible. However, some IPFs that may result in temporary impacts can also result in long-term to permanent impacts that would be negligible.

3.5.1.5.2 Impacts of Alternative B - Proposed Action on ESA-Listed Species

Alternative B may affect the currently federally threatened northern long-eared bat and the proposed federally endangered tri-colored bat. As described earlier and discussed further in the BA (BOEM 2023), the possibility of impacts on these species would be limited to onshore impacts, generally during onshore facilities construction.

3.5.1.5.3 Cumulative Impacts of Alternative B – Proposed Action

Climate Change: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a minimal amount to the cumulative impacts of climate change on bats from ongoing and planned activities including offshore wind. As stated in Section 3.5.1.1, climate change is a global phenomenon that is altering the seasonal timing and patterns of species distributions and ecological relationships, likely causing permanent impacts of unknown but potentially major intensity. The impacts of the Proposed Action, along with ongoing and planned activities including offshore wind, would therefore be widespread, long term, and potentially major, although these impacts would be almost entirely attributable to activities and processes other than the Proposed Action.

Land Disturbance: In the context of reasonably foreseeable environmental trends, the impacts on terrestrial bats may add to the impacts of ongoing and future land disturbance. Impacts due to onshore land use changes are expected to include a gradually increasing amount of habitat alteration and habitat loss, likely changing the composition of local bat assemblages and possibly reducing the local abundance of potentially suitable terrestrial habitat for these species. The future extent of land disturbance from ongoing activities and future non-offshore wind activities over the next 35 years, consistent with the life of the Project, is not known with as much certainty as the extent of land disturbance that would be caused by Alternative B; however, based on regional trends, disturbance from ongoing activities is anticipated to be similar to or greater than that the Project. If a future project were to cross the geographic analysis area or be collocated (partly or completely) within the geographic analysis area, the impacts of those future projects on bats would be of the same type as those of Alternative B; the degree of impacts may increase, depending on the exact location and timing of future activities. For example, repeated construction in a single ROW corridor would have less impact (e.g., displacement, mortality, habitat loss) on bats than construction in an equivalent area of undisturbed habitat. In the context of the reasonably foreseeable environmental trends, the cumulative land disturbance impacts from ongoing and planned actions, including the Project, would be negligible, as only a small amount of habitat loss, if any, would be expected.

Nosie: The impacts on bats from noise may or may not add to the impacts of other anthropogenic noise. Bats may habituate to noise so that it has little to no impact on their behavior or biology (Kight and Swaddle 2011). Considering that the geographic analysis area for bats is mostly developed and contains many roads, bats utilizing the area for roosting and foraging are likely to be already subject to anthropogenic noise. Overall, the impacts on bats from ongoing and planned actions, including the Project, would be negligible.

Presence of Structures: Using the assumptions in Appendix D, *Planned Activities Scenario,* there could be up to 3,081 WTG and OSS foundations in the geographic analysis area for bats where few currently exist, of which up to 121 (3.9 percent of the total) would be attributed to the Project. The structures associated with the Proposed Action and the consequential impacts would remain at least until decommissioning of the Project is complete. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative impacts arising from the presence of structures from ongoing and planned activities including offshore wind, which would be negligible. Approximately 96 percent of these impacts would occur as a result of structures associated with other offshore wind development. The Proposed Action would account for 3.9 percent (121 of 3,081) of the new WTGs on the Atlantic OCS.

3.5.1.5.4 Conclusions

Impacts of Alternative B – Proposed Action. In summary, construction and decommissioning of Alternative B would have negligible impacts on bats, especially if conducted outside the active season. The main significant risk would be from operation of the offshore WTGs, which could lead to **negligible** long-term impacts in the form of mortality, although this would be rare. The impact conclusions for ongoing and future non-offshore wind activities are presented under Alternative A.

Cumulative Impacts of Alternative B – Proposed Action. The cumulative impacts on bats within the geographic analysis area would be negligible. Considering all the IPFs together, the impacts from ongoing and planned activities, including Alternative B, would result in negligible impacts on bats in the geographic analysis area, primarily due to ongoing climate change and onshore habitat loss. Alternative B would contribute to the overall impact rating primarily through the permanent impacts from onshore habitat loss. Thus, the overall impacts on bats would be **negligible** because no measurable impacts are expected due to the likely absence of bats within the offshore portions of the Project area.

While the significance level of impacts would remain the same, BOEM is evaluating the following mitigation and monitoring measures to address impacts on bats, as described in Appendix G, Table G-2. Mitigation and monitoring measures that BOEM could require as a condition of COP approval:

- Require that trees (greater than 3 inches [7.6 centimeters] in diameter at breast height) not be cleared from April 1 to October 31. Should presence/probable absence surveys be conducted pursuant to current USFWS protocols and no northern long-eared bats be documented, this measure may not be necessary for ESA compliance relative to this species.
- Deploy acoustic bat detectors on a subset of WTGs and OSSs to improve understanding of bat use of the OCS and offshore portions of the Project area. Deployment configuration and number of detectors would be determined in consultation with applicable stakeholders.

3.5.1.6 Impacts of Alternatives C, D, and E on Bats

3.5.1.6.1 Impacts of Alternatives C, D and E

The impacts associated with the Proposed Action (Section 3.5.1.5) would not change substantially under the other action alternatives. Alternative C includes an Onshore Export Cable Route from the landfall and avoids installation of a cable crossing Indian River Bay and Indian River (Inshore Export Cable Route) and could thus have marginally larger construction impacts from land disturbance. At this time, the extent of tree clearing required for Alternative C, if any, is unknown. While some clearing of potentially suitable habitat may be required, impacts on bats would be expected to be limited due to the planned use of existing corridors and the availability of large contiguous blocks of potentially suitable habitat in the vicinity of the Project onshore elements. Alternatives D, and E would have the same onshore impacts as Alternative B.

3.5.1.6.2 Impacts of Alternatives C, D, and E on ESA-Listed Species

As discussed under Alternative B, impacts on northern long-eared and tri-colored bats would be greater if impacts associated with action alternatives occur during the active season. However, in the case that tree clearing is required during the active season, additional consultation with applicable state and federal resource agencies would be required, and conservation measures relative to these species, developed in coordination with resources agencies, would be employed; impacts would be expected to remain negligible. A complete discussion of impacts on these species is provided in the US Wind BA (BOEM 2023).

3.5.1.6.3 Cumulative Impacts of Alternatives C, D, and E

The cumulative impacts contributed by this alternative to the overall impacts on bats would be similar to those under the Proposed Action. This impact rating is driven mostly by ongoing activities, such as climate change, as well as by habitat disturbance, noise disturbance from onshore construction, and the construction, installation, and presence of offshore wind structures.

3.5.1.6.4 Conclusions

Impacts of Alternatives C, D and E. As discussed in previous sections, the anticipated negligible impacts associated with the Proposed Action would not change substantially under the action alternatives. While the action alternatives 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. Alternative C may result in slightly more, but not materially different, negligible onshore impacts on bats than those described under the Proposed Action. Alternatives D and E would have slightly fewer, but not materially different, negligible offshore impacts on bats than those described under the Proposed Action. Therefore, the overall **negligible** impacts would be similar among the Proposed Action and action alternatives.

Cumulative Impacts of Alternatives C, D and E. In the context of reasonably foreseeable environmental trends, ongoing and planned activities, the cumulative impacts to bats contributed by the action alternatives to the overall impacts on bats would be undetectable. However, the differences in impacts among the action alternatives would still be considered alongside the impacts of other factors. Therefore, impacts on bats would be slightly smaller, but not materially different, under Alternative C, slightly larger, but not materially different, under Alternatives D and E. BOEM anticipates that the overall impacts of the action alternatives, 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 action alternatives.

3.5.1.7 Comparison of Alternatives

Impacts of Alternatives. As described in Section 3.5.1.5, the potential impacts associated with the Proposed Action, in combination with ongoing and activities, would likely be negligible when compared to the impacts expected under the No Action Alternative. The Proposed Action would impact bats through onshore impacts and the presence of offshore structures. Under the No Action Alternative, these impacts would not occur.

As discussed in Section 3.5.1.6, the impacts associated with the Proposed Action do not change substantially under the other action alternatives. Although the onshore impacts and the number of offshore structures vary slightly, impacts on bats would likely be **negligible** for all action alternatives.

Cumulative Impacts of Alternatives. In the context of reasonably foreseeable environmental trends, ongoing and planned actions, all action alternatives would occur under the same scenario (Appendix D, *Planned Activities Scenario*). Therefore, cumulative impacts to bats would only vary if the alternative's contributions differ. BOEM expects individual negligible impacts, because of the limited removal of potentially suitable onshore habitat and the expected rarity of bats on the OCS. If seasonal restrictions on clearing of onshore forested habitat are required, Project impacts on bats could be further reduced. The overall impact of any action alternative on bats, when combined with past, present, and reasonably foreseeable activities, would be **negligible**.

3.5.1.8 Proposed Mitigation Measures

Several measures are proposed to minimize impacts on bats in Appendix G, *Mitigation and Monitoring*. If one or more of the measures individually described in Appendix G are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced. BOEM conducted consultation with USFWS under Section 7 of the Endangered Species Act, resulting in USFWS issuing conservation measures in a Biological Opinion, which are fully described in Table G-2 in Appendix G and summarized here in Table 3.5.1-3.

Table 3.5.1-3. Measures Resulting from Consultations (Also Identified in Appendix G, Table G-2

Measure	Effect
BOEM-Proposed Mitigation and Monitoring Measures in the USFWS BA	Minimize impacts from presence of structures to bats through adopting a bat monitoring plan, reporting takes of ESA-listed species; minimize lighting impacts through BMPs
Conservation measure in the BiOp issued by USFWS	Minimize lighting impacts through BMPs; monitoring and reporting requirements

3.5.1.9 Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in G-2 in Appendix G are incorporated in the Preferred Alternative. These measures, if adopted, would further define how the effectiveness and enforcement of LPMs would be ensured and improve accountability for compliance with LPMs by requiring the submittal of plans for approval by the enforcing agency(ies) and by defining reporting requirements. Because these measures ensure the effectiveness of and compliance with LPMs that are already analyzed as part of the Proposed Action, implementation of these measures would not further reduce the impact level of the Proposed Action from what is described in Section F2-3.5.1.5, *Impacts of Alternative B – Proposed Action on Bats.*

3.5.3 Birds

This section discusses potential impacts on bird resources from the Proposed Action, action alternatives, and ongoing and planned activities in the geographic analysis area for birds. The geographic analysis area for birds (Figure 3.5.3-1) includes the U.S. coastline from Maine to Florida; the offshore limit is 100 miles (161 kilometers) from the Atlantic shore and the onshore limit is 0.5 miles (0.8 kilometers) inland. The geographic analysis area was established to capture resident species and migratory species that winter as far south as the Caribbean and South America, 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 Project.

3.5.3.1 Description of the Affected Environment

This section discusses bird species that use onshore and offshore habitats, including both resident bird species that use the Project area during all (or portions of) the year and migrating bird species that could pass through the 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, Sections 6.1 and 12.1 and Appendix N; US Wind 2024). Given the differences in life history characteristics and habitat use between offshore and onshore bird species, the following sections 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 Project-specific BA prepared for USFWS (BOEM 2023).

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. Section 4.2.4 of the *Atlantic OCS Proposed Geological and Geophysical Activities Programmatic EIS* (BOEM 2014) 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 historically have been, and will continue to be, subject to a variety of ongoing anthropogenic stressors, including hunting pressure (approximately 86,000 sea ducks are harvested annually [Roberts 2019]), commercial fisheries bycatch (approximately 2,600 seabirds are killed annually on the Atlantic [Hatch 2017; Sigourney et al. 2019]), and climate change, which could have adverse impacts on bird species.

Additional protections to migratory birds are provided through the Migratory Bird Treaty Act of 1918 (MBTA), which makes it illegal to “take” migratory birds, their eggs, feathers, or nests. The official list of migratory birds protected under the MBTA, and the international treaties that the MBTA implements, is found at 50 CFR 10.13.

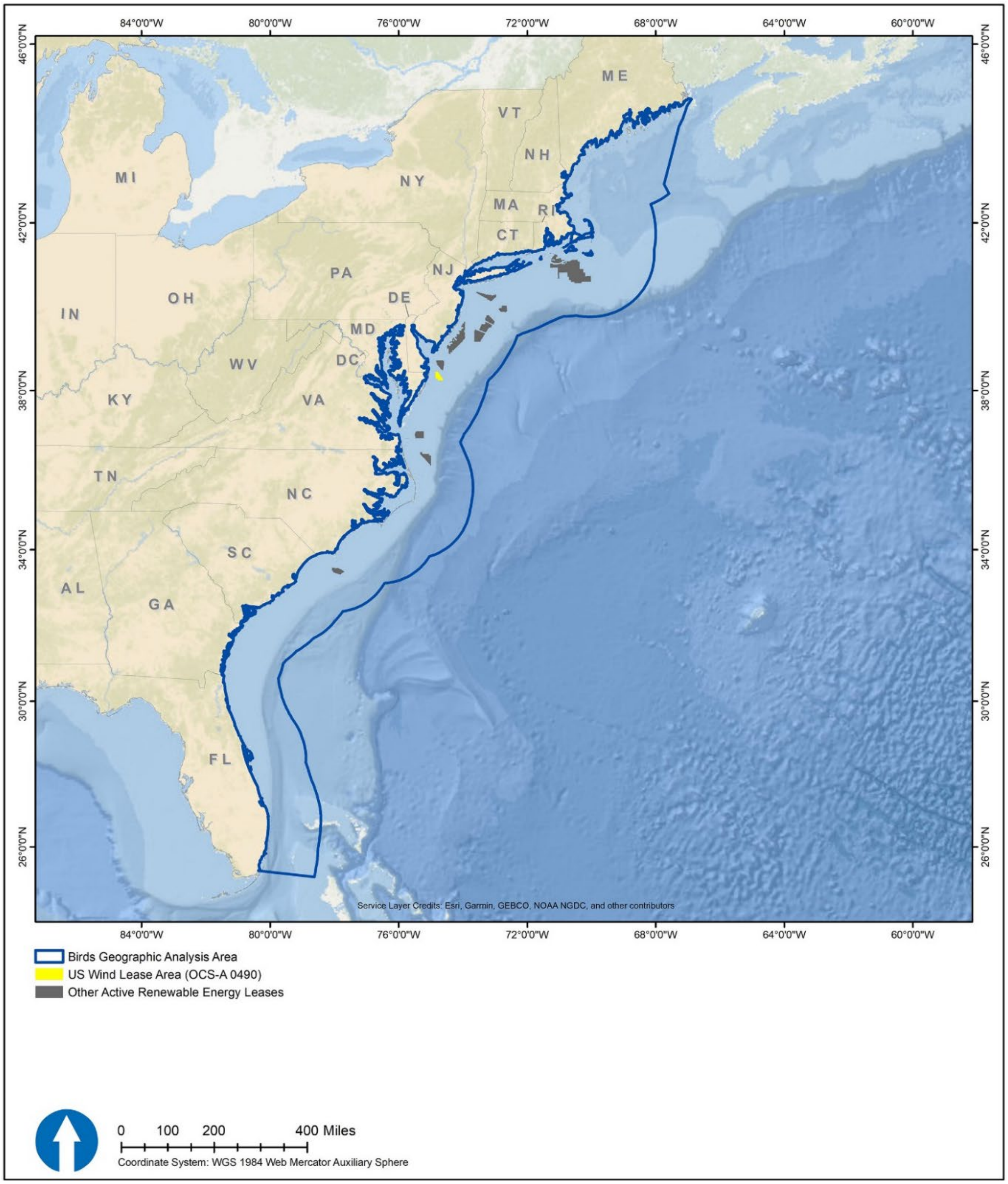

Figure 3.5.3-1. Birds geographic analysis area

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 on 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, shorelines, 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). 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 sea ducks) (COP, Volume II, Appendix N1; US Wind 2021). Approximately 164 bird species have been identified as potentially occurring in the along the Atlantic Flyway (Watts 2010). Of these 164 species, 9 are state-listed as endangered for at least one life stage (i.e., breeding or non-breeding), 4 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, 7 are migratory birds that are listed as breeding birds of conservation concern (USFWS 2021), 3 are federally listed as threatened, and 1 is federally listed as endangered. There is high diversity of marine birds that may use the Lease 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 U.S. 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, sea ducks), 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 to migrate south to warmer climates and are replaced by species that breed farther north and winter in the mid-Atlantic. Table 3.5.3-1 summarizes marine bird presence in the Offshore Project area by family. In addition to marine bird species, Table 3.5.3-2 summarizes bird species that may be present in the Mid-Atlantic coastal habitats that could be impacted by the proposed Project.

Table 3.5.3-1. Bird presence in the Offshore Project area by family

Common Name (Family)	Species[1]	Seasonal Occurrence	Breeds in the Mid-Atlantic
Alcids (Alcidae)	2	Fall to Winter	No
Gannets (Sulidae)	1	Fall to Winter	No
Grebes (Podicpedidae)	1	Winter	Yes
Gulls and Terns (Laridae)	11	Year-round	Yes
Jaegers and Terns (Stercorariidae)	2	Spring and Fall	No
Loons (Gaviidae)	2	Fall to Spring	No
Sea Ducks (Anatidae)	2	Fall to Winter	No
Shearwaters and Fulmars (Procellariidae)	5	Spring	No
Storm-petrels (Hydrobatidae)	1	Spring to Summer	No

Source: COP, Volume II, Appendix N1, Table 1 (US Wind 2024)
[1] The approximate number of species that regularly occur in the Offshore Project area, based on MABS survey results.

Table 3.5.3-2. Bird presence in Mid-Atlantic coastal habitats by family

Common Name (Family)	Seasonal Presence in the Project Area
Cormorants (Phalacoracidae)	Present year-round; nest colonially in the Mid-Atlantic
Brown Pelicans (Pelecanidae)	Present year-round; nest colonially on islands in the Mid-Atlantic
Avocets and Stilts (Recurvirostridae)	Present year-round; few nest in the region
Oystercatchers (Haemotopodidae)	Present year-round; few nest in the region
Plovers (Charadriidae)	Present year-round; few nest in the region
Sandpipers, Yellowlegs, Godwits, Dowitchers, Snipe, and Phalaropes (Socopacidae)	Present year-round; few nest in the region
Bitterns, Egrets, Herons, and Night-Herons (Areidae)	Present year-round; nest colonially in the Mid-Atlantic
Ibises (Theskiomitihidae)	Present year-round; nest colonially in the Mid-Atlantic
Rails, Coots, and Gallinules (Rallidae)	Several species, present year-round and nest in the Mid-Atlantic; other species present only during winter
Geese, swans, and ducks (Anatidae)	Most do not breed in the Project area and are present primarily during winter; however, a handful of species do breed in the Project area
Belted Kingfisher (Alcedinidae)	Present year-round; nest in region
Salt Marsh and Seaside sparrows (Emberizidae)	Present during the breeding season
Red-winged blackbird (Icteridae)	Present year-round
Marsh and Sedge Wrens (Troglodytidae)	Present during the breeding season
Osprey (Pandionidae)	Present in the Mid-Atlantic year-round

Common Name (Family)	Seasonal Presence in the Project Area
Eagles, Hawks, and Harriers (Acciptridae)	Present in the Mid-Atlantic year-round
Falcons (Falconidae)	Present in the Mid-Atlantic year-round
Owls (Strigidae)	Present in the Mid-Atlantic year-round
Vultures (Cathartidae)	Present in the Mid-Atlantic year-round
Various Species (Passeriformes)	Typically not associated with coastal habitats, but any species using the Atlantic Flyway could be present in the Project Area during migration

Source: COP, Volume II, Table 6- 1 (US Wind 2024)

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. The COP (Volume II, Tables 6-1 and 6-2; US Wind 2024) lists bird species with potential to occur in proximity to the substations and Onshore Export Cable Routes. These birds include 11 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 (COP, Volume II, Section 1.4 and Table 6-3; US Wind 2024). The Onshore Project area is within the Indian River Bay and Atlantic Coastal landscape regions, where the Focal Species of Greatest Conservation Need (SGCN) include American oystercatcher, American woodcock, black rail, black skimmer, blue-winged 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.

There are multiple Onshore Export Cable Route alternatives associated with the three POI alternatives. The Onshore Export Cable Routes would be co-located within 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 substation parcel is bordered to the north by the Indian River, and consists of habitat such as tidal salt marsh, forested wetland, and scattered deciduous tree habitat. These trees may provide nesting habitat for piscivorous birds that forage in salt marshes, such as bald eagles, egrets, herons, and ospreys (DCIB 2017). The grid interconnection would be in an existing highly disturbed and industrialized area adjacent to a residential area.

Bald eagles (*Haliaeetus leucocephalus*) are federally protected by the Bald and Golden Eagle Protection Act, 16 U.S.C. § 668 et seq., as are golden eagles (*Aquila chrysaetos*). Bald eagles are also protected by Delaware Code Title 7 Section 739, "Prohibitions protecting bald eagles; disturbing, damaging, or destroying nests; eggs; penalties.". 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 (500 meters) of the shoreline. Bald eagles are present year-round in Maryland and Delaware and nesting is concentrated on the edge of

Delaware Bay. The Delaware River provides essential wintering habitat for bald eagles (Delaware River Basin Commission 2021). The general morphology of bald eagles dissuades long-distance movements in offshore settings, as the species generally relies on thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, bald eagles are unlikely to fly through the Lease Area. As of 2020, more than 220 pairs of bald eagles were successfully nesting in Delaware (Delaware River Basin Commission 2021). DNREC identified a nest on Burton Island, where the Indian River Power Plant is located in response to a request from US Wind (DNREC 2017). Project activities will not intersect the nest location, but if any work is done east of the Power Plant, DNREC requests that US Wind contact USFWS about the nest location (DNREC 2017), and implement all relevant protective measures documented in the USFWS Proposed Eagle Rule (87 *Federal Register* 59598).

Golden eagles are found throughout the U.S., but mostly in the western half of the country and are rare in the eastern states (Cornell University 2019). The Onshore Project area is primarily within the Atlantic Coastal Landscape region, which is not associated with golden eagles. Like with bald eagle, the general morphology of golden eagle dissuades long-distance movements in offshore settings (Kerlinger 1985), as the species generally relies on thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, golden eagles are unlikely to fly through the Lease Area.

Four species of birds listed as federally threatened or endangered under the ESA may occur in the Onshore and Offshore Project areas: roseate tern (*Sterna dougallii*), piping plover (*Charadrius melodus*), eastern black rail (*Laterallus jamaicensis jamaicensis*), and *rufa* red knot (*Calidris canutus rufa*) (USFWS 2022). The Project-specific BA provides a detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2023).

3.5.3.2 Impact Level Definitions for Birds

Definitions of impact levels for birds are provided in Table 3.5.3-3. Impact levels are defined for four different impact levels inclusive of both adverse and beneficial impacts. Table F-5 in this Appendix identifies potential IPFs, issues, and indicators to assess impacts on birds.

Table 3.5.3-3. Impact level definitions for birds

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
Negligible	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.
Minor	Beneficial	Impacts would be localized to a small area but with some measurable effect on one or a few individuals or habitat.
Moderate	Adverse	Impacts would be unavoidable but would not result in population-level effects or threaten overall habitat function.
Moderate	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.
Major	Beneficial	Long-term beneficial population-level effects would occur.

3.5.3.3 Impacts of Alternative A – No Action on Birds

3.5.3.3.1 Impacts of Alternative A – No Action

Under the No Action, baseline conditions for birds would continue to follow current regional trends and respond to IPFs introduced by other ongoing and 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 could 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.

3.5.3.3.2 Impacts of Alternative A on ESA-Listed Species

As previously mentioned, there are four species of birds listed as threatened or endangered under the ESA that may occur within the Project area.

These species may face distinct impacts from ongoing human activity, as well as projected impacts from future offshore wind activity, in addition to those outlined above. Generally, the IPFs described above would also impact ESA listed species. As discussed in the Project-specific BA (BOEM 2023), except for presence of structures, all the IPFs discussed above would be expected to result in impacts that are insignificant (i.e., too small to be measured) and discountable (i.e., extremely unlikely to occur). The presence of structures, specifically operating WTGs on the OCS has the potential to result in impacts to roseate terns, piping plovers, and red knots. Given that few roseate terns are expected to be exposed to the Project, impacts associated with the presence of structures are expected to be insignificant and discountable. This assessment was corroborated using predictive collision risk models, as described in the BA (BOEM 2023). Unlike the roseate tern, piping plovers and rufa red knots may encounter the Project and collision with operating WTGs is possible. As such, BOEM has requested formal consultation with the USFWS relative to these species. Additionally, impacts to the rufa red knot due to impacts associated with horseshoe crab eggs at key stopover locations in the vicinity of the Project are possible, but the current USFWS Species Status Assessment (2020) does not include horseshoe crab abundance as a primary threat to the species. A complete discussion of impacts on ESA-listed species is provided in the US Wind BA.

Although the loss of one or a few individuals to at-risk bird populations would represent an adverse impact, conservation recommendations and reasonable and prudent measures to minimize take of listed species identified during the ongoing ESA Section 7 consultation with the USFWS would minimize adverse impacts on federally listed bird species. Therefore, adverse effects from the Project on ESA-listed species are expected to be negligible. The US Wind BA provides a more detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2023).

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 this 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.

3.5.3.3.3 Cumulative Impacts of Alternative A—No Action

Other ongoing and 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. Appendix D, *Planned Activities Scenario,* Section D.2.14 provides 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. Appendix D, Table D1-4 provides a summary of potential impacts associated with ongoing and future non-offshore wind activities by IPF for birds.

It is assumed that the energy demand the Project would meet would likely be met by other projects in remaining lease areas along the Atlantic Coast (if the Project is not approved). In other words, other offshore wind facilities capable of generating 2,000 MW could still be built in the geographic analysis area under the No Action Alternative. Therefore, the impacts on birds would be similar, but would not be the exact same due to temporal and geographical differences. The following sections summarize the potential impacts of the other offshore wind activities on birds during the various phases of the projects. 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 could result in lethal and sublethal impacts on birds, including decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997; Paruk et al. 2016; Haney et al. 2017). 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 (Appendix D, Table D2-3), 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 accidental releases of trash and debris would not appreciably contribute to overall impacts on birds.

Air Emissions: The secondary standards of the NAAQS (See Section 3.4.1.1) specifically aim to safeguard the environment, including wildlife and their habitats. Air pollution can directly impact birds via physical harm, such as damage to respiratory systems, or indirectly via changes to habitat conditions, food supplies, and/or species interactions (Lianga et al., 2020). Emissions from fossil fuel combustion include NOx gases, which interacts with UV radiation in sunlight to form surface-level ozone. A recent study found that air quality improvements limiting ozone over the past 4 decades have stemmed the decline in US bird populations, averting the loss of 1.5 billion birds, particularly among land birds smaller than 142 g (Lianga et al., 2020). By limiting ozone precursor pollutants, such as NOx, the NAAQS helps prevent harmful effects on vegetation, water bodies, and soil, thus ensuring healthier ecosystems. It is reasonable to assume that the displacement of fossil fuels in the generation of electricity by offshore wind would further reduce ozone and consequently result in minor to moderate beneficial impacts on air quality (See Section 3.4.1.1.5). This decrease in NOx emissions and surface-level ozone formation would consequently have a minor to moderate beneficial impacts to populations of small land birds.

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 (including scour protection) for offshore wind facilities is estimated to be up to 94,055 acres (38,063 hectares). 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 COP (Volume I, Chapter 3.0; US Wind 2024), impacts would be localized and short term, and benthic assemblages would be expected recover from disturbance. Section 3.5.2, *Benthic Resources*, and Section 3.5.5, *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.

Land disturbance: Onshore construction of offshore wind development infrastructure could 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.

Lighting: Offshore wind development would result in additional nighttime light from vessels and offshore wind structures. Construction vessels have an array of lights that can attract some birds. Additionally Black et al. (2005), Gjerdrum et al. (2021), and Rodriquez et al (2017) document potentially fatal interactions with well-lit ships and offshore oil and gas structures, particularly petrels and storm petrels who tend to fly low near the water surface. However, most of the documented groundings occurred in well-lit coastal areas or in the vicinity of major known nesting sites. Vessel lighting could attract birds and potential prey species to construction zones, potentially exposing them to greater harm from other IPFs associated with construction. The resulting vessel-related lighting impacts would be temporary and negligible would not be expected to increase risk of collision,

Under Alternative A, up to 3,215 WTGs, OSSs, and Met Towers would have navigational and Federal Aviation Administration (FAA) hazard lighting in accordance with BOEM's lighting and marking guidelines. This lighting has some potential to result in long-term impacts and may pose an increased collision or predation risk to migrating birds (Hüppop et al. 2006), particularly to night-flying migrants during low-visibility weather conditions. Though, this risk would be minimized through the use of red flashing FAA lighting (Kerlinger et al. 2010; BOEM 2021). Overall, BOEM anticipates lighting impacts related to offshore wind structures and vessels would be negligible.

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, could result in impacts on birds on the OCS. Additionally, onshore construction noise could result in impacts on birds. BOEM anticipates 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 3,081 WTG and OSS foundations 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 could 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 2014, 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.

In addition to noise associated with construction activities and vessels, operating WTGs can emit low-frequency sound, including infrasound, which some species (e.g. Procelliformes) may use to navigate Gillies et al 2023). At this time, it is unclear as to what extent individuals of these species (and others) are attracted to or repelled by infrasound and what impacts to these species may be.

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, the Met Tower, foundations, scour and cable protections, and transmission cable infrastructure. The expanded planned action scenario would include up to 3,081 WTG, OSS, and Met Tower foundations, which would entail new scour protection for foundations and hard protection atop cables (Appendix D, Table D2-2). BOEM anticipates structures would be added and that they would remain until decommissioning of each facility is complete, approximately 35 years following construction.

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. Within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline. 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), though some there is some evidence that some species migrate over the northern Atlantic (Adams et al. 2015). 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. (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 (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. (2013) and consistent with Garthe and Hüppop (2004), Furness and Wade (2012), and 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 populations addressed in Robinson Willmott 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. It should be noted that Robinson Wilmott et al. (2013) cautioned that because of identified data gaps and related uncertainty, particularly concerning species-specific flight altitude and avoidance behavior, their results should be interpreted with caution. 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 3.5.3-2 and Figure 3.5.3-3).

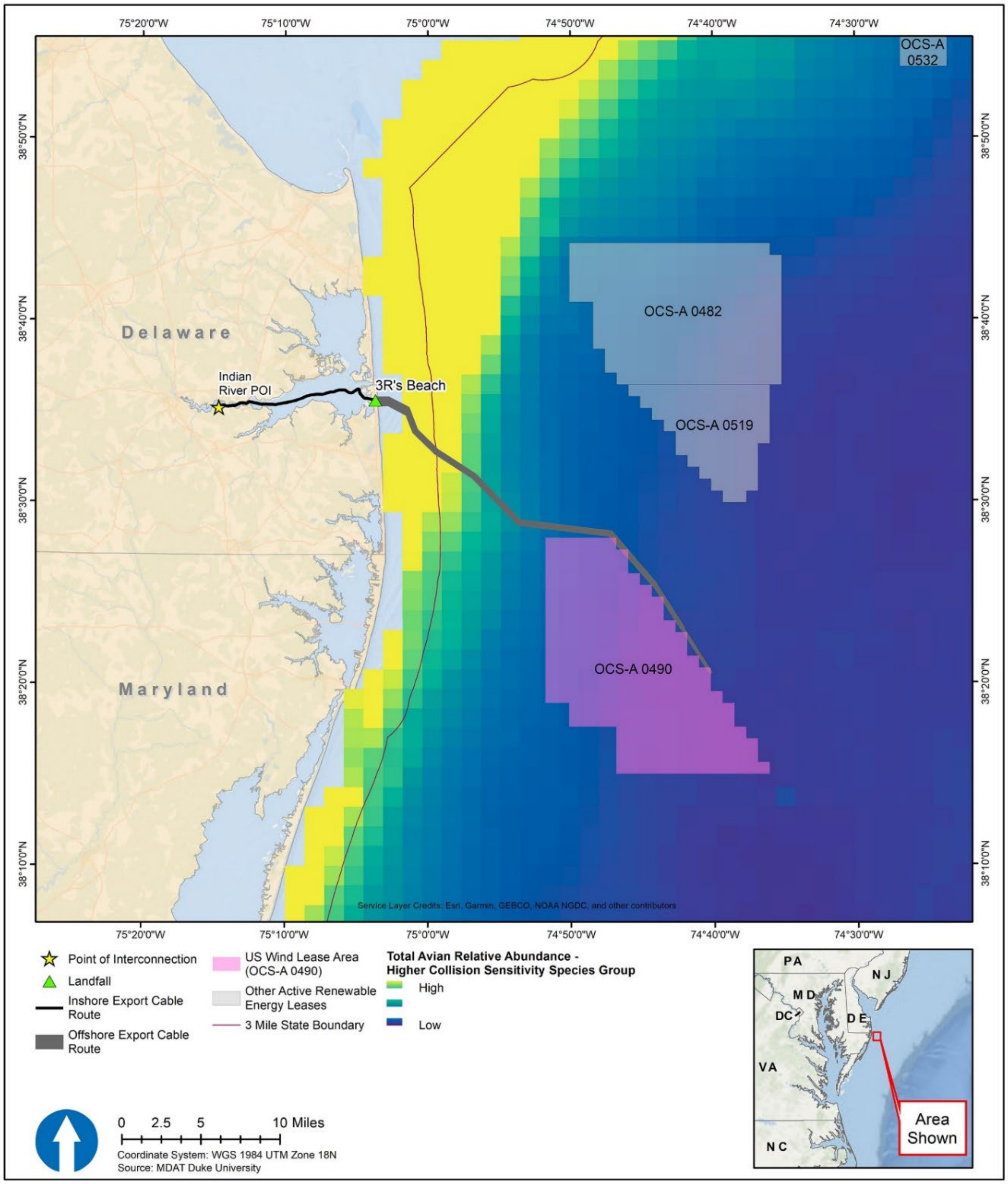

Figure 3.5.3-2. Total avian relative abundance distribution map for higher collision sensitivity species groups

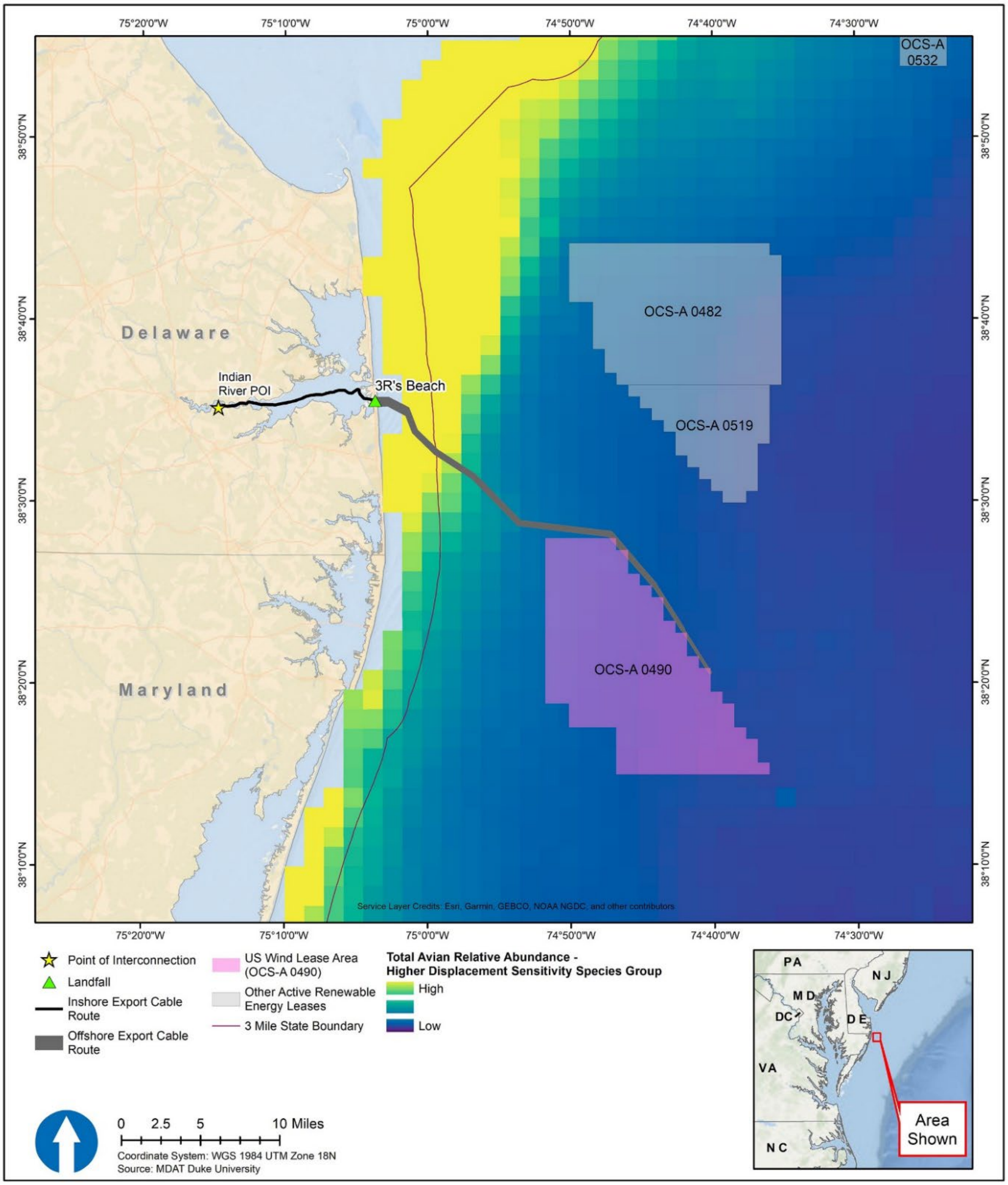

Figure 3.5.3-3. Total avian relative abundance distribution map for higher displacement sensitivity species groups

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 3.5.3-3). Out of the five Birds of Conservation Concern, only two species (Cory's shearwater and Manx shearwater) are predicted to slightly overlap with offshore wind development areas (Table 3.5.3-3). BOEM assumes the 47 species (85 percent of the 55 species) 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 3.5.3-3. Percentage of each Atlantic seabird population that overlaps with anticipated offshore wind energy development on the OCS by season

Species	Spring	Summer	Fall	Winter
Arctic 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	0.1	0.1	0.2
Black-capped Petrel (*Pterodroma hasitata*)[2,3]	0.0	0.0	0.0	0.0
Black Guillemot (*Cepphus grille*)	NA	0.3	NA	NA
Black-legged Kittiwake (*Rissa tridactyla*)[1,3]	0.7	NA	0.7	0.5
Black Scoter (*Melanitta americana*)[3]	0.2	NA	0.4	0.5
Bonaparte's Gull (*Chroicocephalusrquata philadelphia*)[3]	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]	3.9	1.0	1.3	2.1
Common Murre (*Uria aalge*)	0.4	NA	NA	1.9
Common Tern (*Sterna hirundo*)[1, 3]	2.1	3.0	0.5	NA
Cory's Shearwater (*Calonectris borealis*)[2, 3]	0.1	0.9	0.3	NA
Double-crested Cormorant (*Nannopterum auritus*)	0.7	0.6	0.5	0.4
Dovekie (*Alle alle*)[3]	0.1	0.1	0.3	0.2
Great Black-backed Gull (*Larus marinus*)[1, 3]	1.3	0.5	0.7	0.6
Great Shearwater (*Puffinus gravis*)[3]	0.1	0.3	0.3	0.1
Great Skua (Stercorarius skua)	NA	NA	0.1	NA
Herring Gull (*Larus argentatus*)[1, 3]	1.0	1.3	0.9	0.5
Horned Grebe (*Podiceps auritus*	NA	NA	NA	0.3
Laughing Gull (Leucophaeus atricilla)[3]	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 Duck (*Clangula hyemalis*)	0.6	0.0	0.4	0.5

Species	Spring	Summer	Fall	Winter
Manx Shearwater (*Puffinus puffinus*)[1, 2, 3]	0.0	0.5	0.1	NA
Northern Fulmar (*Fulmarus glacialis*)[1,3]	0.1	0.2	0.1	0.2
Northern Gannet (*Morus bassanus*)[1, 3]	1.5	0.4	1.4	1.4
Parasitic Jaeger (Stercorarius parasiticus)[3]	0.4	0.5	0.4	NA
Pomarine Jaeger (Stercorarius pomarinus)[3]	0.1	0.3	0.2	NA
Razorbill (*Alca torda*)[1, 3]	5.2	0.2	0.4	2.1
Ring-billed Gull (*Larus delawarensis*)[3]	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)[3]	0.0	0.2	0.1	NA
Red-throated Loon (*Gavia stellate*)[1, 3]	1.6	NA	0.5	1.0
Sooty Shearwater (*Ardenna grisea*)[3]	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*)[3]	0.2	0.9	0.2	NA
White-winged Scoter (*Melanitta deglandi*)[3]	0.7	NA	0.2	1.3

Source: Calculated from Winship et al. 2018, Appendix D – seasonal percentages were summed for each lease area.
NA = not applicable
[1] Species used in collision risk modeling (see BOEM 2021, Vol 2 A.8.3.1.1. Future Offshore Wind Activities (without Proposed Action))
[2] Species considered Birds of Conservation Concern by USFWS (COP, Volume II, Appendix N1; US Wind 2024)
[3] Species documented in Williams et al. 2015a, 2015b

Twenty-eight species, representing nine families of marine birds have been documented in the Lease area based on the results of the Mid-Atlantic Baseline Studies (MABS) Project surveys and are denoted in Table 3.5.3-3 (COP, Volume II, Appendix N1; US Wind 2024, Williams et al. 2015a, 2015b).

Offshore wind development would add up to 3,081 WTG and OSS foundations (Appendix D, *Planned Activities Scenario,* Table D2-2). Because most structures would be spaced 0.6 to 1 nautical mile (1.1 to 1.9 kilometers) 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. The effects of offshore wind farms on bird movement ultimately depends on the bird species, size of the offshore wind farm, the spacing of WTGs, and the extent of extra energy cost incurred by the displacement of flying birds (relative to normal flight costs pre-construction) and their ability to compensate for this degree of added energy expenditure. Little quantitative information is available on how offshore wind farms may act as a barrier to movement, but Madsen et al. (2012) modeled bird movement through offshore wind farms using bird (common eider) movement data collected at the Nysted offshore wind farm in the western Baltic Sea just south of Denmark. After running several hundred thousand simulations for different layouts/configurations for a 100 WTG offshore wind farm, the proportion of birds traveling between the turbines increased as distance between turbines increased. With eight WTG columns at 0.1 nautical mile (200 meters) spacing, no birds passed between the turbines. However, increasing inter-turbine distance to 0.27 nautical miles (500 meters) increased the percentage of birds to more than 20 percent, while a spacing of 0.54 nautical miles (1,000 meters) increased this further to 99 percent. The 0.6 to 1 nautical mile (1,111 to 1,852 meters) spacing estimated for most structures that will be proposed on the Atlantic OCS is greater than the distance at which 99 percent of the birds passed through in the model. Adverse impacts of additional energy expenditure due to minor course corrections of WDAs 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. Similar results were also reported for foraging birds. A recent study based on GPS tracking of sandwich terns (*Thalasseus sandvicensis*) near several European windfarms found that avoidance rates of offshore wind turbines increased with turbine density (van Bemmelen et al., 2023); interestingly, the turbines in those wind farms were much closer to each other than in the proposed Project, suggesting the proposed turbine spacing may not create a barrier that would displace foraging sandwich terns or other tern species.

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). The additional travel distance would be a small distance in comparison to the distances traveled during most migrations. Loons, sea ducks, and alcids are most likely to have high displacement ranks (COP, Volume II, Appendix N1; US Wind 2024); however, the relative density of birds in the OCS is low, and relatively few birds are likely to encounter wind turbines.). 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 99.6percent (Skov et al. 2018). Vattenfall (a European energy company) recently studied bird movements within an offshore wind farm situated 1.9 to 3.0 miles (3 to 4.9 kilometers) off the coast of Aberdeen, Scotland (Vattenfall 2023). The purpose of the study was to improve the understanding of seabird flight behavior inside an offshore wind farm with a focus on the bird breeding period and post-breeding period when densities are highest. The study was robust in that seabirds were tracked inside the array with video cameras and radar tracks, which allowed for measuring avoidance movements (meso- and micro-avoidance)[16] with high confidence and at the species level. Detailed statistical analyses of the seabird flight data were enabled both by the large sample sizes and by the high temporal resolution in the combined radar track and video camera data. Meso-avoidance behavior showed that species avoided the RSZ by flying in between the turbines with very few avoiding by changing their flight altitude in order to fly either below or above the rotors. The most frequently recorded adjustment under micro-avoidance behavior was birds flying along the plane of the rotor; other adjustments included crossing the rotor either obliquely or perpendicularly, and some birds cross the rotor swept area without making any adjustments to the spinning rotors. The study concluded that, together with the recorded high levels of micro-avoidance in all species (>0.96), it is now evident that many species, of seabirds are good at avoiding collisions and therefore will be exposed to very low risks of collision in offshore wind farms during daylight hours (Vattenfall 2023). This was substantiated by the fact that no collisions or even narrow escapes were recorded in over 10,000 bird videos during the 2 years of monitoring covering the April – October period. The study's calculated micro-avoidance rate (>0.96) is similar to Skov et al. (2018). Maques et al (2021) suggest that while attraction effects were observed, in some groups, these effects were not observed in Anseriformes, Gaviiformes, Pelecaniformes, and Suliformes. Further evidence supporting turbine avoidance can be found in Schwemmer and others (2023), in which 70 percent of approaching 143 GPS tracked Eurasian curlews (*Numenius arquata*) demonstrated horizontal avoidance responses when approaching offshore wind farms in the Baltic and North Seas. While most curlews avoided entire wind farms, others changed their flight altitude to fly below or above the rotor swept zone as they pass through the wind farm (Figures 3.5.3-4, 3.5.3-5, and 3.5.3-6). Given that curlews and red knots are in the same family (*Scolopacidae*) and are ecologically similar, it is reasonable to expect that red knots would behave similarly to curlews when encountering wind farms and turbines.

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 appear transparent to the eye, can also factor into collision risk (Hodos 2003). However, modern offshore WTGs are very large and spin much slower than onshore WTGs that were installed 20 years ago. In the contiguous U.S., bird collisions with operating WTGs are a relatively rare event, with an estimated 140,000 to 500,000 (mean = 320,000) birds killed annually by 49,000 onshore WTGs in 39 states (USFWS 2018). Based on the mean annual mortality rate of 6.86 birds per turbine in the eastern U.S. (USFWS 2018), an estimated 21,609 birds could be killed annually under the anticipated development described in the expanded planned action scenario. This represents a worst-case scenario and does not consider factors, such as landscape and weather patterns, or bird species that are expected to occur. Potential annual bird kills from WTGs would be relatively low compared to other causes of migratory bird deaths in the U.S.; feral cats are the primary cause of migratory bird deaths in the U.S. (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 2021). 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 could encounter operating WTGs (Table 3.5.3-3). The addition of WTGs to the offshore environment may result in increased functional loss of habitat for those species with higher displacement sensitivity (Figure 3.5.3-3). 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.

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.

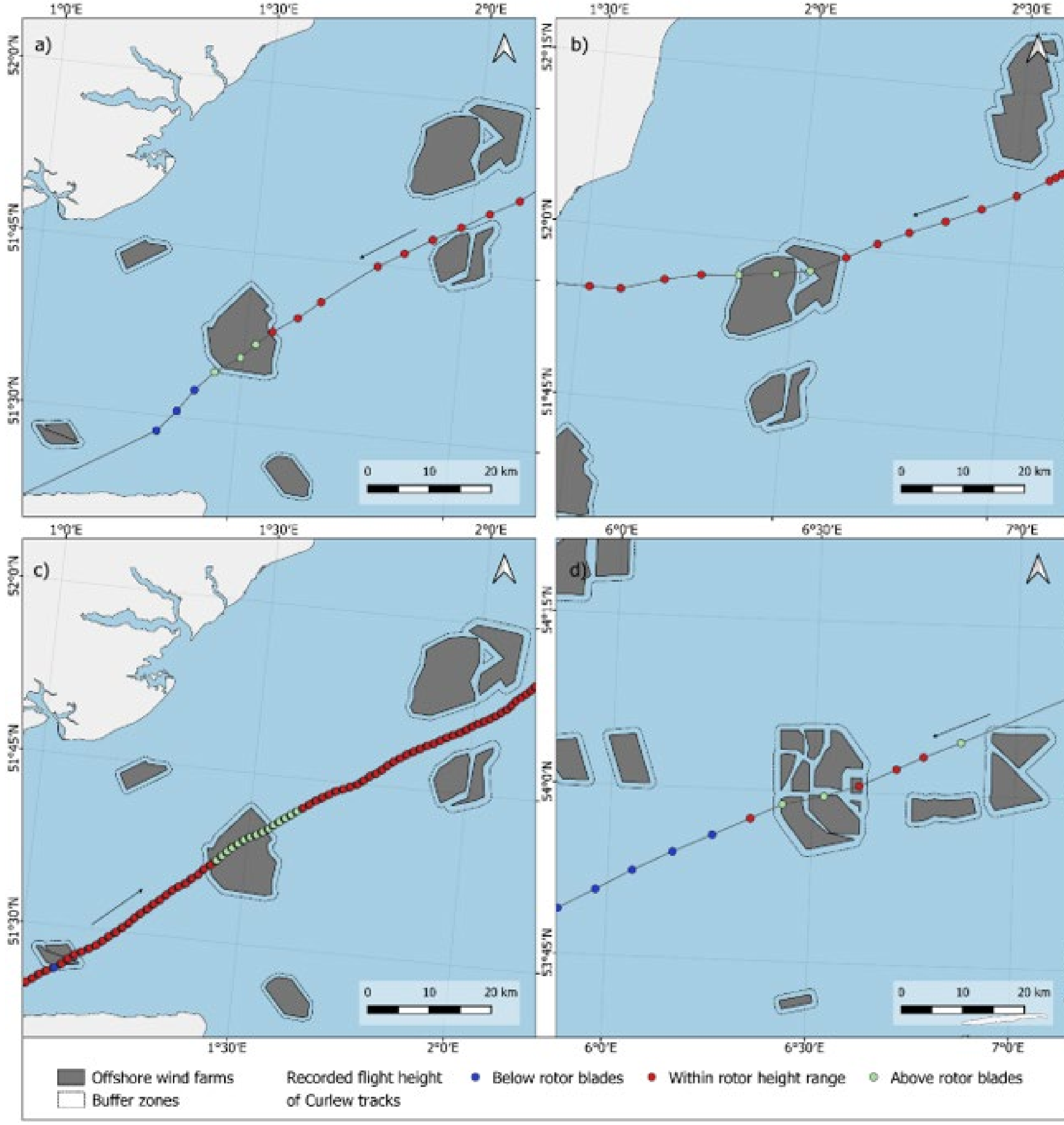

Figure 3.5.3-4. Four examples of curlews approaching OWFs that show avoidance in the vertical plane by increasing flight altitudes: a) OWF "London Array" (UK; rotor level: 27-147 m); b) OWF "Galloper" and "Greater Gabbard" (UK; mean rotor level: 26.1-145.9 m); c) OWF "London Array" (UK; rotor level 27-147 m); d) OWF "Alpha Ventus", "Borkum Riffgrund 1", "Borkum Riffgrund 2" "Merkur", "Triane Windpark", "Borkum I" and "Trianel Windpark Borkum II (Germany; mean rotor level: 27.3-166.2 m). Different colors of GPS fixes represent different flight altitudes. Figure S2 in Schwemmer et al. (2023).

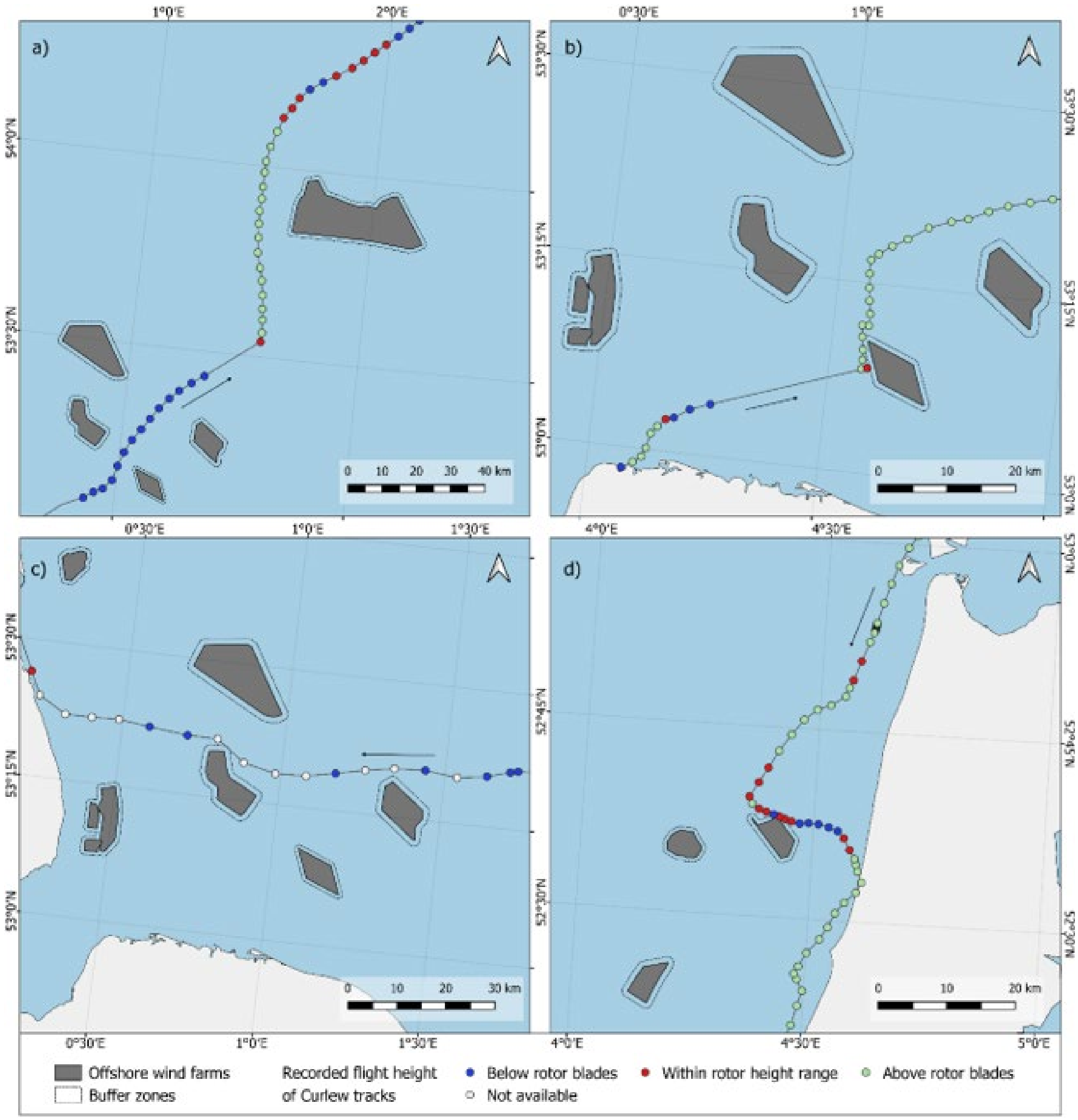

Figure 3.5.3-5. Four examples of curlews approaching OWFs that show avoidance in the horizontal plane by changing flight directions: a) OWF “Hornsea Project One” (UK; rotor level: 36-190 m); b) OWF “Sheringham Shoal” (UK; rotor level: 26.5-133.5 m); c) OWF “Race Bank” (UK; rotor level 23-177 m); d) OWF “Egmond aan Zee” (The Netherlands; rotor level: 25-115 m). Different colors of GPS fixes represent different flight altitudes. Figure S3 in Schwemmer et al. (2023).

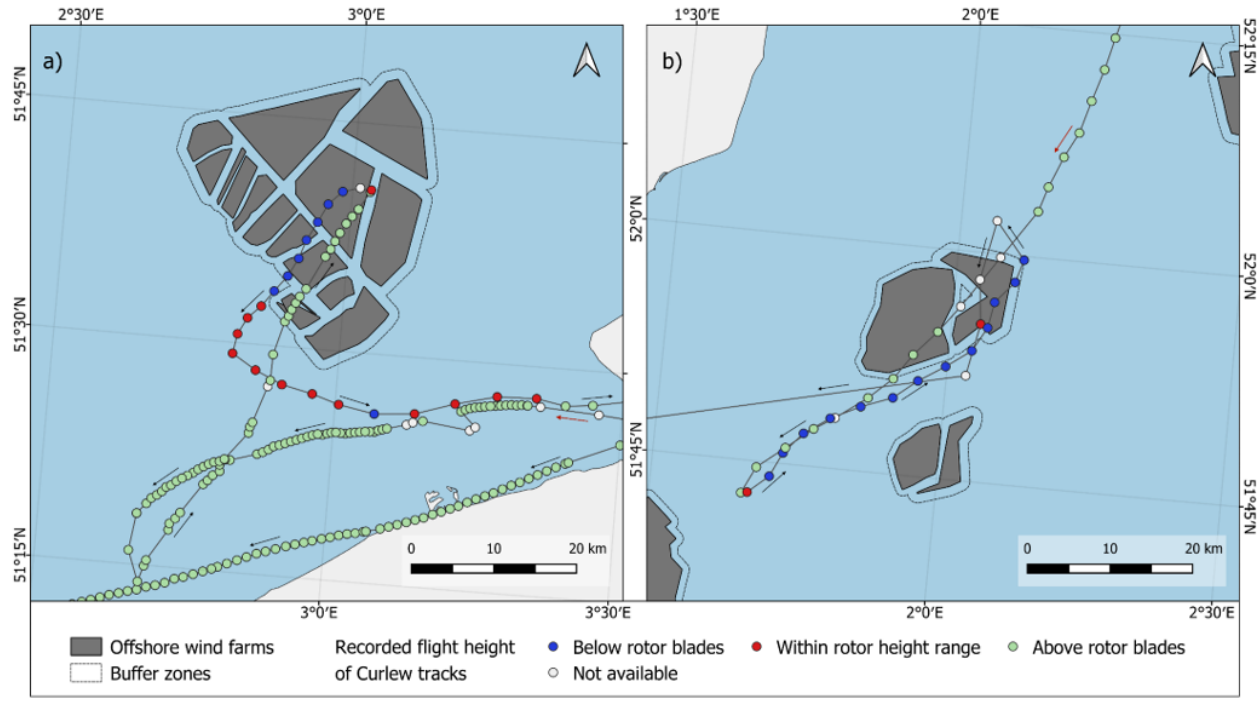

Figure 3.5.3-6. Non-directional flights within or in the vicinity of two OWFs made by two curlews tagged as breeding in north Germany. Left panel: OWF cluster belonging to Belgium and The Netherlands. The bird entered the North Sea approaching from The Netherlands, performed a loop in the south, entered the OWF cluster and returned to a roost in The Netherlands where it stayed for 9 days before continuing its journey in a straight track. Right panel: OWF "Galloper" and "Greater Gabbard" belonging to the UK. The bird entered from the north, crossed the OWF cluster performed a circle in the south, entered the OWF cluster again, performed another circle in the north, entered the OWF cluster for a third time and left the area towards the south-west. Arrows depict flight directions. Figure S4 in Schwemmer et al. (2023).

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 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: 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.

3.5.3.3.3 Conclusions

Impacts of Alternative A – No Action. 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 activities. BOEM expects ongoing activities (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, 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.

Cumulative Impacts of Alternative A – No Action. The impacts of ongoing and 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 the impacts associated with offshore wind activities in the geographic analysis area would result in minor adverse impacts but could include moderate beneficial impacts because of the presence of structures. Most 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 most of the 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 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. In addition, the displacement of fossil fuels in the generation of electricity by offshore wind would further reduce ozone and have consequently minor to moderate beneficial impacts to populations of small land birds.

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

This EIS analyzes the maximum-case scenario; any potential variances in the 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 C) 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 Inshore and Onshore Export Cable Routes, 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 Project design exists as outlined in Appendix C. 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.
- Inshore and 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.
- US Wind has committed to measures to minimize impacts on birds. These measures include anti-perching measures and using lighting technology that minimizes impacts on avian species to the extent practicable (Appendix G, Table G-1).

3.5.3.5 Impacts of Alternative B – Proposed Action on Birds

3.5.3.5.1 Impacts of Alternative B – Proposed Action The following sections summarize the potential impacts of the Proposed Action on birds 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*. 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 *likely to adversely affect* piping plover and rufa red knot and *not likely to adversely affect* eastern black rail or roseate tern (BOEM 2023). There are no critical habitats designated for these species in the action area defined in the BA (BOEM 2023). Consultation with USFWS pursuant to Section 7 of the ESA concluded on May 31, 2024.

Construction and Installation

Onshore Activities and Facilities

Land disturbance: 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. US 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 landfall site and substations) would be co-located with existing developed areas (i.e., landfall beach parking lot and power plant substation) to limit 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, Section 11.2; US Wind 2024).

Clearing and grading during construction. 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 site is already developed and fragmented. The Proposed Action includes three proposed substations totaling 10.3 acres (4.2 hectares). Construction of the interconnection facilities also includes the temporary construction laydown area of 4.02 acres (1.63 hectares), and a temporary access road of 0.76 acres (0.31 hectares) and 0.69 acres (0.23 hectares) at the landfall (see Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). However, to the greatest extent practicable, existing disturbed areas will be used for the construction laydown area and access roads (COP, Volume II, Section 11.2.1; US Wind 2024). A total of 10.3 acres (4.2 hectares) of forested area will be permanently altered by the Project. Impacts to the state-threatened black crowned night heron, a listed species in Delaware, would not be expected due to avoidance of preferred wetland habitats during the course of project construction. Additional information regarding potential habitat related impact is provided in Section 3.5.8, *Wetlands and Other Waters of the United States.*

Impacts on nesting bald eagles are expected to be minor or negligible. Impacts on peregrine falcons are not anticipated because no peregrine falcon nest activity has been identified along or adjacent to any of the Onshore Project components. Due to the short duration of the activities and the LPMs (Appendix G, *Mitigation and Monitoring*, Table G-1) that US 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.

Offshore and Inshore Activities and Facilities

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, US 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. All vessels would be certified to conform to vessel O&M protocols designed to minimize the risk of fuel spills and leaks. 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.

Cable emplacement and maintenance: Offshore, the Proposed Action would result in temporary seafloor disturbance from installation of the offshore export (34 acres [13.76 hectares]) and inter-array cables (29.98 acres [12.13 hectares]), in a phased approach from 2025 through 2027 (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). Export cable installation would result in turbidity effects that could 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 seafloor and potential plumes limited to right above the seafloor 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 164 to 656 feet (50 to 200 meters) of the trench in offshore areas. Dredging, which may also occur along the proposed cable route when crossing federal and state navigation channels, would produce similar effects, but with plumes likely to last longer and extend farther out. As BOEM (2021b) 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 negligible impacts, if any, on individuals or populations would be expected given the localized and temporary nature of the potential impacts.

Installation of the Inshore Export Cable is expected to be completed via jet plow techniques, though different methods (e.g., vibro-injector, trenching) may be used if jet plowing is not feasible. Inshore export cable installation is anticipated to temporarily disturb up to 168.3 acres (68.10 hectares) of seafloor within Indian River Bay (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). Similar to installation of offshore export cables, inshore cable installation has the potential to reduce foraging success or result in temporary and localized impacts on potential prey species due to turbidity effects. Higher sediment impacts (defined as sediment concentrations greater than 200 mg/L or sediment deposition of greater than 0.4 inch [1 millimeter]) are expected to occur within a 354-foot (108 meters) corridor centered on the proposed Inshore Export Cable Route. The duration of these impacts are expected to be less than 5 hours (COP, Volume II, Appendix B1, B3; US Wind 2024). Lower sediment impacts (defined as sediment concentrations in excess of 25 mg/L or sediment deposition of greater than 0.04 inch [0.5 millimeter]) are expected to occur within a 1,968 feet (600 meters) corridor centered on the proposed Inshore Export Cable Route and would be expected to dissipate between 5 to 24 hours (COP, Volume II, Appendix B1, B3; US Wind 2024). Similar to offshore cable impacts, these sediment impacts would be short-term and localized. Individuals actively foraging during installation activities would be expected to successfully forage in nearby areas not affected by increased turbidity and only non-measurable negligible impacts, if any, on individuals or populations would be expected given the localized and temporary nature of the potential impacts.

Noise: The expected impacts of 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 (up to 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.

Operations and Maintenance

Onshore Activities and Facilities

Noise: 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.

Presence of structures: 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 anti-perching measures and 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: The expected impacts of aircraft traffic associated with the Proposed Action would be negligible, similar to those of the No Action Alternative. Currently, US Wind does not anticipate the use of any aircraft for Project Activities (COP, Volume I, Section 4.0; US Wind 2024).

Offshore and Inshore Activities and Facilities

Accidental releases: Impacts from accidental releases during O&M is expected to be equivalent to impacts from offshore construction.

Lighting: Under the Proposed Action, up to 121 WTGs (PDE), 4 OSSs, and 1 Met Tower would be lit with navigational and FAA hazard lighting; these lights have potential to attract birds and result in increased collision risk (Hüppop et al. 2006). In accordance with federal lighting guidelines (BOEM 2021) and as outlined in the COP (Volume II, Section 16.4 and Appendix K2; US Wind 2024), each WTG 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.

US Wind has committed 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. Use of ADLS would reduce the duration of obstruction lighting system activation by more than 99 percent (compared to continuously illuminated lights in a system without ADLS). As a result, ADLS for the Proposed Action would be activated for approximately 5 hours, 46 minutes, 22 seconds in a 1-year period (Capitol Airspace Group 2023), approximately 0.1 percent of all annual nighttime hours. BOEM assumes that, if implemented for other offshore wind projects, ADLS would result in similar reductions in frequency and duration of lighting for those projects. This would reduce impacts already associated with WTG lighting. To further reduce impacts on birds, US 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.

Noise: Operational vessel 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).

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 3.5.3.3. 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 Lease Area, BOEM and USFWS conclude that the Proposed Action would not likely adversely affect eastern black rail and roseate terns. However, piping plover and rufa red knot have some potential to encounter operating WTGs and as such the project is likely to adversely affect these species. The Maryland Offshore Wind Project US Wind FWS BA (BOEM 2023) contains a complete discussion of the potential collision risk to ESA-listed species as a result of operation of the Project.

As previously described and depicted on Figures 3.5.3-2 and 3.5.3-3, 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 (Figures 3.5.3-2 and 3.5.3-3), suggesting that bird fatalities due to collision are likely to be low.

The US Wind performed an exposure assessment to estimate the risk of various offshore bird species encountering the Lease Area (COP, Volume II, Appendix N1; US Wind 2024). 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 could be exposed to the Lease Area, the Lease 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 special concern (non-breeding).

During migration, many bird species, including songbirds, likely fly at heights well above the RSZ (70.8 to 906 feet [22 to 276 meters] above the MLLW) though there is a high degree of variability and a lack of information regarding flight heights (Gauthreaux 1991; Hüppop et al. 2006; Robinson Willmott 2013). As shown in 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 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 (Pettersson 2005; Fox et al. 2006; 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), 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 (Bloch and Bruderer 1982; Bruderer and Boldt 2001; Chapman et al. 2016; Abdulle and Fraser 2018), Robinson Willmott and Forcey (2014) found that most of the bird activity (including blackpoll warblers) in the offshore OCS environment occurred during windspeeds less than 6 miles per hour (mph) (10 km/h) (Figure 109 in Robinson Willmott and Forcey 2014). The cut-in speed for the US Wind WTGs is 7.8 mph (12.6 km/h); therefore, based on the Robinson Willmott and Forcey (2014) offshore study, passerines would likely be migrating when the turbine blades are idle. Furthermore, most carcasses of small migratory songbirds found at land-based wind energy facilities in the Northeast were within 6.6 feet (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 and not from collision (e.g., Stabile et al. 2017).

Some marine bird species might avoid the Lease Area during its operation, leading to an effective loss of habitat. For example, loons (Drewitt and Langston 2006; Petersen et al. 2006; Percival 2010; Lindeboom et al. 2011; Dierschke et al. 2016), grebes (Leopold et al. 2011, 2013; Dierschke et al. 2016), sea ducks (Drewitt and Langston 2006; Petersen et al. 2006), and northern gannets (Drewitt and Langston 2006; Petersen et al. 2006; Lindeboom et al. 2011) typically avoid offshore wind developments. The 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 Project and throughout the region. However, as depicted on Figure 3.5.3-3, modeled use of the Lease 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. (2013). Because the Lease Area is not likely to contain important foraging habitat for some species susceptible to displacement, BOEM expects this loss of habitat to be negligible. Population-level, long-term impacts resulting from habitat loss would not be expected.

In addition to the adverse impacts described above, some beneficial impacts may occur as a result of reef effects, increasing foraging opportunities in the vicinity of WTGs. Generally, these benefits would be conferred to those species with low displacement sensitivity and would not avoid the project, specifically jaegers and skuas, storm-petrels and shearwaters and fulmars (see COP Volume II, Appendix N1; US Wind 2024). However, these species also have generally lower behavioral exposure rankings, based on average estimated flight height elevations as reported by Williams et al. (2015a and 2015b). As such those species that may be attracted to offshore structures due to increased prey availability, are those species that due to their behavior ecology would be less likely to have fatal interactions with operating WTGs. Further reducing the risk to these species is the fact that these species have generally lower geographic exposure to the project area (see COP Volume II, Appendix N1; US Wind 2024).

In addition, US Wind has committed to implementing an Avian and Bat Post-Construction Monitoring Plan (COP, Volume II, Section 12.3 and Appendix N2; US Wind 2024) 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.

Traffic: The expected impacts of aircraft traffic associated with the Proposed Action would be negligible, similar to those of the No Action Alternative. Currently, US Wind does not anticipate the use of any aircraft for Project Activities (COP, Volume I, Section 4.0; US Wind 2024).

Conceptual Decommissioning

The impacts of Proposed Action decommissioning on birds would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. For the expected temporary impacts, including the effects of conceptual onshore decommissioning activities, it is likely that a portion, possibly a majority, of such impacts from planned actions would not overlap temporally or spatially with Alternative B. Decommissioning impacts are expected to be the same as described earlier and would be negligible to minor.

3.5.3.5.2 Impacts of Alternative B on ESA-Listed Species

Four species of birds listed as federally threatened or endangered under the ESA may occur in the Onshore and Offshore Project areas: the threatened piping plover (*Charadrius m. melodus*), threatened eastern black rail (*Laterallus jamaicensis jamaicensis*), and threatened *rufa* subspecies of the red knot (*Calidris canutus rufa*) (USFWS 2022). The Project-specific BA provides a detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2023).

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 this 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.

3.5.3.5.3 Cumulative Impacts of Alternative B

Accidental releases: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative 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.

Cable Emplacement: The Proposed Action combined with ongoing and planned activities including offshore wind would disturb up to 36,131 acres (14,622 hectares) of seafloor from the offshore export cable and inter-array cables. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative 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.

Land Disturbance: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative 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.

Lighting: Under the planned action scenario, up to 3,081 WTG and OSS foundations 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 the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative 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.

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

Presence of structures: Using the assumptions in Table D2-1, there could be up to approximately 3,081 WTG and OSS foundations within the geographic analysis area. Of these, up to 121 WTGs would result from the Project. The structures associated with the Proposed Action and the consequential impacts would remain at least until decommissioning of the Project is complete. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative 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. Approximately 96 percent of these impacts would occur as a result of structures associated with other offshore wind development. The Proposed Action would account for 3.9 percent (121 of 3,081) of the new WTGs on the Atlantic OCS.

3.5.3.5.4 Conclusions

Impacts of Alternative B – Proposed Action. Overall, the Proposed Action would have **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.

Cumulative Impacts of Alternative B – Proposed Action. In the context of other reasonably foreseeable environmental trends, ongoing and planned activities the cumulative impacts contributed by the Proposed Action to the overall impacts on birds would be undetectable. BOEM anticipates 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.

3.5.3.6 Impacts of Alternatives C – Landfall and Onshore Export Cable Routes on Birds

3.5.3.6.1 Impacts of Alternative C

This alternative includes an Onshore Export Cable Route from the landfall and avoid installation of a cable crossing Indian River Bay and Indian River (Inshore Export Cable Route). The two sub-alternatives vary by Onshore Export Cable Routes. Further details about Alternative C are provided in Section 2.1.3. Offshore Project components within the Lease Area (WTGs, OSSs, inter-array cables, and Met Tower) would be the same as the Proposed Action (Alternative B).

The impacts of Alternative C would be similar to those described under Alternative B (**minor**) as the main driver of potential impacts are due to the presence of structures on the OCS and permanent removal of potentially suitable terrestrial habitat at proposed substation sites, which would not differ under this Alterative. Impacts associated with foraging effects within Indian River Bay would be avoided, but temporary to permanent impacts could occur to potentially suitable terrestrial habitat along the proposed terrestrial export cable routes. However, these impacts, if any, are expected to be minimal due to the proposed use of existing ROWs and areas with existing disturbance.

3.5.3.6.2 Cumulative Impacts of Alternative C

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative 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.

3.5.3.6.3 Conclusions

Impacts of Alternative C. Although Alternative C would eliminate the potential for effects to foraging birds within Indian River Bay and would potentially include impacts on potentially suitable terrestrial habitat for coastal and marine bird species, BOEM does not anticipate a measurable benefit to bird species in the overall geographic analysis area. As such, potential impacts would be the same as the Proposed Action and would be **minor** and could potentially include **minor beneficial** impacts.

Cumulative Impacts of Alternative C. In the context of reasonably foreseeable environmental trends, ongoing and planned activities the cumulative impacts on bird species, including Alternative C would be the same as those described under the Proposed Action. BOEM anticipates 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**.

3.5.3.7 Impacts of Alternative D and E on Birds

3.5.3.7.1 Impacts of Alternative D and E

Alternative D would result in the exclusion of 32 WTG positions and 1 OSS within 14 mi (22.5 kilometer), while Alternative E would result in the exclusion of 11 WTG positions from the Lease Area. While Alternatives D and E would reduce risks to birds due to reduced exposure to operating WTGs on the OCS, these differences would not meaningfully change impacts on birds compared to the Proposed Action, the impact designation would be **minor** and could potentially include **minor beneficial** impacts.

3.5.3.7.2 Cumulative Impacts of Alternative D and E

In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative 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.

3.5.3.7.3 Conclusions

Impacts of Alternatives D and E. Although Alternatives D and E would eliminate 32 or 11 WTGs, respectively, BOEM does not anticipate a measurable benefit to bird species in the overall geographic analysis area. As such, potential impacts on birds would be the same as the Proposed Action and would be **minor** and could potentially include **minor beneficial** impacts.

Cumulative Impacts of Alternatives D and E. In the context of reasonably foreseeable environmental trends, ongoing and planned activities the cumulative impacts on bird species, including Alternatives D and E would be the same as those described under the Proposed Action. BOEM anticipates 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**.

3.5.3.8 Comparison of Alternatives

Impacts of Alternatives. As described in Section 3.5.3.5, the potential impacts associated with the Proposed Action in combination with ongoing activities would likely be similar to the impacts expected under the No Action Alternative. The Proposed Action would impact birds through onshore land disturbance and the presence of offshore structures. Under the No Action Alternative, these impacts would not occur.

As discussed in Sections 3.5.3.6 and 3.5.3.7, the impacts associated with the Proposed Action do not change substantially under the other action alternatives. Although the onshore impacts and the number of offshore structures varies slightly, impacts on marine and coastal birds would likely be **minor** with **minor beneficial** impacts for all action alternatives.

Cumulative Impacts of Alternatives. In the context of reasonably foreseeable environmental trends, ongoing and planned actions, all action alternatives would occur under the same scenario (Appendix D, *Planned Activities Scenario*). Therefore, cumulative impacts on birds would only vary if the alternative's contributions differ. BOEM expects overall **minor** impacts with **minor beneficial** impacts, because of the limited removal of potentially suitable onshore habitat and the expected rarity of birds on the OCS. The overall impact of any action alternative on marine and coastal birds when combined with past, present, and reasonably foreseeable activities would be **moderate** adverse with **moderate beneficial** impacts.

3.5.3.9 Proposed Mitigation Measures

Several measures are proposed to minimize impacts on bats in Appendix G, *Mitigation and Monitoring*. If one or more of the measures individually described in Appendix G are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced. BOEM conducted consultation with USFWS under Section 7 of the Endangered Species Act, resulting in USFWS issuing conservation measures in a Biological Opinion, which are fully described in Table G-2 in Appendix G and summarized here in Table 3.5.3-4.

Table 3.5.3-4. Measures Resulting from Consultations (Also Identified in Appendix G, Table G-2

Measure	Effect
BOEM-Proposed Mitigation and Monitoring Measures in the USFWS BA	Minimize impacts from presence of structures to bats through adopting a bat monitoring plan, reporting takes of ESA-listed species; minimize lighting impacts through BMPs; use of bird deterrent devices
Conservation measure in the BiOp issued by USFWS	Minimize lighting impacts through BMPs; monitoring and reporting requirements; use of bird deterrent devices; minimize impacts through avoidance of nesting beaches; timing of year activity restrictions; creation of a compensatory mitigation plan; support of SCRAM modeling for collision risk; bird mortality reporting; training for personnel.

3.5.3.10 Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in G-2 in Appendix G are incorporated in the Preferred Alternative. These measures, if adopted, would further define how the effectiveness and enforcement of LPMs would be ensured and improve accountability for compliance with LPMs by requiring the submittal of plans for approval by the enforcing agency(ies) and by defining reporting requirements. Because these measures ensure the effectiveness of and compliance with LPMs that are already analyzed as part of the Proposed Action, implementation of these measures would not further reduce the impact level of the Proposed Action from what is described in Section F2-3.5.3.5, *Impacts of Alternative B – Proposed Action on Birds.*

3.5.7 Sea Turtles

This section discusses potential impacts on sea turtles likely to be present in the proposed Project area resulting from the Proposed Action, alternatives, and ongoing and planned actions in the sea turtle geographic analysis area. The geographic analysis area (Figure 3.5.7-1) 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 large size of the geographic analysis area, analysis in this Final EIS focuses on sea turtles that would likely occur in the Project area and potentially could 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).

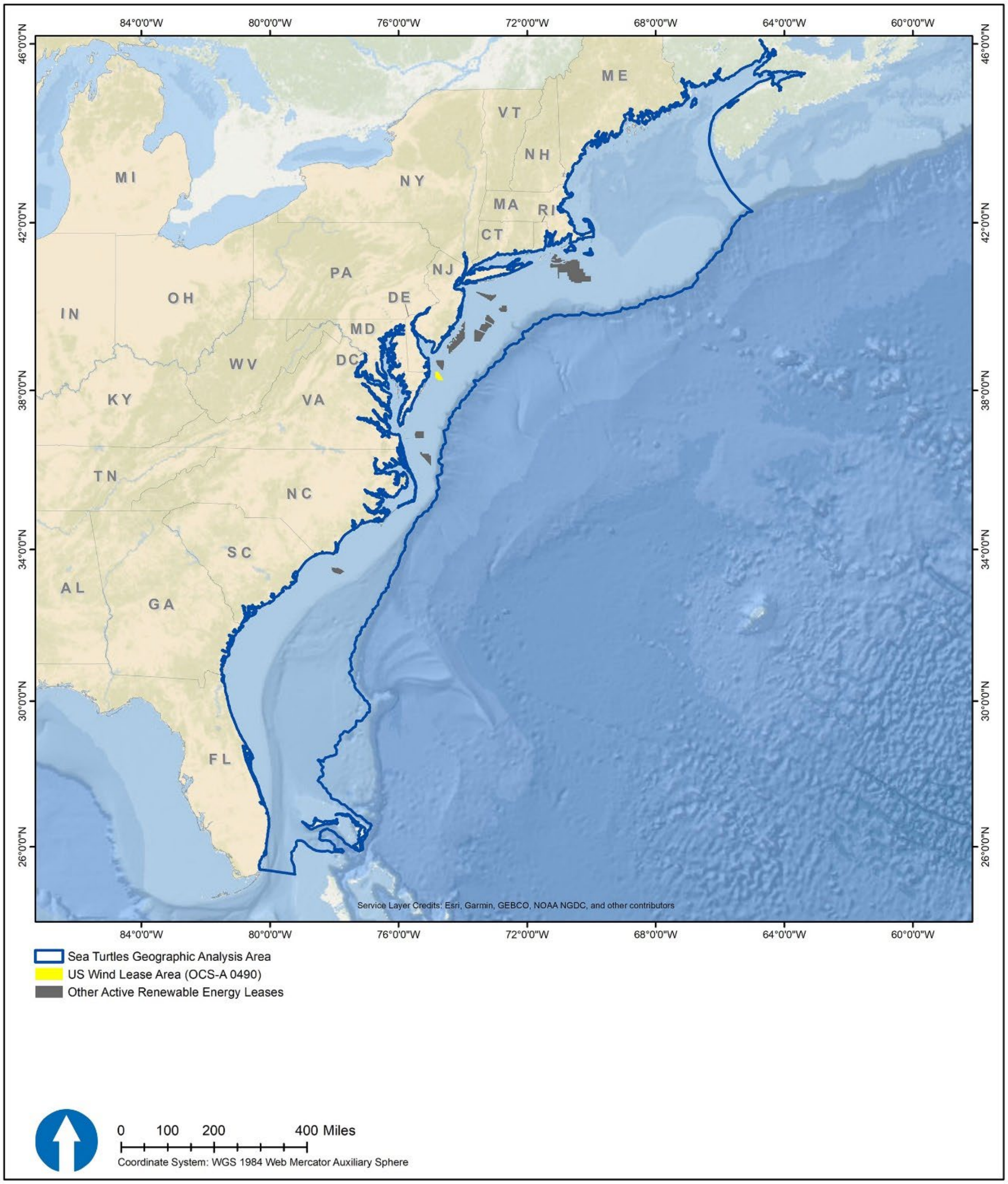

Figure 3.5.7-1. Sea turtles geographic analysis area

3.5.7.1 Description of the Affected Environment

This section discusses potential impacts on sea turtle species from the Project, action alternatives, and ongoing and planned actions in the sea turtle geographic analysis area as described in Appendix D, *Planned Activities Scenario*, Table D-1, and shown on Figure 3.5.7-1. The geographic analysis area for sea turtles includes LMEs along the Northeast and Southeast Atlantic OCS that capture most habitats in the U.S. and movement for sea turtle species.

This section also summarizes information on sea turtles occurring offshore Maryland that is provided in the COP (Volume II, Chapter 10.0; US Wind 2024) as well as BOEM wind project documents (e.g., BOEM 2012, 2014), the *Biological Assessment for Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf* (Baker and Howsen 2021), the Ocean Biodiversity Information System (OBIS 2022) the most recent AMAPPS reports (Palka et al. 2017, 2021), and the most recent recovery plans and 5-year reviews available for each species. The US Wind COP (Volume II, Chapter 10; US Wind 2024) summarizes information on sea turtle occurrence in the Project area based on the MABS conducted in the Maryland Wind Energy Area between 2012 and 2014 (Williams et al. 2015); the VAQF study conducted for MDNR (Barco et al. 2015); and PSO monitoring data collected during G&G surveys in Lease Area OCS-A 0490 in 2015 and 2016 (Alpine Ocean Seismic Surveys Inc. 2015, 2017).

Five sea turtle species have reported occurrences along the East Coast in both coastal and offshore waters. They are the loggerhead sea turtle (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*), green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and hawksbill sea turtle (*Eretmochelys imbricata*). The loggerhead sea turtle – Northwest Atlantic distinct population segment (DPS) and green sea turtle – North Atlantic DPS are listed as threatened under the Endangered Species Act; the leatherback, Kemp's ridley, and hawksbill sea turtles are listed as endangered under the Endangered Species Act.

Except for the polar regions, sea turtles occupy all oceans with higher densities and most nesting occurring in tropical and subtropical seas and foraging well into temperate regions. Sea turtles can remain underwater for extended periods which allows them to spend as little as 3 to 6 percent of their time at the water surface (Lutcavage et al. 1997; NSF and USGS 2011). Conversely, sea turtles may also remain at the surface for long periods of time while resting or basking. Freitas et al. (2019) found that tagged juvenile loggerhead sea turtles spent roughly one third of their time at the surface (0 to 3 feet [0 to 1 meter] water depths), specifically spending 43 percent of their time at the surface during the day and 29 percent of their time at the surface during the night. Therefore, while sea turtles have the capability for spending long periods submerged, dive patterns will vary with activity, water temperature, life stage, and environment. Sea turtles in the Atlantic often travel long distances between temperate foraging areas, offshore nursery areas, and tropical or sub-tropical nesting beaches (Cailouet et al. 2020; Evans et al. 2019; Mansfield et al. 2021; Meylan 1995; Patel et al. 2021), making them a seasonally common faunal group found in offshore and nearshore environments of Maryland.

Sea turtle species distribution and presence in the Project area are summarized in Table 3.5.7-1 based on a review of monthly aerial surveys of the Maryland Wind Energy Area and surrounding waters between 2013 and 2015 (Barco et al. 2015) as well as boat and aerial based surveys conducted in the vicinity of the Maryland Wind Energy Area between 2012 and 2014 (Williams et al. 2015). Additional detail about each species' range and distribution, population status, ecology and life history, and conservation and management can be found in available Environmental Assessments for the Atlantic OCS (BOEM 2012, 2014) and the most recent recovery plans and 5-year reviews but are incorporated here by reference for each species.

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 U.S., 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 (Bolten et al. 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 (15°C to 28°C) and at depths between 26.2 and 301.8 feet (8 and 92 meters), and the highest probability of occurrence occurs in regions with sea surface temperatures from 63.9°F to 77.5°F (17.7°C to 25.3°C) and at depths between 85.3 and 242.8 feet (26 and 74 meters) (Patel et al. 2021). Studies have indicated that the MAB of the Atlantic OCS, where the Project area occurs, is an important 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 MAB (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 2022). 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).

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). The species primarily feeds on seagrasses and algae (Bjorndal 1997), although they will occasionally feed on invertebrates, including jellyfish and sponges (Heithaus et al. 2002). Green turtles do not nest on beaches in the Project area; their primary nesting beaches are in Costa Rica, Mexico, the U.S. (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 2015a). According to NMFS and USFWS (2015a), nesting trends are generally increasing for this population. 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 (Palka et al. 2021).

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. 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, but are also commonly observed in coastal waters along the U.S. OCS (NMFS and USFWS 1992). Leatherback sea turtles are dietary specialists, feeding almost exclusively on jellyfish, siphonophores, and salps; the species' migratory behavior is closely tied to the availability of pelagic prey resources (Eckert et al. 2012; NMFS and USFWS 2020). 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 (11.1°C to 31.7°C) (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 (Palka et al. 2017, 2021).

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, USFWS, and SEMARNAT 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 2022a) and nearshore waters less than 120 feet (36.6 meters) deep (Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters. Kemp's ridley sea turtles are generalist feeders that prey on a variety of species, including crustaceans, mollusks, fish, jellyfish, and tunicates, and forage on aquatic vegetation (Byles 1988; Carr and Caldwell 1956; Schmid 1998). However, the preferred diet of Kemp's ridley sea turtles is crabs (NMFS and USFWS 2015b).

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 2015b). 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 2015b). 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

2015b). 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 2015b). 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 (Palka et al. 2021).

Hawksbill Sea Turtle: Hawksbill sea turtles regularly occur in the Gulf of Mexico; though the species have been documented in OCS waters of the northwest Atlantic Ocean, they typically prefer tropical, inshore habitats and are exceedingly rare north of Florida (Lee and Palmer 1981; Keinath et al. 1991; Parker 1995; Plotkin 1995; USFWS 2001; GARFO 2022). The majority of nesting in the Atlantic occurs in Mexico and within the Caribbean; nesting in the continental U.S. is rare and not observed outside of southeast Florida and the Florida Keys (NMFS 2023a). All hawksbill sea turtles belong to a single population that is endangered under the ESA (35 *Federal Register* 8491). Critical habitat is designated in the coastal waters surrounding Mona and Monito Islands, Puerto Rico (63 *Federal Register* 46693). The species primarily forages on sea sponges, but will also eat marine algae, corals, mollusks, tunicates, crustaceans, sea urchins, small fish, and jellyfish (NMFS 2023a). AMAPPS surveys rarely encountered hawksbill sea turtles, with only two confirmed sightings reported: one off Florida and one off South Carolina (Palka et al. 2021).

Sea Turtle Occurrence in the Project area: Sea turtle species distribution and presence in the Project area is described in the COP (Volume II, Section 10.1; US Wind 2024) and summarized in this section as well as in Table 3.5.7-1. The species most likely to occur in the Project area are loggerhead sea turtles while leatherback, green, and Kemp's ridley sea turtles are less frequently observed. Surveys conducted in and around the Maryland WEA indicate most detections were loggerhead sea turtles followed by green, leatherback, and Kemp's ridley sea turtles (Barco et al. 2015; Williams et al. 2015; Palka et al. 2021).

Hawksbill sea turtles are considered rare in waters offshore Maryland, with only one potential sighting in the Maryland WEA during the MABS surveys (Williams et al. 2015). MDNR has only reported two sightings which were documented by amateur naturalists in Worcester County which surrounds Chincoteague Bay and in Calvert County which is inshore towards the middle of Chesapeake Bay (Funk 2020). Hawksbill sea turtle typically prefers tropical habitats and therefore may be only rarely encountered in the Offshore Project area (USFWS 2022a). However, this species is more common in the Southeastern U.S. and U.S. Gulf of Mexico and may be encountered by Project vessels if they are traveling to the Project area from ports in the Gulf of Mexico (COP, Volume II, Section 10.2; US Wind 2024).

Table 3.5.7-1. Sea turtles with potential occurrence in the Project area

Common Name	Scientific Name	ESA Status	Occurrence in Project Area[1]	VAQF Survey[2]	MABS Maryland Surveys[3]	
				Aerial Survey Sightings (# individuals)	Boat Survey Sightings (# individuals)	Aerial Survey Sightings (# individuals)
Loggerhead sea turtle	*Caretta caretta*	Threatened[4]	Common	833	15	22
Green sea turtle	*Chelonia mydas*	Threatened[5]	Common	45	0	5
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Common	14	3	16

Common Name	Scientific Name	ESA Status	Occurrence in Project Area[1]	VAQF Survey[2] Aerial Survey Sightings (# individuals)	MABS Maryland Surveys[3] Boat Survey Sightings (# individuals)	MABS Maryland Surveys[3] Aerial Survey Sightings (# individuals)
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	Uncommon	1	0	8
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	Rare	0	0	1

ESA = Endangered Species Act; MABS = Mid-Atlantic Baseline Surveys; VAQF = Virginia Aquarium & Marine Science Center Foundation

[1] Occurrence defined as:

Common: Project area within typical range of the species, and species sightings are regularly documented.

Uncommon: Project area within typical range of the species, but species sightings are only occasionally documented.

Rare: Project area within total range of the species, but few species sightings have been documented.

[2] Source: Barco et al. (2015) monthly aerial surveys of the Maryland Wind Energy Area and surrounding waters between 2013 and 2015 reported by the VAQF.

[3] Source: Williams et al. (2015) boat and aerial based surveys conducted in the vicinity of the Maryland Wind Energy Area between 2012 and 2014 conducted as part of the MABS Project.

[4] The Northwest Atlantic distinct population segment of loggerhead sea turtle, which is likely to occur in the Project area, is listed as threatened under the ESA.

[5] The North Atlantic distinct population segment of green sea turtle, which is likely to occur in the Project area, is listed as threatened under the ESA.

There is no designated sea turtle critical habitat in the OCS waters off Maryland or Delaware (NMFS 2022a,b,c,d). Nesting for sea turtles primarily occurs between spring and early fall depending on the species (NMFS 2022a,b,c,d), which corresponds with the seasons in which higher numbers of sightings were reported offshore Maryland (Barco et al. 2015; Williams et al. 2015; Palka et al. 2021). Loggerhead sea turtles are the only species reported nesting in Maryland; no reports of green, Kemp's ridley, or leatherback sea turtle nesting has been reported in Maryland (Funk 2020; Croatan Civic League 2021). Delaware has had three records or sea turtle nests along their coastline; one for loggerhead sea turtles in North Bethany Beach in 1973 (Bies 2018), one for green sea turtles in Cape Henlopen State Park in 2011 (Steele 2011), and another for loggerhead sea turtles in Fenwick Island in 2018 (Bies 2018). Loggerhead sea turtles are commonly documented nesting on southern beaches in Virginia (Funk 2020), and the first successful loggerhead nesting event was documented in Maryland in 2017 when approximately 100 baby loggerhead sea turtles emerged from a nest in Assateague Island National Seashore (Helf 2017). According to the Maryland Park Service, loggerhead sea turtle nesting north of Virginia is uncommon, and though sea turtles have made attempts in the past to nest on Assateague's Beach, this is the first reported group of hatchlings to make it to the water (Helf 2017). Based on these nesting patterns, only the loggerhead sea turtle and potentially the green sea turtle may reasonably nest in the vicinity of the Project area. Assateague Island National Seashore is located approximately 28 miles (45 kilometers) from the 3R's Beach landfall location and 34 miles (55 kilometers) from the Towers Beach landfall location; the footprint of offshore export cable would not overlap with this know nesting location.

Sea turtles generally migrate into or through the Project area as they travel between their northern-latitude feeding grounds and their nesting grounds in the southern U.S., the Gulf of Mexico, and the Caribbean. As ocean waters warm in the spring, sea turtles migrate northward to their feeding grounds in the Mid-Atlantic, typically arriving in the spring or summer and remaining through the fall. As water temperatures cool, most sea turtles begin their return migration to the south. Most sea turtles encountered within the Project area would most likely be migrating or foraging and occur in highest numbers from May through November (Marine Geospatial Ecology Lab 2023). Green, Kemp's ridley, and loggerhead sea turtles that remain in mid-Atlantic waters into the winter may experience cold stunning, which occurs when lower sea surface temperatures cause individuals to become lethargic and float to the surface. Cold-stunned sea turtles are more vulnerable to predators, anthropogenic effects (including vessel strikes), and strandings (NMFS 2022 a, b, c, d).

3.5.7.2 Impact Level Definitions for Sea Turtles

Definitions of impact levels are provided in Table 3.5.7-2. Table F-9 in this Appendix identifies potential IPFs, issues, and indicators to assess impacts to sea turtles.

Table 3.5.7-2. 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.
Negligible	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.
Minor	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 distinct population segment viability.
Moderate	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.
Major	Beneficial	Impacts would be significant and extensive and contribute to population or distinct population segment recovery.

3.5.7.3 Impacts of Alternative A – No Action on Sea Turtles

3.5.7.3.1 Impacts of Alternative A – No Action

Under the No Action Alternative, BOEM would not approve the COP and the project would not take place so the baseline conditions for sea turtles described in Section 3.19.1, *Affected Environment*, would continue to follow current regional trends and respond to IPFs introduced by ongoing non-offshore wind activities. Hence, not approving the COP would have no additional effect on sea turtles. The primary IPFs for sea turtles within the geographic analysis area are generally associated with noise and vessel strikes, the presence of structures, and ongoing climate change. Fuel spills and releases of trash and debris have lesser potential impact on sea turtles due to their low probability of occurrence and relatively limited spatial impact. Land use and coastal development affect sea turtles mostly through habitat loss from development near sea turtle nesting areas, which occur outside of the Project area. Specific non-offshore wind activities that may affect sea turtles include undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); dredging and port improvement projects; tidal energy projects; marine minerals use and ocean-dredged material disposal; military testing and training activities; marine transportation; commercial and recreational fisheries use and management; NMFS research initiatives; oil and gas activities; installation of new structures on the U.S. Continental Shelf; oil and gas activities; onshore development activities; and global climate change (Appendix D includes a complete description of ongoing and planned activities). Most of these activities would only likely result in temporary displacement and behavioral changes; however, vessel strikes and entanglement in marine debris could result in potential injury or mortality of individuals.

Additionally, the following ongoing offshore wind activities[1] within the geographic analysis area would contribute to impacts on sea turtles:

- Continued operations of the Block Island Wind Farm (5 WTGs) installed in state waters and South Fork Wind (12 WTGs and 1 ESP) in OCS-A 0517;
- Continued operations of the Coastal Virginia Offshore Wind-Pilot Project (2 WTGs) installed in OCS-A 0497;
- Ongoing construction and eventual operations of Vineyard Wind 1 (62 WTGs and 1 ESP) in OCS-A 0501, Revolution Wind (100 WTG and 2 ESP) in OCS-A 0486, Empire Wind (147 WTG and 1 ESP) in OCS-A 0512, Coastal Virginia Offshore Wind-Commercial Project (176 WTG and 3 ESP) in OCS-A 0483, Sunrise Wind (94 WTG and 1 ESP) in OCS-A 0487, and New England Wind (130 WTG 5 ESP) in OCS-A 0534; and

[1] Construction activities associated with the Revolution Wind and Sunrise Wind projects that is expected to occur at the time of publication of this Final EIS are limited to onshore and nearshore project components (Stantec 2023; VHB 2023), whereas offshore construction associated with the offshore export cables or WTG installation is assumed to have begun and is ongoing for the Vineyard Wind 1, Coastal Virginia Offshore Wind-Commercial, and Empire Wind projects at the time of publication (Epsilon 2020; Dominion Energy 2023; Tetra Tech 2023). Construction of the Ocean Wind 1 Project that was proposed at the time of publication of this Final EIS was supposed to include construction of onshore components, HRG surveys, and UXO detonations, if required; however, the developer announced that this project was cancelled, and so construction of this Project is not considered under ongoing offshore wind activities, and is instead considered as part of the cumulative impact assessment in Section 3.5.6.3.3. Construction activities associated with the New England Wind project are not expected to begin until Quarter 3 2024 (Epsilon 2024), after publication of this Final EIS, so they are also considered as part of the cumulative impact assessment in Section 3.5.6.3.3.

- Ongoing site assessment and site characterization surveys (e.g., G&G surveys, habitat monitoring surveys, fisheries monitoring surveys).

Global climate change is an ongoing potential risk to sea turtles, although the associated impact mechanisms are complex, not fully understood, and difficult to predict with certainty. Possible impacts on sea turtles due to climate change include increased storm severity and frequency; increased erosion and sediment deposition; increased disease frequency; ocean acidification; and altered habitat, prey availability, ecology, and migration patterns. Over time, climate change, in combination with coastal development, would alter existing nearshore and coastal (nesting beach) habitats and render some areas unsuitable for some species and more suitable for others. Furthermore, regarding the effects of temperature on nesting sea turtles, termed ‘temperature-dependent sex determination' or TSD, increased temperatures could result in skewed and even lethal incubation conditions, which would result in impacts on turtle species, hatchling success (the proportion of eggs that produce viable hatchlings), hatchling size and locomotory performance, the prevalence of scute abnormalities, and possibly infectious disease outbreaks (National Ocean Service 2023; Laloë and Hays 2023; Patrício et al. 2021). These factors individually and in combination can influence individual survivorship and fecundity over broad geographical and temporal scales. Therefore, global climate change and its associated consequences could lead to long-term, high-consequence impacts on sea turtles.

3.5.7.3.2 Cumulative Impacts of Alternative A – No Action

In addition to the ongoing non-offshore wind and offshore wind activities described in Section 3.5.7.3, a number of additional offshore wind projects are planned to be constructed in the geographic analysis area (Appendix D). These planned projects (excluding the Proposed Action) would result in an additional 3,081 WTG and OSS foundations in the geographic analysis area (Appendix D). Additionally, the ongoing non-offshore wind activities introduced in Section 3.5.7.3 and described in Appendix D would continue to occur in the geographic analysis area and contribute to the potential for impacts on sea turtles. The cumulative impacts of the ongoing and planned offshore wind and non-offshore wind projects are discussed in this section.

Accidental releases: Trash and debris or water quality contaminants could be accidentally released as a result of increased human activity associated with future offshore wind development activities. Future offshore wind development would require large quantities of coolant fluids, oils and lubricants, and diesel fuel (Appendix D, Table D2-3 provides specific quantities). In the Planned Activities Scenario (Appendix D, Table D2-3), there would be a low risk of a leak of fluids from any single one of approximately 3,081 WTG and OSS foundations, 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 (484,533 liters) is likely to occur no more often than once per 1,000 years, and a release of 2,000 gallons (7,571 liters) or less is likely to occur every 5 to 20 years. The likelihood of a spill occurring from multiple WTGs and OSSs 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. Based on the volumes potentially involved, the likely number 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 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. Fuel spills from vessels 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.

All species of sea turtles have been documented ingesting plastic debris (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016), as well as a variety of other anthropogenic waste (Tomás et al. 2002), likely mistaking debris for potential prey items (Schyuler et al. 2014). Ingesting trash or exposure to aquatic contaminants could result in lethal or sublethal effects including depressed immune system function; poor body condition; and reduced growth rates, fecundity, and reproductive success (Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). 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). 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). However, all vessels associated with offshore wind development projects would comply with USCG regulations and BOEM regulations that would avoid and minimize accidental release of trash or other debris and aquatic contaminants. Each project would also be expected to have its own OSRP to implement in the case of accidental releases. Therefore, potential accidental release volumes would not appreciably contribute to adverse impacts on sea turtles, and no population-level impacts are expected for any species.

Cable emplacement and maintenance: Future offshore wind projects could disturb up to 130,150 acres (52,670 hectares) of seafloor during the installation of associated undersea cables, causing an increase in suspended sediment (Appendix D, *Planned Activities Scenario*, Table D2-2). This disturbance would be localized and temporary. Data are not available regarding effects of suspended sediments on adult and juvenile sea turtles, although elevated suspended sediments may cause individuals to alter normal movements and behaviors. However, these changes are expected to be limited in extent, short term in duration, and likely too small to be detected (Johnson 2018; NMFS 2022e).

Dredging for sand wave clearance may be necessary in places to ensure cable burial below mobile seafloor 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 seafloor. Direct impacts, especially for entrainment, typically results in severe injury or mortality (Dickerson et al. 2004; NMFS 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; NMFS 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 (Section 3.5.2, *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.

EMFs and cable heat: Under the No Action Alternative, the future development of planned offshore wind projects would result in up to 5,595 miles (9,004 kilometers) of new submarine power cables in the geographic analysis area for sea turtles (Appendix D, *Planned Activities Scenario*, Table D2-1). Each cable would generate EMF potentially detectable by sea turtles in the immediate area around the cable (Klimley et al. 2020). The available evidence indicates that sea turtles are magnetosensitive and orient to the Earth's magnetic field for navigation. Although they may be able to detect magnetic fields as low as 0.05 milligauss, sea turtles are unlikely to detect magnetic fields below 50 milligauss (Normandeau et al. 2011; Snoek et al. 2016). Recent reviews by Bilinski (2021) of the effects of EMF on marine organisms concluded that measurable, though minimal, effects can occur for some species, but not at the relatively low EMF intensities representative of marine renewable energy projects. Electrical telecommunications cables are likely to induce a weak EMF on the order of 1 to 6.3 microvolts per meter within 3.3 feet (1 meter) of the cable route (Gill et al. 2005). Fiber-optic communications cables with optical repeaters would not produce EMF effects. Under the No Action Alternative, export cables would be added in 26 BOEM offshore wind lease areas. As of March 30, 2023, 16 of these projects have a COP under review and are presumed to include at least one identified cable route, which will produce EMF in the immediate vicinity of each cable during operations. Transmission cables using HVAC emit ten times less magnetic field than HVDC (Taormina et al. 2018); therefore, HVAC cables are likely to have less EMF impacts on sea turtles. This EIS anticipates the proposed offshore energy projects would use HVAC transmission, but HVDC designs are possible and could occur. Additionally, potential EMF effects would be reduced by cable shielding and burial to an appropriate depth, and new submarine cables would be installed to maintain a minimum separation of at least 331 feet (101 meters) from other known cables to avoid damaging existing infrastructure during installation. This separation distance would avoid additive EMF effects from adjacent cables. While artificial EMF effects on sea turtles are not well studied, current construction and mitigation methods would limit projected EMF effects to below levels that are expected to cause measurable biological effects. Short-term displacement of individual turtles from the Project area or deviations in their migrations therefore would be small and would not be expected to substantially affect energy expenditure in sea turtles. 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.

Heat transfer into surrounding sediment associated with buried submarine high-voltage cables is possible (Emeana et al. 2016). However, heat transfer is not expected to extend to any appreciable effect into the water column due to the use of thermal shielding, the cable's burial depth, and additional cable protection such as scour protection or concrete mattresses for cables unable to achieve adequate burial depth. As a result, heat from submarine high-voltage cables is not expected to affect sea turtles.

Impacts from EMF from ongoing and planned non-offshore wind activities would likely be negligible for sea turtles as it would be of the lowest level of detection and no perceptible consequences to individuals or populations are expected. Impacts from EMF from other offshore wind activities would similarly be negligible for sea turtles.

Gear Utilization (biological/fisheries monitoring surveys): Fisheries survey activities for planned offshore wind projects may include use of trawl, gillnet/trammel net, otter and beam trawl, ventless trap/pots. A primary threat to sea turtles is their unintended capture in fishing gear like trawl and pot 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 (Bolten et al. 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 in the southeastern U.S. shrimp fisheries (NMFS 2023b), 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 may result in the injury or mortality of individual sea turtles of any species that may occur within sampled area(s). These impacts are expected to be localized and short-term in duration (limited to active sampling periods, only). Loss or injuries of individual turtles resulting from these activities is not expected to result in population-level effects to any species and are therefore expected to be minor. A reduction of sea turtle interactions with fisheries is a priority for sea turtle recovery.

Lighting: Nighttime lighting associated with offshore structures and vessels could represent a source of attraction, avoidance, or other behavioral responses in sea turtles. Although responses to light have been studied in various species and life stages of sea turtles, the effects are expected to be negligible (BOEM 2019). Shoreline development is the predominant existing artificial lighting source in the nearshore component of the geographic analysis area while vessels, mainly fishing vessels, are the predominant source of artificial lighting offshore. Future wind energy development would contribute additional light sources to the offshore component of the geographic analysis area; onshore components of offshore wind projects are not expected to produce a substantial amount of light or be present in areas where sea turtles are expected. Offshore sources of light consist of short-term lighting from vessels used during construction and the long-term use of navigational lighting on new WTGs and OSSs. More than 3,081 structures are forecasted for construction in the geographic analysis area. Each structure would have minimal yellow flashing navigational lighting, as well as red flashing FAA hazard lights in accordance with BOEM (2019) lighting and marking guidelines. Data from oil and gas platform operation in the Gulf of Mexico, which can have considerably more lighting than offshore WTGs, have not resulted in any known impacts on sea turtles (BOEM 2019) and no long-term or population-level impacts from offshore lighting produced by offshore wind projects is expected.

Noise: The siting, construction, operation, maintenance, and decommissioning of other offshore wind farms is expected to introduce several types of underwater sound into the marine environment. Physical descriptions of sounds associated with these activities can be found in Appendix B, *Supplemental Information*. The expected impacts of each of these sources on sea turtles is discussed below.

Noise from Geophysical and Geotechnical Surveys

For the purposes of future offshore wind projects, geophysical and geotechnical surveys use active acoustic sources to evaluate the feasibility of turbine installation and to identify potential hazards. A description of the physical qualities of geophysical sound sources can be found in Appendix B. Both impulsive and non-impulsive noise may be produced by HRG survey activities used during pre-, during-, and post-construction site characterization surveys and impact pile driving used to install WTG and OSS foundations. Some HRG survey equipment (e.g., boomers, sparkers) can produce high-intensity impulsive noise while other survey equipment (e.g., compressed high-intensity radiated pulse [CHIRP] sonar) produce lower intensity noise without the characteristic rise in pressure (Crocker and Fratantonio 2016; Crocker et al. 2019). Both types of HRG survey equipment could result in short-term impacts on sea turtles such as behavioral disturbances, avoidance, stress, or TTS. Recently, BOEM and the USGS characterized underwater sounds produced by high-resolution geophysical sources and their potential to affect marine animals (Ruppel et al. 2022). Although some geophysical sources can be detected by sea turtles, given several key physical characteristics of the sound sources—including source level, frequency range, duty cycle, and beamwidth—most HRG sources are unlikely to result in behavioral disturbance of sea turtles, even without mitigation (Ruppel et al. 2022). Given the type and intensity of noise generated by these equipment (Crocker and Fratantonio 2016; Crocker et al. 2019), they are unlikely to result in PTS for any turtle species. The *Biological Assessment for Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf* (Baker and Howsen 2021) concluded that disturbance of sea turtles from noise related to HRG survey activities would likely result in temporary displacement or behavioral responses that would not result in biologically notable physiological consequences, no injury or mortality would occur, and impacts on sea turtles would not result in stock or population-level effects.

Noise from Unexploded Ordnance Detonations

There are several options for UXO removal that include stabilizing the UXO for safe relocation without detonation, low-order detonation designed to reduce the net explosive yield of a UXO compared to conventional "blow-in-place" techniques, and high-order detonation in which the full explosive weight is detonated in the place where the object is found. The appropriate method of removal for each project will depend on the condition of the UXO (i.e., how stable it is for potential relocation) and surrounding environmental conditions. Further information on UXO detonations can be found in Appendix B. Underwater explosions generate shock waves, or a nearly instantaneous wave characterized by extreme changes in pressure, both positive and negative. This shock wave can cause injury and mortality to a sea turtle, depending on how close an animal is to the blast. The physical range at which injury or mortality could occur will vary based on the amount of explosive material in the UXO, size of the animal, and the location of the animal relative to the explosive. Injuries may include hemorrhages or damage to the lungs, liver, brain, or ears, as well as auditory impairment such as PTS and TTS (Ketten 2004; Finneran et al. 2017). Smaller animals are generally at a higher risk of blast injuries. Potential impacts from *in situ* UXO detonation would result from both low- and high-order detonation methods, with less intense pressures and noise produced from the low-order detonations. However, though low-order detonation methods would generally be preferred by projects, they may not always fully eliminate the risk of high-order detonation, so potential impacts from *in situ* UXO disposal need to be assessed assuming high-order detonations would occur. Noise generated during detonation is dependent on the size and type of UXO, amount of charge used, location, water depth, soil conditions, and burial depth of the UXO.

Noise from Impact and Vibratory Pile Driving

In the Planned Activities Scenario (Appendix D), the construction of up to 3,081 new WTG and OSS foundations in the geographic analysis area is expected to occur intermittently over an approximate 7-year period. During the installation of WTG foundations, underwater sound related to pile driving would likely occur for 4 to 6 hours per day. The sound generated during pile driving will vary depending on the piling method (impact or vibratory), pile material, size, hammer energy, water depth, and substrate type. A description of the physical qualities of pile-driving noise can be found in Appendix B. These sounds may affect sea turtle species in the area. The impacts would vary in extent and intensity based on the scale and design of each project, as well as the schedule of project activities.

Impulsive noise from impact pile driving during future offshore wind development, due to the anticipated frequency and spatial extent of effect, represents the highest risk of exposure and potential for adverse effects on sea turtles in the geographic analysis area. While these potential effects are acknowledged, their significance is unclear because sea turtle sensitivity and behavioral responses to impulsive underwater noise are subjects of ongoing study. Potential behavioral effects may include altered submergence patterns, short-term disturbances, startle responses (e.g., diving, swimming away), short-term displacement of feeding or migrating activity, and a temporary stress response if present within the ensonified area (NSF and USGS 2011; Samuel et al. 2005). The accumulated stress and energetic costs of avoiding repeated exposures to pile-driving noise over a season or life stage could have long-term effects on survival and fitness (U.S. Department of the Navy 2018). Conversely, sea turtles could become habituated to repeated noise exposures over time and not suffer any long-term consequences (Hazel et al. 2007). This type of noise habituation has been demonstrated even when the repeated exposures were separated by several days (Bartol and Bartol 2012; U.S. Department of the Navy 2018).

Vibratory pile driving may be used prior to impact pile driving to reduce the risk of pile run for some offshore wind projects and during export cable installation and port facility construction. Typical noise levels generated by vibratory pile driving are lower than noise levels produced by impact pile driving. Available measurements indicate the SPL was, on average, 165 dB re 1 µPa at 32.8 feet (10 meters), and decreased to 140 dB re 1 µPa when measured 656.2 feet (200 meters) away (Illingworth and Rodkin 2017). These measurements are based on smaller piles in shallower water locations, appropriate for export cable installation activities, and it is expected that vibratory pile driving conducted for the foundations prior to impact pile driving will produce a greater area of ensonification. However, based on these sound levels, it is still not expected that the PTS thresholds (Finneran et al. 2017) would be exceeded more than 328.1 feet (100 meters) from the pile, even in deeper water environments. Ranges to the behavioral disturbance threshold for sea turtles (Finneran et al. 2017) may extend farther; however, the behavioral disturbance threshold is an SPL of 175 dB re 1 µPa and would not be exceeded beyond 1,640.4 feet (500 meters) from the source. Additionally, vibratory pile-driving activities would be relatively short term, occurring over approximately 4 hours per pile for the foundations, and over several days for export cable installation.

Sea turtles exposed to pile driving could experience acoustic injury such as TTS or PTS. In theory, reduced hearing sensitivity could limit the ability to detect predators, prey, or potential mates and reduce the survival and fitness of affected individuals. However, the role and importance of sound in these biological functions for sea turtles remains poorly understood (Lavender et al. 2014). Assuming that all future offshore wind projects would follow BMPs and mitigation from BOEM such as sound attenuation technologies, visual monitoring, and pre-clearance of the affected area, impacts on sea turtles from construction-related noise would be limited to minimal or minor short-term effects on a small number of individuals. Short-term effects on individuals would not be notable at the population level and therefore minor overall.

Noise from Vessels

Construction and operational vessels are the most broadly distributed source of non-impulsive noise associated with offshore wind projects. Sea turtle exposure to underwater vessel noise would increase as a result of future offshore wind projects, especially during construction periods (Appendix D, *Planned Activities Scenario*). Applying vessel activity estimates developed by BOEM (2019), vessel activity could peak in 2025 with as many as 207 vessels involved in the construction of expected future wind energy projects. However, this increase must be considered relative to the baseline level of vessel traffic in the geographic analysis area (Appendix D, Table D-1). Sea turtles are less adept at detecting sound compared to faunal groups like marine mammals and no injury or behavioral effects from vessel noise are anticipated for future offshore wind projects. Although sea turtles could become habituated to repeated noise exposure over time (Hazel et al. 2007), vessel noise effects for future wind development projects are expected to be broadly similar to noise levels from existing vessel traffic in the region. Nonetheless, periodic localized, short-term behavioral impacts on sea turtles could occur. Based on sea turtle responses to other types of disturbance (e.g., Bevan et al. 2018) turtle behavior is expected to return to normal when vessel noise dissipates. Given turtles' limited sensitivity to underwater noise produced by vessels, the temporary nature of any behavioral responses, and the patchy distribution of sea turtles throughout the geographic analysis area, the effects of vessel noise from future offshore wind activities would be negligible. No population-level effects would occur.

Noise from Dredging, Trenching, and Cable-Laying

Preparing a lease area for turbine installation and cable-laying may require jetting, plowing, or removal of soft sediments, as well as the excavation of rock and other material through various dredging methods. Cable installation vessels are likely to use dynamic positioning systems while laying the cables. The sound associated with dynamic positioning generally dominates other sound sources present especially in the situation of cable-laying. A description of the physical qualities of these sound sources can be found in Appendix B, *Supplemental Information*. Given the low source levels and transitory nature of these sources, exceedance of PTS and TTS levels are not likely for sea turtles (Heinis et al. 2013), and behavioral disturbances would be low intensity, localized, and result in negligible impacts on sea turtles.

Noise from Aircraft

Several different types of aircraft may be used during initial site surveys, protected species monitoring prior to and during construction, facility monitoring, and crew transfers during construction. Sea turtle sensitivity to airborne noise is not well studied, but available information indicates potential disturbances would be minimal. Bevan et al. (2018) observed no evident behavioral responses from sea turtles exposed to drones flown directly overhead at altitudes ranging from 59 to 102 feet (18 to 31 meters). Aircraft traveling at relatively low altitude can elicit stress or behavioral responses such as diving, swimming away, or altered dive patterns (Samuel et al. 2005). Aircraft would operate at altitudes of 1,000 feet (305 meters) or more except when landing or departing from service vessels. NMFS (2016) determined that noise and disturbance effects on sea turtles from aircraft operations for a single offshore wind project would be negligible, and effects from aircraft use during multiple projects within the geographic analysis area would similarly be expected to be negligible as these noises are not expected to overlap in time or space.

Noise from WTG Operations

No notable effects on sea turtles are anticipated from non-impulsive noise produced by WTG operation. Noise associated with operational WTGs would be expected to attenuate below ambient levels at a relatively short distance from WTG foundations (Miller and Potty 2017; Thomsen et al. 2015; Tougaard et al. 2009). Maximum anticipated noise levels produced by operational WTG are estimated to be between 125 and 130 dB re 1 μPa m (Lindeboom et al. 2011; Tougaard et al. 2009), and HDR (2019) measured SPL below 120 dB re 1 μPa at 164 feet (50 meters) from operating turbines at the Block Island Wind Farm, which are below recommended thresholds for sea turtle injury and behavioral disturbance (Finneran et al. 2017). Current generation WTGs use direct drive motors that produce even lower noise levels than earlier generation technologies considered in prior studies (BOEM 2019). Sea turtles appear to habituate to repetitive underwater noise not accompanied by an overt threat (Bartol and Bartol 2012; Hazel et al. 2007; U.S. Department of the Navy 2018). This suggests that even if WTGs generate noise detectable to sea turtles in the immediate proximity, the exposed individuals are not expected to experience measurable adverse effects. Therefore, the effects of operational noise from future offshore wind projects on sea turtles would be negligible at both individual and population levels.

Port utilization: Port expansions could increase the total amount of disturbed benthic habitat and result in impacts on some sea turtle prey species. However, given that port expansions would likely occur in subprime areas for foraging and the disturbance would be relatively small in comparison to the overall sea turtle foraging areas in the geographic analysis area, port expansions are not expected to affect sea turtles. Dredging for port facility improvement could lead to additional impacts on turtles from incidental entrainment, impingement, or capture. Dredging impacts on sea turtles are relatively uncommon; most observed injury and mortality events in the U.S. were associated with hopper dredging in and around core habitat areas in the southern portion of the geographic analysis area and in the Gulf of Mexico outside the geographic analysis area (Michel et al. 2013; NMFS 2020). Ongoing maintenance dredging of these facilities may increase related risks to individual turtles over the lifetime of the facilities; however, typical mitigation measures such as timing restrictions should minimize this potential. Additionally, the size, scope, and location of the dredging activities conducted for offshore wind projects would be less than that identified for other projects such as beach nourishment or port deepening, and the type of equipment used reduces the risk of entrainment or impingement. Compared to the dredging activities for planned offshore wind projects, navigation dredging projects, which occur primarily in channels close to shore, generally pose a greater risk of entrainment of sea turtles because of their tendency to concentrate in channels (Ramirez et al. 2017). For example, the number of sea turtles entrained by hopper dredging in BOEM offshore borrow areas has historically been relatively low when compared to navigation channel dredging (Ramirez et al. 2017). Between 1995 and 2015, there were 69 reported sea turtle takes in the North Atlantic (i.e., north of North Carolina) by trailing suction hopper dredges, versus approximately 260 taken in hopper dredges operating in the South Atlantic. The takes per project across the entire South Atlantic were estimated to be 0.96 (the North Atlantic was not analyzed). Therefore, given the extent of and location of navigation projects using hopper dredges, the limited amount of dredging conducted as part of the Proposed Action is not expected to result in population effects as few to no takes of sea turtles would reasonably be expected. The risk of injury or mortality to individual sea turtles resulting from dredging associated with future offshore wind projects exclusive of the Proposed Action is low and population level effects are unlikely to occur.

Presence of structures: The addition of more than 3,081 new offshore structures (WTGs and OSSs) in the geographic analysis area could result in hydrodynamic changes; obstructions that cause loss of fish gear resulting in entanglement or ingestion by sea turtles; habitat conversion from open-water pelagic and benthic soft substrates to structurally complex, mid-water and benthic hard bottom; new areas of prey aggregation; avoidance or displacement; and behavioral disruption.

The presence of tall vertical structures like WTG and OSS foundations could alter local hydrodynamic patterns at a fine scale. Water flows are reduced immediately downstream of foundations but return to ambient levels within a relatively short distance (Miles et al. 2017). The downstream area affected by reduced flows is dependent on pile diameter. For monopiles (i.e., the structures with the largest diameter), effects are expected to dissipate within 300 to 400 feet. Although effects from individual structures are highly localized, the presence of an estimated 3,081 offshore structures associated with ongoing and planned offshore wind activities (not including the Proposed Action) could result in regional impacts on wind wave energy, mixing regimes, and upwelling (van Berkel et al. 2020). These localized and regional alterations to hydrodynamics could have impacts on sea turtle prey species. Hydrodynamic alterations due to the presence of WTGs could increase primary productivity in the vicinity of the structures (Carpenter et al. 2016). However, such an increase would be highly localized and the increased productivity may be consumed by filter feeders colonizing the structures (Slavik et al. 2019) rather than leading to increased prey abundance for sea turtles.

The long-term effects of offshore structure development on ocean productivity and sea turtle prey species, and therefore sea turtles, are difficult to predict with certainty because they are expected to vary by location, season, and year depending on broader ecosystem dynamics. For example, the presence of new hard surfaces could increase the abundance of associated organisms (e.g., mussels, crustaceans) on and around the structures, providing an aggregation of new prey resources for sea turtles. Increased primary and secondary productivity in proximity to hard-bottom structures could increase the abundance of prey species like jellyfish (English et al. 2017). Additionally, hard bottom (scour control, cable protection) and vertical structures (WTG and OSS foundations) in a soft bottom habitat can create a three-dimensional artificial reef structure, thus inducing the “reef effect” and resulting in higher densities and biomass of mollusks, fish, and decapod crustaceans (Causon and Gill 2018; Taormina et al. 2018). Recent studies have found increased biomass for benthic fish and invertebrates, and possibly for pelagic fish, sea turtles, and birds as well (Raoux et al. 2017; Pezy et al. 2018; Wang et al. 2019) indicating that offshore wind facilities can generate beneficial long-term impacts on local ecosystems, translating to increased foraging opportunities for sea turtle species. Sea turtles may also use vertical structures for shelter from strong currents to conserve energy and for cleaning their shells (Barnette 2017). In contrast, increased fish biomass around the structures could attract commercial and recreational fishing activity, creating an increased risk of injury or mortality from gear entanglement and ingestion of debris (Berreiros and Raykov 2014; Gregory 2009; Vegter et al. 2014). Additionally, although sea turtle prey may be aggregated through the reef effect, it may also aggregate sea turtle predators, including sharks (Paxton et al. 2020). Although the potential for increased predation risk associated with the presence of structures may affect individual sea turtles, it is not expected to result in population-level effects given the localized scale of artificial reef effects compared to the geographic range of sea turtles.

Some level of displacement of sea turtles from future wind farm lease areas into areas with a higher potential for interactions with ships or fishing gear could occur. However, the addition of structures could locally increase pelagic productivity and prey availability for sea turtles and decrease the likelihood of long-term displacement from the wind farm lease areas. While the effect would be present long term throughout the life of future offshore wind projects, the overall impact of displacement of individual sea turtles from wind farm lease areas is not expected to result in population-level effects for any sea turtle species.

Vessel traffic: Vessel strikes are a concern for sea turtles. The percentage of loggerhead sea turtles with reported strandings due to vessel strikes increased from approximately 10 percent in the 1980s to 20.5 percent in 2004 (NMFS and USFWS 2007). Sea turtle strandings reported to have vessel strike injuries have been reported to be as high as 25 percent in Chesapeake Bay, Virginia (Barco et al. 2016), and Foley et al. (2019) reported that roughly one-third of stranded sea turtles in Florida had injuries indicative of a vessel strike. Sea turtles are expected to be most susceptible to vessel strikes in shelf waters where they forage (Barkaszi et al. 2021). Furthermore, they cannot reliably avoid being struck by vessels traveling in excess of 2 knots (3.7 km/h) (Hazel et al. 2007); typical vessel speeds in the geographic analysis area may exceed 10 knots (18.5 km/h). Up to 207 vessels associated with offshore wind development may be operating in the geographic analysis area during the peak construction period in 2025 (BOEM 2019) (Appendix D, *Planned Activities Scenario*, Table D-1). Increased vessel traffic could result in a higher number of vessel strikes, resulting in injury or mortality of individual sea turtles. However, despite the potential for individual fatalities, potential impacts are localized and no population-level impacts on sea turtles are expected. It is expected that planned offshore wind projects will adhere to vessel speed restrictions, minimization measures for vessel impacts, and visual monitoring which, while geared primarily towards marine mammals, will help reduce the risk of a strike occurring which results in a serious injury or mortality. PSO sightings data indicate sighting rates for sea turtles during vessel operations were approximately 13 sea turtle detections per 100 hours of vessel effort (Marine Ventures International, Inc. 2022; RPS 2021). These detection rates are relatively high, and even with these high detection rates there were only 18 vessel strike mitigation actions required (2.8 percent of all sea turtle detections) and no strikes reported. With the implementation of these measures, impacts are expected to be minor.

3.5.7.3.3 Impacts of Alternative A on ESA-Listed Species

As noted in Section 3.5.7.1, Description of the Affected Environment and Future Baseline Conditions, all sea turtle species that are expected to occur regularly in the Offshore Project area are listed as either threatened or endangered under the ESA. Therefore, the impacts of the No Action Alternative previously described in *Future Offshore Wind Activities (without Proposed Action)*, apply to the ESA-listed sea turtle species in the Project area.

3.5.7.3.4 Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, ongoing activities would result in a range of temporary to long-term impacts (temporary disturbance, long-term displacement from wind farm lease areas, PTS, mortality, and reduced foraging success) on sea turtles, primarily from exposure to construction-related underwater noise, vessel activity (vessel strike), and changes in habitat from presence of new structures acting as artificial reefs and altering hydrodynamics. Ongoing activities are expected to continue to result in **minor** impacts on sea turtles. Although impacts on individual sea turtles and their habitat are anticipated, impacts are not likely to lead to population-level effects.

Cumulative Impacts of Alternative A – No Action. Under Alternative A, existing environmental trends and ongoing activities would continue in addition to impacts from planned offshore wind and non-offshore wind activities. Sea turtles would continue to be affected by natural and human-caused IPFs. BOEM anticipates that cumulative effects of the No Action Alternative, including all ongoing and planned offshore wind and non-offshore wind activities, would result in **minor** impacts on sea turtles, largely due to impact pile-driving and UXO detonation noise, the presence of structures, interactions with fishing gear, and vessel traffic. Additionally, the presence of structures could contribute potentially beneficial impacts on some sea turtle species, though these effects may be offset by increased interactions with fishing gear associated with the presence of structures. Offshore wind activities would be responsible for most of the impacts associated with pile-driving and UXO detonation noise, while non-offshore wind activities would be responsible for most of the impacts associated with vessel traffic and interactions with fisheries gear; considering all activities together, these could lead to minor impacts on sea turtles in the geographic analysis area. However, overall, this conclusion assumes mortality of individual sea turtles would not have negative significant consequences at the population level, and that any population-level effects would be recoverable and would not affect stock or population viability.

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

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

- The number, size, and location of WTGs;
- The number, size, and location of OSSs, including foundations and scour protection;
- The number and location of inter-array cables, OSS cables, and offshore export cables, including landfall and scour protection;
- The number of simultaneous vessels, number of trips, and size of the vessels;
- The number, size, and location of WTGs as they relate to hardened structure; and
- The vessels and gear utilized to sample environmental parameters in the Project area through HRG surveys, fisheries, and biological monitoring plans.

Variability of the Project design exists as outlined in Appendix C. A summary of potential variances in impacts is provided below.

- The number, size, and location of WTGs and OSSs, all installed by pile driving, which are factors that contribute to the intensity and duration of noise resulting in behavioral and physiological effects (TTS), or cause auditory injury (PTS) to sea turtles;
- The number and location of inter-array cables, OSS cables, and offshore export cables;
- Variability in installation methods of OSSs and cables; and
- The number of simultaneous vessels, number of trips, and size of the vessels could affect vessel 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 number, size, and location of WTGs as it relates to hardened structure, 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.

3.5.7.5 Impacts of Alternative B – Proposed Action on Sea Turtles

3.5.7.5.1 Impacts of Alternative B – Proposed Action

The following sections summarize the potential impacts of the Proposed Action on sea turtles during the various phases of the Project. Routine activities would include construction, O&M, and conceptual decommissioning of the Proposed Action, as described in Chapter 2, *Alternatives*. BOEM prepared a BA for the potential effects on NMFS federally listed species, which found that the Proposed Action may adversely affect sea turtles (BOEM 2024). Consultation with NMFS pursuant to Section 7 of the ESA concluded June 18, 2024.

The analysis of impacts under the No Action Alternative, and references therein, applies to the following discussion of the Proposed Action. The most impactful IPFs associated with the Proposed Action are underwater noise from impact pile driving, which could cause temporary impacts during foundation installation for the WTGs, OSSs, and Met Tower (119 days over 3 years); the presence of structures, which could lead to increased interactions with fishing gear; and increased vessel traffic, which could lead to injury or mortality from vessel strikes.

Construction and Installation

Onshore Activities and Facilities

As described in Section 3.5.7.1, there are no know nesting locations in or near the onshore facility locations (COP, Volume I, Section 2.6; US Wind 2024), so onshore construction and installation activities for the Proposed Action are not expected to contribute to IPFs for sea turtles.

Offshore Activities and Facilities

Accidental releases: During construction and operation of the Project there could be a short-term risk of sanitary and other waste fluids or fuels and other petrochemicals accidentally entering the water from vessels operating during Project activities. If sea turtles were exposed to an oil spill or discharge of waste material, potential impacts would be the same as those discussed in Section 3.5.7.3. Any nonroutine spills or accidental releases that could result in negligible and short-term impacts on surface water resources would be avoided or minimized through the implementation of the Project Oil Spill Response Plan and other environmental protection measures (COP, Volume II, Section 10.3; US Wind 2024). Impacts on sea turtles from accidental spills or pollutant releases are considered minor because of the low probability of accidents and mitigation measures that will be implemented. Trash and debris from Project-related vessels that enters the water also represents a risk factor to sea turtles because they could ingest or become entangled in debris, causing lethal or injurious impacts. Plastic materials (e.g., plastic bags) are often mistaken for prey (e.g., jellyfish, salps) and ingested, which can block the turtles' intestinal tracts, causing injury or mortality. Personnel working offshore would receive training on sea turtle awareness and marine debris awareness (Appendix G, *Mitigation and Monitoring*) in addition to other proposed measures which would lower the probability of such risk. Therefore, impacts from accidental releases on sea turtles are expected to be negligible for the Proposed Action.

Cable emplacement and maintenance: New cable emplacement or maintenance activities could affect benthic prey items for sea turtles within the Project area that through seafloor disturbance associated with installation of the offshore export cables and inter-array cables. This disturbance would be short-term and prey species would be expected to return to the area once the cables are installed (Section 3.5.5). Similar levels of impact would be realized during cable maintenance. While trailing hopper suction dredgers are being considered for use for the Proposed Action, seabed preparation such as leveling, pre-trenching, or boulder removal are not expected to be required. Additionally, the potential risks of sea turtle entrainment if these equipment are used for the Proposed Action would be low as discussed in Section 3.5.7.3. Because impacts during cable installation or maintenance would be temporary and localized, the impact of Project activities on sea turtles would be negligible for the Proposed Action.

Gear utilization (biological/fisheries monitoring surveys): US Wind will conduct pre-construction, during construction, and post-construction fisheries resource monitoring surveys. These surveys will result in an increase the amount of fishing gear in the water. The fisheries resource monitoring program will consist of two components: 1) a commercial ventless pot survey and 2) a recreational charter fisheries survey using bottom drift and jig angling techniques. Surveys will be conducted in water depths greater than 65 feet (20 meters) and characterized by a soft sediment bottom type.

The commercial ventless pot survey will be conducted with pots spaced proximate and distant to turbine structures to capture both turbine- and project-scaled changes in black sea bass catch rates. The ventless pot surveys will be conducted monthly between March and November, consisting of six sets (four in the Project area and two in an adjacent control area) of 15, 40-inch commercial pots each. All sets will use ropeless EdgeTech devices to eliminate the use of buoy lines. Pots will be soaked without bait for a single night and recovered the following day.

The recreational charter fisheries survey will consist of six monthly surveys (May through October) in each sampling year using standard angling techniques to obtain catch rates at two reference artificial reef sites and at two sites where turbine foundations will be constructed. For each month, one control and one turbine site are visited per day across two days, with the order of site visits randomized within a day and all sites visited within a 2-day window. Effort will consist of a 3-minute drop, with each site fished for 45 minutes (15 drops/angler). At each site, a jigging trial is conducted for a 15-minute period prior to the onset of the drift, near-bottom angling.

Implementation of monitoring and mitigation measures under the Proposed Action would help reduce entanglement or capture risk for sea turtles in Project-related fisheries monitoring surveys. Ropeless gear technology (i.e., EdgeTech acoustic release devices) will be used for all pot surveys, which eliminates the use of vertical buoy lines in the water column. This effectively reduces the entanglement risk for sea turtles. Furthermore, the short soak time (less than 24 hours) for gear further lowers the potential co-occurrence rate between sea turtles and fisheries monitoring gear, thereby reducing the overall entanglement risk. Sea turtles may also be at risk of entanglement in angling-type fishing gear (i.e., hand or hook-and-line), such as that used for the recreational fisheries survey. However, all recreational fishing gear will be hand-tended during the surveys by dedicated anglers, who would monitor the line while it is in the water. Several monitoring and mitigation measures are designed to standardize sea turtle handling and reporting procedures in response to an entanglement (Appendix G, *Mitigation and Monitoring*). Notably, these measures would improve response and potential survival of released live animals if an entanglement or interaction with gear were to occur.

As discussed in Section 3.5.7.3.1, any sampling that utilizes in-water gear may pose an entanglement or capture risk to sea turtles. However, given the relatively limited extent and duration of these surveys and the application of monitoring and mitigation measures (e.g., ropeless gear technology, soak time limits, and standardized handling methods), entanglement as a result of the Proposed Action, if it were to occur, is not likely to lead to population-level effects. The impact of gear utilization as a result of the Proposed Action, therefore, is expected to be minor for sea turtles.

Lighting: The Proposed Action would generate lighting associated with construction vessels, which would increase artificial lighting in the marine environment. Though vessel-related lighting impacts would be localized and temporary, it could lead to attraction, avoidance, or other behavioral responses in sea turtles. BOEM anticipates that lighting effects on sea turtles, however, would be negligible.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects on sea turtles are impact pile driving (installation of WTG and OSS foundations), geophysical surveys (HRG surveys), vessel traffic, aircraft, cable laying or trenching and dredging during construction. UXO detonations are not included under the Proposed Action and will not be discussed in this section (US Wind 2024). Project construction activities could generate underwater noise and result in auditory injury (i.e., PTS), behavioral disturbance, and masking effects on sea turtles.

Assessment of the potential for underwater noise to injure or disturb a sea turtle requires acoustic thresholds against which received sound levels can be compared. Noises are less likely to disturb or injure an animal if they are at frequencies at which the animal cannot hear well. Acoustic thresholds used for the purpose of predicting the spatial extent of potential noise impacts on sea turtles and subsequent management of these impacts aim to account for the duration of exposure (Finneran et al. 2017). The most widely accepted thresholds are provided by Finneran et al. (2017) and are summarized in Table 3.5.7-3.

Table 3.5.7-3. Acoustic thresholds for sea turtles for each type of impact and noise category

Impact	Impulsive Noise Threshold	Non-impulsive Noise Thresholds
PTS	L_{pk} 232 dB re 1 µPa	SEL_{24h} 220 dB re 1 µPa^2 s
PTS	SEL_{24h} 204 dB re 1 µPa^2 s	SEL_{24h} 220 dB re 1 µPa^2 s
TTS	L_{pk} 226 dB re 1 µPa	SEL_{24h} 200 dB re 1 µPa^2 s
TTS	SEL_{24h} 189 dB re 1 µPa^2 s	SEL_{24h} 200 dB re 1 µPa^2 s
Behavioral Disturbance	SPL 175 dB re 1 µPa	

Source: Finneran et al. 2017
dB re 1 µPa = decibels referenced to 1 micropascal; dB re 1 µPa^2 s = decibels referenced to 1 micropascal squared second; L_{pk} = peak sound pressure level; SEL_{24h} = sound exposure level over 24 hours; SPL = root-mean-square sound pressure level

The assessment of underwater noise in this Final EIS uses modeling and exposure estimates presented in the COP and accompanying underwater noise acoustic assessment report (Volume II, Appendix H1; US Wind 2024).

Noise from Offshore Impact Pile-driving

Noise from impact pile driving for the installation of WTGs, OSSs, and Met Tower foundations would occur intermittently during the installation of offshore structures. Impact pile driving would be used for three pile types: 36.1-foot (11-meter) monopiles for the WTG, 9.8-foot (3-meter) skirt piles for the OSSs, and 5.9-foot (1.8-meter) monopiles for the Met Tower. The maximum hammer energy was assumed to be 4,400 kJ for the 36.1-foot (11-meter) monopiles, 1,500 kJ for the 9.8-foot (3-meter) skirt piles, and 800 kJ for 5.9-foot (1.8-meter) pin piles, and the modeling assumed the maximum strike energy was used for each strike during the pile-driving progression (Appendix II-H1; US Wind 2024). The estimated duration is 120 minutes for impact pile driving of the monopile assuming one pile is installed per day, 480 minutes per day for the skirt piles assuming up to four would be installed per day, and up to 360 minutes per day for the pin piles assuming up to three would be installed per day (Appendix II-H1; US Wind 2024). Consistent with the anticipated NMFS requirements for an LOA, US Wind will implement at least two functional noise abatement systems, such as double bubble curtains and nearfield attenuation devices, to reduce noise levels to the modeled harassment isopleths, assuming 10-dB attenuation, during all impact pile driving for monopile foundations. A double bubble curtain is system of two compressed air systems (air bubble barriers) laid in concentric rings around the source for sound absorption in water. Air is pumped from a separate vessel with compressors into nozzle hoses lying on the seafloor and it escapes through holes that are provided for this purpose. The double layer of air bubbles provides physical barriers to underwater noise which helps reduce the overall level of noise that propagates through the water column. These technologies are expected to achieve at least 10 dB noise reduction from impact pile-driving activities relative to modeled levels. However, BOEM considers 10 dB the most realistic level of noise reduction to achieve during these activities with these systems so the impact assessment in this Final EIS applies the modeled threshold ranges with 10 dB noise reduction applied (COP, Volume II, Appendix H1; US Wind 2024). Results of the acoustic modeling using the threshold ranges provided in Table 3.5.7-3 with 10 dB noise mitigation for impact pile-driving scenarios are summarized in Table 3.5.7-4.

Table 3.5.7-4. Summary of underwater acoustic modeling conducted for the Project COP

Scenario	Distances to PTS Threshold (L_{pk}) (meters)	Distances to PTS Threshold (SEL_{24h}) (meters)	Distance to Behavioral Threshold (SPL) (meters)
Impact pile driving, one 11-meter monopile (10 dB noise attenuation)	<50	250	850
Impact pile driving, four 3-meter skirt piles (10 dB noise attenuation)	<50	50	0
Impact pile driving, three 1.8-meter pin piles (10 dB noise attenuation)	<50	0	0

L_{pk} = peak sound pressure level in units of dB referenced to 1 micropascal; SEL_{24h} = sound exposure level over 24 hours in units of dB referenced to 1 micropascal squared second; SPL= root-mean-square sound pressure level in units of dB referenced to 1 micropascal; PPW = phocid pinniped in water PTS = permanent threshold shift

Noise produced by impact pile driving during installation of both the WTG and OSS foundations are unlikely to result in PTS for any sea turtles, but may result in behavioral disturbances during impact pile driving. As summarized in Table 3.5.7-4 ranges to the PTS thresholds for impact pile driving estimated with 10-dB of noise attenuation may extend up to 820.2 feet (250 meters) for the installation of one 36.1-foot (11-meter) monopile per day and up to 164.0 feet (50 meters) for the installation of four 9.8-foot (3-meter) pin piles per day. The PTS thresholds for sea turtles will not be met during installation of up to three 5.9-foot (1.8-meter) pin piles per day (Table 3.5.7-4). These ranges are small enough that the risk of PTS occurring for sea turtles is low, and with the proposed mitigation outlined for impact pile driving such as clearance of the ensonified area, soft-start procedures, daytime only pile-driving, and shutdown procedures if a species enters their defined exclusion zone and it is safe and technically feasible for the Project to stop pile driving (Appendix G, *Mitigation and Monitoring,* Table G-1), PTS is not likely to be realized for any sea turtle.

Behavioral and masking effects are more difficult to mitigate but the ranges to the behavioral threshold are only estimated to extend to a maximum of 2,788.7 feet (850 meters) so there is a low risk of any severe behavioral responses occurring during impact pile driving. The Proposed Action includes installation of up to 121 WTGs (PDE), 4 OSSs, and 1 Met Tower, which would equate to approximately 126 days of impact pile driving (assuming one WTG monopile, four OSS pin piles, and three Met Tower pin piles are installed per day), so the duration of noise-producing activities is expected to be relatively short. However, the Proposed Action includes a mitigation measure of a 1 nautical mile (1.9 kilometer) setback from the TSS from Delaware Bay which would remove seven WTG locations and would equate to approximately 119 days of impact pile driving (TRC 2023a). Sea turtles may temporarily avoid the Project area, but behaviors would be expected to return to normal after construction, and no long-term impacts that would affect stock or population viability. Impacts from impact pile driving on sea turtles would be **minor**.

Noise from Inshore Impact Pile-driving

Impact pile driving activities may occur inshore during construction to support the development and retrofitting of the proposed O&M Facility. Construction at the O&M Facility will include pile driving associated with the proposed sheet steel bulkhead and pile supported fixed pier. It is anticipated up to 170, 12-to-18-inch (30.5 to 45.7 centimeters) diameter steel pipe piles will be installed using impact pile driving over an approximate 6-month period; up to 240, 12-to-18-inch (30.5 to 45.7 centimeters) diameter timber fender system piles will be installed using impact pile driving over an approximate 6-month period; and up to 120 sheet piles will be installed using impact pile driving for the bulkhead over an approximate 3-month period.

The NMFS Multi-Species Pile Driving Calculator Tool (NMFS 2023c) was used to in the NMFS BA (BOEM 2024) estimate ranges to the thresholds for sea turtles. Results from the calculator tool indicate PTS ranges for sea turtles may be met or exceeded within <1 foot (<1 meter) from the source for both the 12- to 18-inch steel piles and timber piles; and within 9 feet (3 meters) from the source for the sheet piles based on the SEL_{24h} metric. Noise levels may exceed the SPL 175 dB re 1 µPa behavioral disturbance threshold for sea turtles within 1.8 feet (0.5 meters) from the 12- to 18-inch steel piles; 1 feet (0.3 meters) from the 12- to 18-inch timber piles; and 15 feet (5 meters) from the sheet piles.

The Project O&M Facility is set to be established in Worcester County, Maryland, Ocean City or the unincorporated West Ocean City area on the mainland. Positioned inshore, this location is not anticipated to overlap with established sea turtle nesting sites (Section 3.5.7.1). While instances of sea turtle nesting and strandings have been noted near nearshore beaches, it's essential to emphasize that inshore pile driving activities will be limited to inshore waters. Therefore, sea turtles are not expected to occur within the inshore location of the proposed O&M facility where pile driving activities would occur. Moreover, both BOEM and the USACE will ensure that US Wind comprehensively monitors the entire area where noise levels exceed the 175 dB re 1 µPa behavioral disturbance threshold for sea turtles. This monitoring will extend throughout all pile driving activities and for 30 minutes following their conclusion, with detailed records maintained to document any observed instances of take. Additionally, a 164-foot (50-meter) shutdown zone will be implemented for sea turtles, fully covering the expected ranges for PTS and behavioral disturbance associated with these pile types.

Given the small ranges to both the PTS and behavioral disturbance thresholds estimated by the calculator tool (NMFS 2023k) and unlikely occurrence of sea turtles inshore around the proposed location of the O&M Facility, impacts on sea turtles during inshore pile driving would be negligible.

Noise from Geophysical Surveys

HRG survey equipment would likely be used during pre-construction surveys to support design finalization. This equipment produces noise in the 1.1 to 200 kilohertz frequency range at sound levels that may exceed sea turtle behavioral thresholds. No injurious impacts are expected for sea turtles from any HRG survey equipment (Baker and Howsen 2021). Behavioral disturbances may occur up to 295 feet (90 meters) from impulsive sources and up to 6.6 feet (2 meters) from non-impulsive sources assuming equipment are operating at the highest power settings (Baker and Howsen 2021). Some low-level behavioral disturbances could occur during Project-related HRG surveys; however, implementation of mitigation measures (Appendix G) and the relatively short duration of these surveys would reduce the risk of exposure. Impacts from HRG surveys on sea turtles are therefore expected to be negligible for the Proposed Action.

Noise from Vessels

Underwater noise levels produced by construction and maintenance vessels throughout the life of the Project are not expected to exceed PTS thresholds for sea turtles. The main frequency range of vessels (10 to 1,000 hertz) overlaps with the frequency range of sea turtle hearing (100 to 1,200 hertz) (Ketten and Bartol 2006; Lavender et al. 2014); sea turtles can detect vessel noise and could respond with a startle or temporary stress response (NSF and USCG 2011). However, sea turtles may also habituate to vessel traffic associated with the Project as they inhabit areas that experience regular marine traffic (Hazel et al. 2007). A conservative assumption is that Project construction and support vessels could elicit behavioral changes in individual sea turtles present in the Project area during vessel operations, but these changes would be limited to evasive maneuvers such as diving, changes in swimming direction, or changes in swimming speed. These changes are not expected to be biologically notable and impacts on sea turtles from Project vessel noise would therefore be negligible for the Proposed Action.

Noise from Aircrafts

Currently, US Wind does not anticipate the use of any aircraft for Project Activities (COP, Volume I, Section 4.0; US Wind 2024).

Noise from Cable Laying or Trenching

During Project construction, jetting, plowing, or removal of soft sediments may be required prior to installation of the WTG, OSS, and Met Tower foundations, and installation of the inter-array cable and export cable. As described in Section 3.5.7.3, these activities may result in behavioral disturbances for some sea turtles, though these are expected to be low intensity and localized (Heinis et al. 2013). Additionally, because activities associated with the Proposed Action are expected to be short-term and localized, and impacts on all sea turtles from dredging or trenching activities during cable laying would be expected to be negligible.

Noise from Foundation Relief Drilling

Drilling activities may be used during installation of the WTG foundations in the unlikely event that pile refusal occurs prior to meeting the target embedment depth for the piles. Drilling would be used removal of soils, boulders, or other obstructions from the pile to ensure the foundation is safely and securely installed in the seabed (COP, Volume I, Section 3.3.2; US Wind 2024). Drilling activities may produce SPL of 140 dB re µPa at 3,281 feet (1,000 meters) (Austin et al. 2018). This would exceed the continuous noise threshold of 120 dB re 1 µPa beyond 3,281 feet (1,000 meters), but these events are expected to be short term, which limits the risk of sea turtles potentially present during construction.

While behavioral responses may occur from drilling, they are expected to be short-term and of low intensity. Impacts from potential drilling activities on all sea turtles would therefore be negligible.

Port utilization:

US Wind's proposed use of the primary port facilities located in Baltimore (Sparrows Point), Maryland; Ocean City, Maryland; Gulf of Mexico (e.g., Ingleside, Texas or Houma, Louisiana or Harvey, Louisiana); and Brewer, Maine are considered under the Proposed Action. Baltimore (Sparrows Point), Maryland and Ocean City, Maryland, would increase vessel traffic in the area and potentially require expansion or increased maintenance of port facilities within the sea turtle geographic analysis area. Expansion could result in adverse effects on coastal and estuarine habitats from shoreline noise during construction and disturbance or loss of habitat for prey species. However, the Greater Baltimore area has significant marine infrastructure and port facilities to support offshore wind projects, and extensive port expansions are not considered likely at this time. Alternate construction ports that would be used for support services, delivery, storage, pre-assembly, fabrication, assembly of components, and load out to feeder or installation vessel include Port Norris, New Jersey; Lewes, Delaware; Cape Charles, Virginia; Hampton Roads area, Virginia; Port of New York/New Jersey; Charleston, South Carolina; Delaware River and Bay (e.g., Paulsboro, New Jersey; Hope Creek, New Jersey; and Wilmington, Delaware) (COP, Volume I, Table 3-1; US Wind 2024).

Increased maintenance such as dredging could expose sea turtles to increased levels of underwater noise, increased turbidity, and entrainment risk, affecting individual sea turtles or their prey. Increased activities associated with port expansion and port maintenance would likely be intermittent but long term. Increased noise associated with dredging was discussed previously under the *Noise* IPF, and vessel traffic associated with the specified ports is covered in the *Traffic* IPF section. However, as discussed in Section 3.5.7.3, most dredging impacts on sea turtles were associated with hopper dredging in the southeastern U.S. and Gulf of Mexico (Michel et al. 2013; USACE 2020) which is used for dredging projects that have a much larger scope than what would be associated with the Proposed Action. Additionally, most sea turtles occurring in the area would be migrating or foraging offshore, and while one species has been documented nesting in Maryland, nesting locations primarily in Virginia south of the Project area (Section 3.5.7.1). Therefore, dredging impacts on sea turtles from port utilization during Project construction would be negligible for the Proposed Action.

Traffic: Many vessels will be required to support activities carried out during the construction and installation phase of the Project. Specific vessels are required for surveying activities, foundation installation, OSS installation, cable installation, WTG installation, and support activities. Vessels are expected to have conventional propeller- or thruster-based propulsion systems. Smaller vessels designed primarily for crew transfer applications may use water jet-drive based systems. The COP (Volume I, Table 4-1; US Wind 2024) details the anticipated vessels to be used during construction activities.

Existing vessel traffic in the immediate vicinity of the Lease Area is mainly composed of deep-draft vessels, with a smaller proportion of fishing vessels, based on AIS data (COP, Volume II, Appendix K1; US Wind 2024). Cargo/carrier and tanker vessels mainly follow the designated TSS when entering and leaving Delaware Bay, which predominantly passes to the north of the Lease Area. However, vessel traffic at the southern terminus of the TSS spread out and pass through the Lease Area, though this traffic is mainly limited to the furthest east, offshore portion of the Lease Area and aligned in a north-south direction (COP, Volume II, Appendix K1; US Wind 2024). Commercial fishing as well as pleasure/recreational vessel activity within the Lease Area is sparce and mainly constitutes transits from Ocean City, Maryland, to fishing grounds east of the Lease Area. Other vessels (with AIS) that utilize the waters of the Lease Area include tug, cruise/ferry, and other non-categorized vessels. In total, 3,547 vessel transits traversed the Lease Area in 2019, with an average of 9.7 transits per day; the highest density of these transits occur in the eastern portion of the Lease Area (COP, Volume II, Appendix K1; US Wind 2024). In comparison, directly north of the Lease Area is the Entrance to Delaware Bay, which has an average of 24.5 transits per day (COP, Volume II, Appendix K1; US Wind 2024). When considering vessel traffic in the vicinity of the Lease Area (defined as within 4.3 nautical mile [8 kilometer] of the Lease Area), 8,288 annual transits were recorded in 2019, which is equivalent to approximately 22.7 transits per day (COP, Volume II, Appendix K1; US Wind 2024). These data indicate relatively high levels of regional baseline traffic in the vicinity of the Project area.

Based on information provided by US Wind, construction activities (including offshore installation of WTGs, substations, array cables, interconnection cable, and export cable) would require up to 39 simultaneous construction vessels. In total, the Proposed Action would generate approximately 2,343 round trip vessel transits during the 3-year construction and installation phase and approximately the same number of vessel trips per year during decommissioning as during construction and installation. The vessels that would be used for Project construction are described in the COP (Volume I, Table 4-1; US Wind 2024). WTG, OSS, and foundation components may be supplied and transported to a staging area in Baltimore, Maryland, from ports in Europe or the Gulf of Mexico; this would be accomplished using a mix of heavy lift and general cargo vessels undergoing up to five round trips per construction year (COP, Volume I, Section 3.0; US Wind 2024).

PSOs for offshore wind site investigation surveys have reported sightings of sea turtles during vessel transits and survey operations (Marine Ventures International, Inc. 2022; RPS 2021). The RPS (2021) report recorded 75 leatherback sea turtles, 470 loggerhead sea turtles, and 83 unidentified turtles over a 2-year period totaling roughly 4,893 observation hours which equates to approximately 13 sea turtle detections per 100 hours of survey and vessel effort. These detection rates are relatively high, and even with these high detection rates there were only 18 vessel strike mitigation actions required (2.8 percent of all sea turtle detections) and no strikes reported.

If a vessel strike does occur, the impact on the individual sea turtles could result in a serious injury or mortality, depending on the severity of the strike. As discussed in Section 3.5.7.3, vessel strikes are an increasing concern for sea turtles with the number of stranded turtles showing vessel strike injuries having increased substantially in the last few decades (NMFS and USFWS 2007; Barco et al. 2016; Foley et al. 2019). However, US Wind has committed to a range of mitigation measures to avoid vessel collisions with sea turtles (Appendix G, Table G-1). These include vessel separation distances and strict adherence to NMFS Regional Viewing Guidelines for vessel strike avoidance as well as specific vessel speed restrictions for all Project vessels moving to and from ports, the Lease Area, and cable lay routes. These measures, while geared towards marine mammals, will subsequently benefit sea turtles by reducing the risk of a vessel strike occurring. However, few measures have proven effective at reducing collisions between sea turtles and vessels (Schoeman et al. 2020). The relatively small size of sea turtles and the amount of time spent at or just below the water's surface within the vessel strike zone (i.e., draft of vessels) makes their observation by vessel operators extremely difficult, therefore reducing the effectiveness of trained PSOs to mitigate vessel strike risk on sea turtles. Although vessel strike resulting in mortality may occur, these impacts would not result in population-level effects. Impacts from Project-related vessel traffic on sea turtles are therefore considered minor.

The area around the Offshore Project area (including Project vessel transit routes) is used by many different vessels, including large, deep-draft vessels; fishing vessels; recreational vessels; and tugs operating to and from ports in Maryland, Delaware, New Jersey, Virginia, and abroad (COP, Volume II, Appendix K1; US Wind 2024). The contribution of the Proposed Action would be relatively small when compared to the number of vessel trips associated with ongoing and planned non-offshore activities and offshore wind activities (without the Proposed Action) throughout the sea turtle geographic analysis area (Section 3.5.7.3) and would represent only a small portion of the overall annual increases in vessel traffic in the region.

Operations and Maintenance

Onshore Activities and Facilities

Onshore O&M activities for the Proposed Action are not expected to contribute to IPFs for sea turtles.

Offshore Activities and Facilities

Accidental releases: The impacts of the Proposed Action during O&M from accidental releases of hazardous materials and trash/debris would be the same, though slightly reduced, as that described earlier for construction and installation of the Proposed Action. During O&M of the Proposed Action, at-sea refueling for construction vessels would not likely occur, thereby reducing overall risk for an accidental spill. All other impacts of accidental releases during O&M would be the same as during construction and installation and would therefore remain negligible for sea turtles.

Cable emplacement and maintenance: Only intermittent, localized cable maintenance is predicted during the O&M phase of the Proposed Action. Routine procedures will include cable surveys, typically required to check the cable burial depths, especially in those locations with sand waves or a high fishing activity that can have impacts on buried cables. Cable surveys are anticipated in year 1, year 3, and then every 5 years after. In case of insufficient burial or cable exposure, whether attributable to natural or human caused issues, appropriate remedial measures will be taken including reburial or placement of additional protective measures. If a cable failure occurs, an appropriate cable repair spread will be mobilized. During these remedial activities, if they occur, sediment plumes would be limited to directly above the seafloor and not extend into the water column. The sediment transport model predicts that suspended sediments due to jet plowing will remain localized to the area of disturbance and settle quickly to the seafloor (COP, Volume II, Appendix B2; US Wind 2024). Elevated turbidity levels would be short term, highly localized, and temporary. Therefore, effects to sea turtles would be similar to that described for the construction and installation phase and impacts would be negligible for sea turtles.

EMFs and cable heat: As discussed in Section 3.5.7.3, sea turtles are unlikely to detect magnetic fields produced by Project cables more than a few meters from the cable (Normandeau et al. 2011). Both the inter-array and export cable arrays are high-voltage AC which would be buried to a target depth of 3.3 to 6.6 feet (1 to 2 meters) and installed with appropriate shielding where needed to further limit sea turtle exposure to both EMF and heat originating from the cable. Therefore, EMF effects on sea turtles would be negligible.

Lighting: The Proposed Action would introduce stationary artificial light sources in the form of navigation, safety, and work lighting. The Project is proposing to use an ADLS, which if implemented would only activate WTG lighting when aircraft enter a predefined airspace, which would minimize the amount of artificial lighting associated with the Proposed Action. Vessel lighting during operations will be greatly reduced compared to that during construction activities (see Traffic IPF). The WTGs, OSSs, and vessels would be lighted and marked in accordance with FAA, USCG, and BOEM guidelines to aid safe navigation within the Project area. Orr et al. (2013) summarized available research on potential operational lighting effects from offshore wind energy facilities and developed design guidance for avoiding and minimizing lighting impacts on aquatic life, including sea turtles. BOEM concluded that operational lighting was non-disruptive to sea turtle behavior if recommended design and operating practices are implemented. Therefore, BOEM anticipates that operational lighting effects on sea turtles would be negligible.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects on sea turtles are WTG operations, geophysical surveys, and vessel traffic during O&M. Project O&M activities could generate underwater noise and result in behavioral disturbance and masking effects on sea turtles.

Noise from WTG Operations

As discussed in Section 3.5.7.3, operations of the WTG would result in long-term, low-level, continuous noise in the Project area which could result in behavioral disturbances and auditory masking at close distances (Lucke et al. 2007; Tougaard et al. 2005, 2020; Thomsen and Stober 2022). Noise produced by operational WTG is within the auditory hearing range for all sea turtles, but the potential for impacts is not likely to occur outside a relatively small radius surrounding the Project foundations (SPL ranging from 92 to 137 dB re 1 µPa at distances of 65 to 656 feet [20 to 200 meters] from the source; Tougaard et al. 2020) and the audibility of the WTGs may be further limited by the ambient noise conditions of the Project area (Jansen and de Jong 2016, as an example). However, these measurements are for up to 6 MW WTG and the compiled data also showed an increase in noise levels with increasing WTG power and wind speed (Tougaard et al. 2020). Stöber and Thomsen (2021) conducted a similar review and also identified an increase in underwater sound levels (up to 177 dB re 1 µPa) with increasing power size with a nominal 10 MW WTG. Even with increased WTG size, operational noise is not expected to exceed noise produced by vessel traffic out to 0.6 miles (1 kilometers; Tougaard et al. 2020) and impacts would therefore be similar to those described for vessel noise in Section 3.5.7.3, and would be expected to be negligible for sea turtles.

Noise from Geophysical Surveys

Geophysical surveys may occur irregularly throughout the O&M phase of the Proposed Action to check the integrity of the scour protection around the foundations and ensure the inter-array and export cables have not become exposed. The scope of geophysical surveys during O&M would be similar to that described for Project construction and impacts on sea turtles would similarly be negligible.

Noise from Vessels

Vessel traffic during the O&M phase of the Proposed Action is expected to be infrequent and limited to the use of smaller vessels which would limit the level of noise produced during the maintenance trips and geophysical surveys. Given the lower volume of vessel traffic expected during O&M and the smaller size of the vessels expected, impacts on sea turtles are expected to be negligible.

Port Utilization: US Wind's planned O&M Facility in Ocean City, Maryland, is intended to serve as the primary port for Project maintenance activities and routine inspections. This site will serve as the primary point for the loading of maintenance crews, replacement components, and consumables onto crew transfer vessels. Additional O&M ports that would support major maintenance activities requiring deep draft or jack-up vessels include Lewes, Delaware, Hampton Roads area, Virginia, Baltimore (Sparrows Point), Maryland, Hope Creek, New Jersey and the Port of New York/New Jersey. The crew transfer vessels will transport the maintenance crews to the offshore site on an as needed basis dependent on weather conditions. Port activities beyond routine maintenance of the facilities are not predicted at this time. Therefore, port utilization during the O&M phase of the Proposed Action is likely to have negligible impacts on sea turtles.

Presence of structures: Under the Proposed Action, US Wind proposes to install up to 121 WTGs (PDE), up to 4 OSSs, 1 Met Tower, and up to 63.98 acres (25.9 hectares) of new hard scour/cable protection along the offshore export and inter-array cables. The structures and scour/cable protection, and the potential consequential impacts, would remain at least until decommissioning of each facility is complete. The 121 WTG monopile foundations would be placed in a grid-like pattern with approximate spacing of 0.77 nautical mile (1.2 kilometer) between WTGs in the east-west direction and 1.02 nautical mile (1.64 kilometer) between WTGs in the north-south direction. The largest sea turtle species present in the proposed Action Area is the leatherback sea turtle, which measures on average approximately 5.9 feet (1.8 meters) with the largest documented leatherback turtle measuring up to 9.8 feet (3 meters) (Sea Turtle Conservancy 2022) and would therefore fit end to end between two foundations spaced at 1.2 miles (1.9 kilometers) more than 200 times over. This simple assessment of spacing relative to animal size indicates that the physical presence of the monopile foundations is unlikely to pose a barrier to the movement of leatherback sea turtles, and even less likely to impede the movement of other smaller species of sea turtles. Additionally, sea turtles are known to be attracted to offshore energy structures (Lohoefener et al. 1990; Valverde and Holzwart 2017; Viada et al. 2008). Studies have shown that sea turtles incorporate oil and gas platforms in core areas within their home ranges (Valverde and Holzwart 2017) and utilize offshore structures for foraging, resting, and other behaviors (Klima et al. 1988). Based on the proposed WTG spacing and reported sea turtle behavior, this EIS concludes that the presence of the Project's WTG foundations would pose a negligible risk of long-term displacement effects on sea turtles.

The reef effect is expected to lead to an increase in colonizing organisms on the surface of the pile which likely enhance food availability and food web complexity to the base of the structure and laterally away from the foundation through an accumulation of organic matter (Degraer et al. 2020; Mavraki et al. 2021). The accumulation could lead to an increased importance of the detritus-based food web, which could increase the availability of some sea turtle prey such as mollusks and crustaceans (Degraer et al. 2020). However, although the reef effect increases the total amount of biomass at each foundation, thereby increasing food resources and attraction by predators, significant, broad-scale changes to the regional trophic structure are considered unlikely (Raoux et al. 2017). Overall, the increased prey availability around the structures due to the reef effect may result in long-term benefit for sea turtles; however, it should be noted the risk of increased secondary entanglement from derelict or abandoned fishing gear and hydrodynamic effects on prey distribution would result in minor adverse impacts on sea turtles that could offset the potential beneficial impacts.

Hydrodynamic changes in prey aggregations would primarily affect the leatherback sea turtle, which feeds on planktonic prey that have limited independent movement, as opposed to green, loggerhead, and Kemp's ridley sea turtles, whose diets include organisms that are sessile or can actively swim against ocean currents. The abundance and distribution of jellyfish are influenced by factors other than just currents, including sea surface temperature and prey (zooplankton) availability (Gibbons and Richardson 2008). Leatherback sea turtle prey such as jellyfish may be affected by changes in nutrient cycling and currents as a result of changes in oceanographic and hydrologic changes due to the presence of Project structures. However, these changes would be highly localized and would not affect regional jellyfish aggregations outside the Project area. Effects on sea turtles from hydrodynamic changes in prey aggregations around the Project structures would therefore be negligible as impacts on sea turtles would be undetectable or barely measurable, with no consequences to individuals or populations.

The presence of structures may concentrate recreational fishing around foundations and would also increase the risk of gear loss or damage. This would increase the risk of secondary entanglement for sea turtles around the Project structures, 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 fishing activity and turtles are concentrated around the same foundations. Therefore, the risk of increased interactions with active or abandoned fishing gear would result in minor impacts on sea turtles, as impacts to or loss of individuals may occur, but no population-level effects are expected.

Traffic: The O&M phase of the Proposed Action would result in approximately 822 vessel roundtrip transits per year originating from O&M facilities in Ocean City and Baltimore, Maryland, to the Wind Farm Area. Crew transfer vessels would be the most common vessel type used during O&M, followed by service operation vessels and other as-needed vessels (i.e., heavy lift vessels for non-routine procedures). Crew transfer vessels operating out of Ocean City, Maryland, would conduct daily vessel round trip transits from May through August and two to three roundtrip transits per week for the remainder of the year throughout the duration of the O&M phase; less than one service operation vessel roundtrip transit is expected per year.

US Wind has committed to specific mitigation measures as summarized in (Appendix G, Table G-1). Those relevant to the assessment of vessel strikes on sea turtles include vessel speed restrictions; vessel strike avoidance measures; use of qualified observers; and minimum separation distances. The mitigation measures to be implemented are aimed to reduce sea turtle injury or mortality from potential Project-related vessel strikes. However, few measures have proven effective at reducing collisions between sea turtles and vessels (Schoeman et al. 2020). The relatively small size of sea turtles and the amount of time spent at or just below the water's surface within the vessel strike zone (i.e., draft of vessels) makes their observation by vessel operators extremely difficult, therefore reducing the effectiveness of trained PSOs to mitigate vessel strike risk on sea turtles.

The potential effect of a vessel strike on individuals sea turtle populations is considered severe in intensity due to the risk of serious injury or mortality but are not likely to rise to population-level effects for any sea turtle species. The geographic extent is considered localized to the vessel transit routes and the Offshore Project area. As Project vessels would operate throughout the construction, O&M, and decommissioning phases, the potential for a vessel to strike a sea turtle is considered continuous (life of Project). Effects from vessel strikes range from short term in duration for less severe injuries to permanent in the case of death of an animal. Proposed measures to mitigate vessel-sea turtle strikes (e.g., vessel speeds) are expected to be limited in their effectiveness, as discussed above.

The area around the Offshore Project area (including Project vessel transit routes) is used by many different vessels, including large, deep-draft vessels; fishing vessels; recreational vessels; and tugs operating to and from ports in Maryland, Delaware, New Jersey, and abroad (COP, Volume II, Appendix K1; US Wind 2024). The contribution of the Proposed Action would be relatively small when compared to the number of vessel trips associated with ongoing and planned non-offshore activities and offshore wind activities (without the Proposed Action) throughout the sea turtle geographic analysis area (Section 3.5.7.3) and would represent only a small portion of the overall annual increases in vessel traffic in the region.

Conceptual Decommissioning

Onshore Activities and Facilities

Onshore decommissioning activities for the Proposed Action are not expected to contribute to IPFs for sea turtles.

Offshore Activities and Facilities

The decommissioning process for the WTGs and ESPs is anticipated to be the same sequence and time frame, but in reverse of construction and installation.

The first stage will require Project components to be drained of all fluids and chemicals, transported to an appropriate disposal or recycling facility. All foundations will be removed to a level below the mudline of the seafloor in accordance with the conditions of the lease, potentially to 15 feet (4.6 meters). Cables and scour protection around each foundation may be left in place to provide seafloor habitat, although this is not certain and may be removed entirely to return the seafloor to pre-project conditions if required. It is anticipated that the equipment and vessels used during decommissioning will be similar to those used during construction and installation and would likely include heavy lift vessels, jack-up vessels, larger support vessels, tugboats, crew transport vessels, and possibly vessels specifically built for installing WTGs.

Decommissioning impacts include underwater noise emitted from underwater acetylene cutting torches, mechanical cutting, high-pressure water jet, and vacuum pump. Noise levels are not available for these types of equipment but are not expected to be higher than construction vessel noise. US Wind would return the sediments previously removed from the inner space of the pile to the depression left after the pile is removed. In addition, US Wind would likely use a vacuum pump and diver or ROV-assisted hoses to minimize sediment disturbance and turbidity. US Wind may abandon the offshore export cables in place to minimize environmental impact, in which case there would be no impacts from their decommissioning. If required, US Wind would remove the cables from their embedded position in the seabed. Where necessary, US Wind would jet plow the cable trench to remove the sandy sediments covering the cables and reel the cables onto barges. A physical description of underwater potential methods that could be used for decommissioning, can be found in Appendix B, *Supplemental Information*. The impacts from noise generated during decommissioning activities are likely be similar to those outlined for construction activities. Risks from removing the cables would be short-term, localized to the Proposed Action area, and similar to those experienced during cable installation. Although some of the decommissioning activities (e.g., acoustic impacts, increased levels of turbidity) may cause sea turtles to avoid or leave the Proposed Action area, this disturbance would be short term and temporary. The increased vessel traffic associated with decommissioning could also cause a temporary increase in potential effects.

When compared to the construction of the Proposed Action, impact determinations for IPFs either will not change or will be greatly reduced for sea turtles during decommissioning activities. Impacts from accidental releases, new cable emplacement/maintenance, port utilization, and climate change will not change from the determinations discussed in the construction phase. Impacts from EMF and heat will be less than or entirely gone in comparison to construction and operation phases due to the removal of cables. The impact from vessel traffic and noise related to vessels is expected to be the same as construction but noise levels will be reduced in relation to HRG surveys; no pile-driving operations will be utilized during decommissioning. Impacts from the presence of structures related to fishing gear entanglement risk would be less than during construction and operations. However, decommissioning activities would reverse the artificial reef effect. Benefits some sea turtle species experienced due to the presence of the artificial reef effect would likely be reduced following the decommissioning process due to removal of the Project structures; however, this would also reduce the risk of interactions with fishing gear present around the structures.

3.5.7.5.2 Impacts of Alternative B on ESA-Listed Species

General impacts of the Proposed Action on sea turtles were described in the previous subsection. Because all sea turtle species present in the Project area are listed under the ESA, the impact determinations provided in the previous subsections would apply here.

3.5.7.5.3 Cumulative Impacts of Alternative B – Proposed Action

Accidental Releases: In the context of reasonably foreseeable environmental trends, construction of the Proposed Action would contribute an undetectable amount to the cumulative accidental release and discharge impacts from other ongoing and planned actions including offshore wind. Impacts, therefore, are expected to be temporary and highly localized due to the likely limited extent and duration of a release, resulting in minor impacts for sea turtles.

In the context of reasonably foreseeable environmental trends, O&M of the Proposed Action would contribute an undetectable amount to the cumulative accidental release and discharge impacts from other ongoing and planned actions including offshore wind. Impacts, therefore, are expected to be temporary and highly localized due to the likely limited extent and duration of a release, resulting in minor impacts for sea turtles.

Cable Emplacement: In the context of reasonably foreseeable environmental trends, construction of the Proposed Action would contribute an undetectable amount to the cumulative cable emplacement impacts on sea turtles are expected to be minor. Some non-measurable, minor impacts could occur if impacts occur in close temporal and spatial proximity, although these impacts would not be expected to be biologically significant.

In the context of reasonably foreseeable environmental trends, O&M of the Proposed Action would contribute an undetectable amount to the cumulative cable emplacement impacts on sea turtles are expected to be minor. Some non-measurable, minor impacts could occur if impacts occur in close temporal and spatial proximity, although these impacts would not be expected to result in population-level effects.

EMFs and Cable Heat: In context of reasonably foreseeable environmental trends, construction of the Proposed Action would contribute an undetectable amount to the cumulative EMF and cable heat impacts from other ongoing and planned activities including offshore wind, which would likely be minor for sea turtles.

In the context of reasonably foreseeable environmental trends, the undetectable impact during O&M of the Proposed Action would result in a noticeable increase in EMF in the geographic analysis area beyond that described under the No Action Alternative. However, the cumulative impacts from EMF on sea turtles would likely still be negligible, localized, and long term.

Gear Utilization: In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment amount to the cumulative gear utilization impacts from other ongoing and planned activities including offshore wind, which would likely be minor for sea turtles.

Lighting: In context of reasonably foreseeable environmental trends, construction of the Proposed Action would contribute an undetectable amount to the combined lighting impacts from other ongoing and planned activities including offshore wind, which would likely be negligible for sea turtles.

In context of reasonably foreseeable environmental trends, O&M of the Proposed Action would contribute an undetectable amount to the cumulative lighting impacts from other ongoing and planned activities including offshore wind, which would likely be negligible for sea turtles.

Noise: The Proposed Action would contribute a noticeable amount to the cumulative noise impacts of all future planned non-wind and wind projects. Construction-related noise impacts (from activities including pile driving, UXO detonation, and HRG surveys) would occur within a limited time frame. However, long-term noise sources from operational turbines and vessels would persist. All effects on sea turtles from noise (e.g., TTS, behavioral changes, masking) are anticipated to be the same as described in Section 3.5.7.3.2, Cumulative Impacts of the No Action Alternative. The addition of the noise from the Proposed Action is not anticipated increase the severity or risk of cumulative impacts such that the cumulative impacts from the Proposed Action would not be appreciably different from the impact findings for the cumulative impacts of the No Action Alternative given the amount of planned offshore wind activities in the geographic analysis area. Cumulative impacts of the Proposed Action from noise are therefore expected to result in minor impacts for sea turtles.

Presence of Structures: In the context of reasonably foreseeable environmental trends, the combined impacts from the presence of structures from ongoing and planned actions, including construction of the Proposed Action, would be expected to be similar to the impacts under the No Action Alternative and would be expected to be negligible.

In the context of reasonably foreseeable environmental trends, the cumulative impact contributed by O&M of the Proposed Action would result in a noticeable increase in the presence of structures in the geographic analysis area beyond that described under the No Action Alternative. However, the cumulative impacts from the presence of structures would likely still be minor for sea turtles primarily because the increased risk for fishing gear entanglement that could result in impacts to or loss of individuals, but no population-level consequences.

Traffic: In the context of reasonably foreseeable environmental trends, construction of the Proposed Action would inclemently contribute to the cumulative impacts from ongoing activities and planned actions including offshore wind, which could increase the risk of vessel strike. However, as discussed in Section 3.5.7.3.1, BOEM expects all offshore wind projects, including the Proposed Action will adhere to vessel strike avoidance and minimization measures which would reduce the risk of strikes occurring which could result in serious injury or mortality. While individuals would likely be affected, no population-level effects are expected and impacts on sea turtles due to Project vessel traffic would be minor for sea turtles.

In the context of reasonably foreseeable environmental trends, O&M of the Proposed Action would inclemently contribute to the cumulative impacts from ongoing activities and planned actions including offshore wind, which could increase the risk of vessel strike. However, as discussed in Section 3.5.7.3.1, BOEM expects all offshore wind projects, including the Proposed Action will adhere to vessel strike avoidance and minimization measures which would reduce the risk of strikes occurring which could result in serious injury or mortality. While individuals would likely be affected, no population-level effects are expected and impacts on sea turtles due to Project vessel traffic would be minor for sea turtles.

Port Utilization: In the context of reasonably foreseeable environmental trends, the combined impacts from port utilization from ongoing and planned actions, including construction of the Proposed Action, would be expected to be similar to the impacts under the No Action Alternative and would be expected to be negligible.

In the context of reasonably foreseeable environmental trends, the cumulative impacts from this IPF from ongoing and planned actions, including O&M of the Proposed Action, would be expected to be similar to the impacts under the No Action Alternative and would be expected to be negligible.

Conceptual Decommissioning: In the context of reasonably foreseeable environmental trends considering, all the IPFs, the cumulative impacts on sea turtles from ongoing, future offshore non-wind activities, and planned action, including decommissioning of the Proposed Action, are anticipated to range from negligible to minor impacts for sea turtles as population-level effects would not be expected. The decommissioning phase of the Proposed Action would contribute to, but would not change, the overall impact rating.

3.5.7.5.4 Conclusions

Impacts of Alternatives B – Proposed Action. Project construction and installation, O&M, and conceptual decommissioning would result in habitat disturbance (presence of structures and new cable emplacement), habitat conversion (presence of structures), underwater and airborne noise, vessel traffic (strikes and noise), and potential discharges/spills and trash. BOEM expects individual impacts ranging from negligible to minor for sea turtles because impacts would be noticeable and measurable but would not result in population-level effects. Adverse impacts are expected to result mainly from pile-driving noise, increased vessel traffic, and the presence of structures related to fishing gear interactions. Beneficial impacts for sea turtles are also expected to result from the presence of structures. However, it must be noted that these minor beneficial effects may be offset due to the risk of entanglement due to derelict or abandoned fishing gear or fishing line. Considering all IPFs together, BOEM anticipates that adverse impacts associated with the Proposed Action would be **minor** because impacts would be detectable and measurable but would not result in population-level effects.

Cumulative Impacts of Alternatives B – Proposed Action. In context of other reasonably foreseeable environmental trends, ongoing and planned activities, cumulative impacts to sea turtles contributed by the Proposed Action would range from undetectable to appreciable. BOEM anticipates that the overall impacts for sea turtles in the geographic analysis area from the Proposed Action when combined with ongoing and planned actions would be **minor**. BOEM made this determination because the anticipated impact would be noticeable and measurable, but sea turtles are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken. The main drivers for this impact rating are impact pile-driving noise, the presence of structures, and vessel traffic. The Proposed Action would contribute to the overall impact rating primarily through impact pile-driving noise, vessel traffic, and the presence of structures.

3.5.7.6 Impacts of Alternatives C, D, and E on Sea Turtles

3.5.7.6.1 Impacts of Alternatives C, D and E

Alternatives C, D, and E would result in the same impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action, with some impacts being minimally decreased in duration and geographic extent. Alternative C, the Landfall and Onshore Export Cable Route Alternative ("Landfall Alternative" inclusive of Alternatives C-1 and C-2), would result in onshore export cable routing that avoids Indian River Bay and the Indian River which would not have any significant differences in the potential effects on sea turtles compared to Alternative B; all other Project components including construction, operations, and decommissioning would be identical to those of Alternative B. Alternative D, the Viewshed Alternative, would result in the exclusion of 32 WTG positions and 1 OSS within 14 miles (22.5 kilometers) from shore associated with the future development phase, and Alternative E, the Habitat Impact Minimization Alternative, would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable), or repositioning the export cable route. Micrositing of WTGs and cables may also be necessary under Alternative E to avoid AOCs. The removal of WTG and OSS positions under Alternatives D and E would decrease the overall duration of impact pile-driving noise present during project construction, the overall number of structures present during operations, and the overall area of seafloor disturbance resulting from Project construction. All other Project components including construction, operations, and decommissioning would be identical to those of Alternative B.

Reductions in the WTGs would reduce the number of monopiles required. As a result, the number of hours of impact pile driving required to install the WTGs would be reduced. The length of inter-array cable to be installed would also be reduced if fewer WTGs are installed. IPFs that could change as a result include presence of structures, underwater noise from pile driving and vessels during construction activities, habitat alteration, vessel strikes, and cable emplacement and maintenance. The changes in the number of monopiles and associated Project construction vessels between the Proposed Action (PDE of up to 121 WTG) and each alternative (up to 82 under Alternative D and 103 under Alternative E) would be nominal in the context of the complete assessment of effects on sea turtles. As a result, a reduction in the duration of the effects would occur; however, the magnitude of the effects would remain unchanged from that of the Proposed Action. Similarly, the volume of Project vessels and area of seafloor disturbance and the overall reduction in the number of Project structures present during operations would not differ significantly between Alternative B and Alternatives D and E, so the relative risk of impacts on sea turtles would be expected to remain as described in Section 3.5.7.5 for those IPFs. Alternatives C-1, C-2, D, and E may change the duration for the IPFs in comparison to that described for the Proposed Action in Section 3.5.6.5.

3.5.7.6.2 Impacts of Alternative C, D, and E on ESA-Listed Species

All sea turtle species present in the Project area are listed as either threatened or endangered under the ESA, and the impacts of Alternatives C, D, and E would therefore not differ from those described for Alternative B, the Proposed Action.

3.5.7.6.3 Cumulative Impacts of Alternatives C, D and E

In the context of reasonably foreseeable environmental trends and planned actions, BOEM expects individual impacts of Alternatives C, D, And E ranging from negligible to minor for sea turtles and would be the similar to those described for the Proposed Action in Section 3.5.7.5.3. The overall impact of any action alternative on sea turtles when combined with past, present, and reasonably foreseeable activities would be minor because the anticipated impact would be notable and measurable, but sea turtles are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken. The main drivers for this impact rating are impact pile-driving noise, the presence of structures, and vessel traffic. The action alternatives would contribute to but would not change the overall impact rating primarily through impact pile-driving noise, and the presence of structures.

3.5.7.6.4 Conclusions

Impacts of Alternatives C, D and E. As discussed previously, the impacts associated with Alternative B, the Proposed Action, do not change substantially under the other action alternatives. Although the number of WTGs and their associated inter-array cables varies slightly, the impacts to sea turtles would not differ from the Proposed Action. Therefore, construction and installation, O&M, and decommissioning of Alternatives C, D, and E would result in negligible to **minor** impacts across individual IPFs for sea turtles. Overall, BOEM anticipates that adverse impacts associated with Alternatives C, D, and E would be **minor** because impacts would be detectable and measurable but would not result in population-level effects. Adverse impacts are expected to result mainly from impact pile-driving noise, increased vessel traffic, and the presence of structures as related to fishing gear interactions. Beneficial impacts for sea turtles are also expected to result from the presence of structures. However, it must be noted that these minor beneficial effects may be offset due to the risk of entanglement due to derelict or abandoned fishing gear or fishing line.

Cumulative Impacts of Alternatives C, D and E. In the context of reasonably foreseeable environmental trends, ongoing and planned actions, all action alternatives would occur under the same scenario (Appendix D, *Planned Activities Scenario*). Therefore, cumulative impacts to sea turtles would only vary if the alternative's contributions differ. BOEM expects individual impacts ranging from negligible to minor for sea turtles because impacts would be noticeable and measurable but would not result in population-level effects. The overall impact of any action alternative on sea turtles when combined with past, present, and reasonably foreseeable activities would be **minor** because the anticipated impact would be notable and measurable, but sea turtles are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken. The main drivers for this impact rating are impact pile-driving noise, the presence of structures, and vessel traffic. The action alternatives would contribute to but would not change the overall impact rating primarily through impact pile-driving noise, and the presence of structures.

3.5.7.7 Comparison of Alternatives

Impacts of Alternatives. As described in Section 3.5.7.5, the potential impacts associated with the Proposed Action would likely range from negligible to minor across individual IPFs when compared to the impacts expected under the No Action Alternative. The Proposed Action would impact sea turtles primarily through impact pile driving, vessel traffic, and the presence of structures as related to fishing gear interactions. Under the No Action Alternative, these impacts would not occur; rather under the No Action Alternative, minor impacts on sea turtles that do occur would be the result of existing environmental trends and ongoing non-offshore wind activities. Overall, the impacts of the Proposed Action would result in **minor** impacts on sea turtles, largely due to impact pile-driving noise, the presence of structures as related to fishery gear interactions, and vessel traffic.

As discussed in Section 3.5.7.6, the impacts associated with the Proposed Action do not change substantially under the other action alternatives. Although onshore exposure cable route would avoid Indian River Bay and the Indian River; up to 32 WTGs and 1 OSS may be removed from the overall total number of foundations installed; and the export cable route and foundation placements within the Wind Farm Area may be altered to avoid AOCs, the magnitude of impacts to sea turtles would likely remain **minor** for all action alternatives.

Cumulative Impacts of Alternatives. In the context of reasonably foreseeable environmental trends, ongoing and planned actions, all action alternatives would occur within the same baseline (Section 3.5.7.3.1) and under the same planned activities scenario (Appendix D, *Planned Activities Scenario*). Therefore, cumulative impacts to sea turtles would only vary if the individual alternative's contributions differ. BOEM expects individual impacts ranging from negligible to minor across individual IPFs, because impacts would be noticeable and measurable, but would not result in population-level effects. The overall impact of any action alternative on sea turtles when combined with past, present, and reasonably foreseeable activities would be **minor** because the anticipated impact would be notable and measurable, but sea turtles are expected to recover completely when IPF stressors are removed and remedial or mitigating actions are taken. The main drivers for this impact rating are impact pile-driving and UXO detonation noise, the presence of structures, interactions with fisheries gear, and vessel traffic.

The action alternatives would contribute to but would not change the overall impact rating primarily through impact pile-driving noise, the presence of structures, and vessel traffic.

3.5.7.8 Proposed Mitigation Measures

Several measures are proposed to minimize impacts on marine mammal resources in Appendix G, *Mitigation and Monitoring*. If one or more of the measures individually described in Appendix G are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced. BOEM conducted consultation with NMFS under Section 7 of the Endangered Species Act, resulting in NMFS issuing reasonable and prudent measures in a Biological Opinion, which are fully described in Table G-2 in Appendix G and summarized in Table 3.5.7-5. Additional proposed mitigation and monitoring measures are fully described in Table G-3 in Appendix G summarized in Table 3.5.7-6.

Table 3.5.7-5. Measures Resulting from Consultations (Also Identified in Appendix G, Table G-2)

Measure	Effect
BOEM-Proposed Mitigation and Monitoring Measures in the NMFS BA or Proposed MMPA ITA	Minimize impacts through monitoring and documentation of take for any Protected Species; minimize acoustic impacts through mitigation and monitoring related to acoustic activities, including PAM, PSOs, Pile Driving Monitoring Plan, development of SFV plan, and shutdown zones; minimize impacts of vessel strikes through personnel training; minimize impacts through adherence to BMPs minimize impacts of marine debris through reporting and training for personnel; twice annual sea turtle monitoring meetings
Reasonable and Prudent Measures and Implementing Terms and Conditions from the NMFS BiOp	Minimize impacts through monitoring and documentation of take for any Protected Species; minimize acoustic impacts through mitigation and monitoring related to acoustic activities, including PAM, PSOs, , development of mitigation plans, sound attenuation devices and shutdown zones.

Table 3.5.7-6. Additional Proposed Mitigation and Monitoring Measures (Also Identified in Appendix G, Table G-3)

Measure	Effect
BOEM-Proposed Mitigation and Monitoring Measures	Minimize impacts of lost fishing gear through monitoring surveys of WTGs closes to shore; minimize impacts of lighting through adherence to established lighting and marking guidelines; minimize impacts of fishing gear by requiring gear to be hauled at least once every 30 days and stored on land between survey seasons.

3.5.7.9 Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in G-2 in Appendix G, along with mitigation measures described in Table G-3 in Appendix G, are incorporated in the Preferred Alternative. These measures, if adopted, would further define how the effectiveness and enforcement of LPMs would be ensured and improve accountability for compliance with LPMs by requiring the submittal of plans for approval by the enforcing agency(ies) and by defining reporting requirements. Because these measures ensure the effectiveness of and compliance with LPMs that are already analyzed as part of the Proposed Action, implementation of these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.5.7.5, *Impacts of Alternative B – Proposed Action on Sea Turtles.*

3.5.8 Wetlands and Other Waters of the United States

This section discusses potential impacts on wetlands and other waters of the U.S. from the Project, action alternatives, and ongoing and planned actions in the geographic analysis area. The wetlands geographic analysis area (Figure 3.5.8-1) includes all subwatersheds that intersect the Onshore Project area, which encompasses all wetlands and surface waters that are most likely to experience impacts from the Project. Under Section 404 of the CWA, the USACE considers fill impacts that permanently convert a wetland to an upland as a permanent impact. Conversion of a wetland type may also be considered a permanent impact. Temporary impacts occur when fill is placed in wetlands, but they are restored to preconstruction contours when construction activities are complete (e.g., stockpiling, temporary access). The limits of USACE jurisdiction in non-tidal waters (33 CFR 328.4) are as follows:

- In the absence of adjacent wetlands, the jurisdiction extends to the ordinary high-water mark; or when adjacent wetlands are present, the jurisdiction extends beyond the ordinary high-water mark to the limit of the adjacent wetlands.
- When the water of the U.S. consists only of wetlands, the jurisdiction extends to the limit of the wetland.

Section 3.4.2 (*Water Quality*) addresses impacts on tidal waters (other than tidal wetlands) from mean high water to the edge of the U.S. Exclusive Economic Zone.

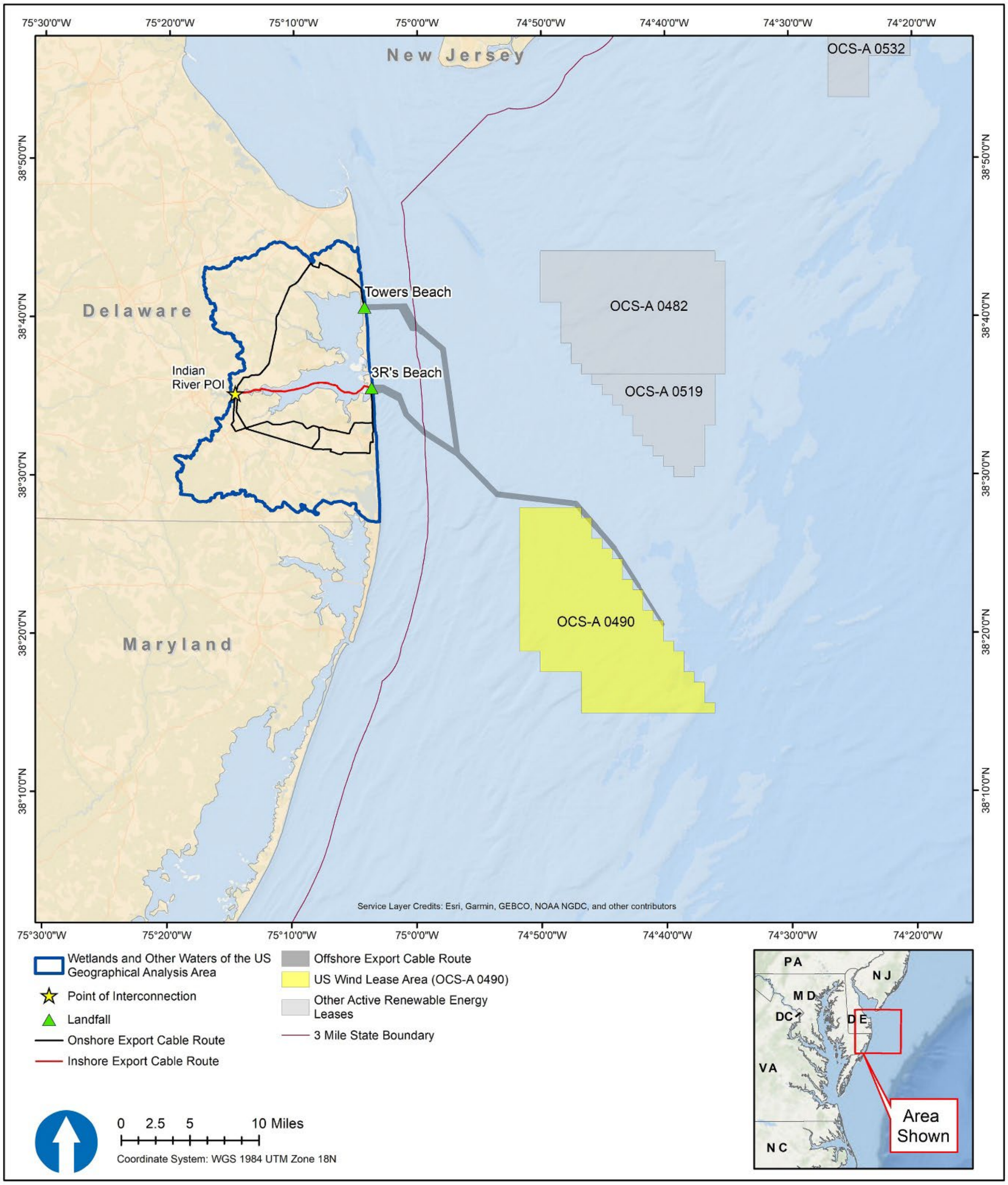

Figure 3.5.8-1. Wetlands and other waters of the United States geographic analysis area

3.5.8.1 Description of the Affected Environment

The National Wetlands Inventory (NWI) wetland data were used to determine the potential presence of wetlands. Tidal wetlands are areas where the Atlantic Ocean and estuaries meet land, are found below the spring high tide line, and are subject to regular flooding by the tides. Tidal wetlands are typically categorized into two zones: high marsh and low marsh. The former occurs at a higher elevation, where it is subject to shorter tidal inundation, while the latter is flooded for extended periods during daily tidal cycles (COP, Volume II, Section 6.1.1.3; US Wind 2024). Non-tidal wetlands, otherwise referred to as freshwater wetlands, are not influenced directly by tides and are typically categorized based on their hydrology and predominant vegetation.

Wetlands are important features in the landscape that provide numerous beneficial services or functions. Some of these include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, providing aesthetic value, ensuring biological productivity, filtering pollutant loads, and maintaining surface water flow during dry periods. Most wetlands in the geographic analysis area are tidally influenced saline marshes, which provide shelter, food, and nursery grounds for coastal fisheries species including shrimp, crab, and many finfish. Saline marshes also protect shorelines from erosion by creating a buffer against wave action and by trapping soils. In flood-prone areas, saline marshes reduce the flow of flood waters and absorb rainwater. Tidal wetlands also serve as carbon sinks, holding carbon that would otherwise be released into the atmosphere and contribute to climate change. Other wetlands in the geographic analysis area include estuarine and marine deepwater (marine and estuarine subtidal unconsolidated bottom), freshwater emergent wetland (non-tidal freshwater marsh), and freshwater forested/scrub-shrub (non-tidal freshwater scrub-shrub wetland).

Table 3.5.8-1 provides information about the wetland communities within the geographic analysis area based on NWI data. Figure 3.5.8-2 shows wetlands near the onshore substation site. These are also included in the COP (Volume II, Appendix G1; US Wind 2024):

- a large emergent tidal wetland with a non-tidal wetland fringe along the border with the Indian River;
- an emergent forested non-tidal wetland north of the existing substation that may be of conservation concern; and
- an emergent scrub/shrub tidal wetland with a non-tidal wetland fringe to the west of the substation site.

Figure 3.5.8-3 shows wetlands near the 3R's Beach landfall site. These are also included in the COP (Volume II, Section 6.1; US Wind 2024):

- Tidal salt marsh along the eastern edge of Indian River Bay, across Delaware State Route (SR) 1 from the landfall site;
- A non-tidal freshwater scrub-shrub wetland between the tidal salt marsh and the western edge of SR 1; and
- A non-tidal freshwater marsh wetland immediately south of the 3R's Beach parking lot.
- Although not shown on Figure3.5.8-3, according to correspondence from DNREC there is also an interdunal swale located directly north of the 3R's parking lot. The low-lying swales within the dune landforms in this area create wetland habitat in the depressions between sand dunes.

Other wetlands in the geographic analysis area are predominantly found along the shores and tributaries of Indian River Bay and the Indian River.

Table 3.5.8-1. Wetland communities in the geographic analysis area

Wetland Community	Area (acres)	Percent of Total
Non-tidal		
Freshwater emergent wetland	1,493.319	2.2%
Freshwater forested/scrub-shrub wetland	17,757.257	26.2%
Freshwater pond	1,469.136	2.2%
Riverine	1,073.327	1.6%
Lake	502.476	0.7%
Other	115.694	0.2%
Total Non-tidal	22,401.210	33.1%
Tidal		
Estuarine and marine wetland	20,126.306	29.7%
Estuarine marine subtidal unconsolidated bottom (deep water)	25,225.837	37.2%
Total Tidal	45,352.143	66.9%
Total Wetlands	67,753.353	100.0%

Source: USFWS 2022. National Wetland Inventory GIS data. Available: Download Seamless Wetlands Data by State. Accessed: December 1, 2022.

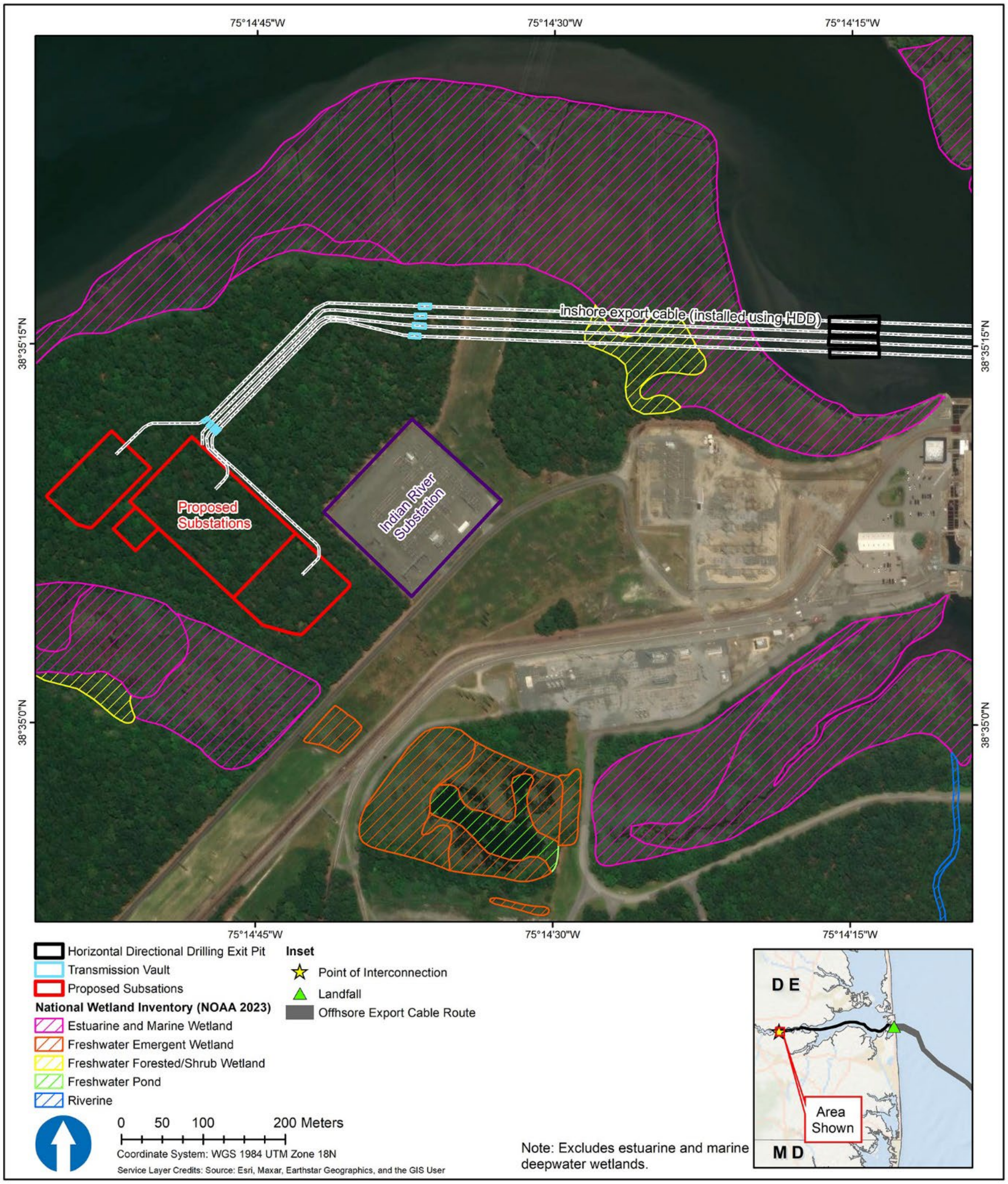

Figure 3.5.8-2. National Wetland Inventory wetlands and Proposed Action onshore substation site

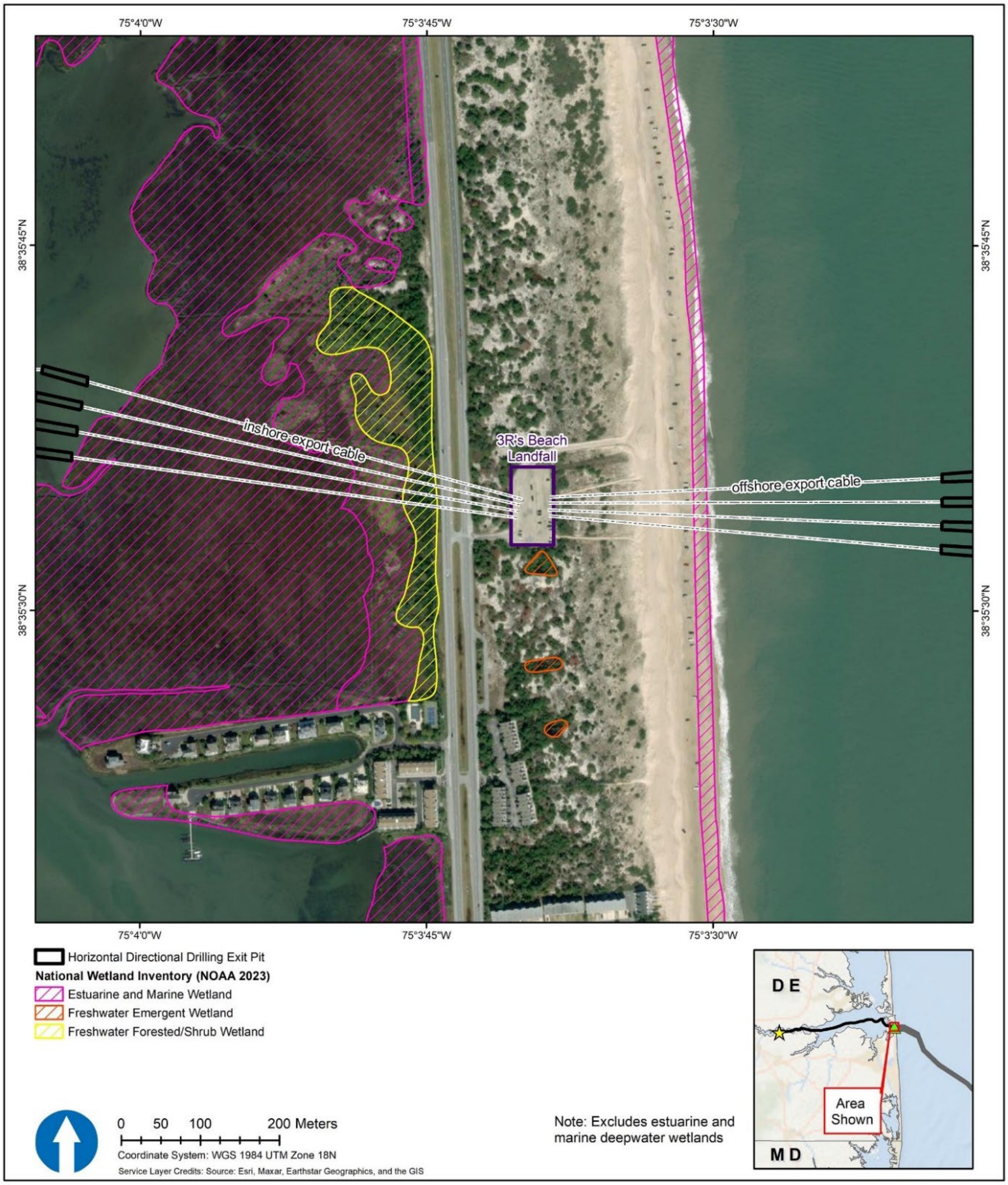

Figure 3.5.8-3. National Wetland Inventory wetlands and Proposed Action landfall site

3.5.8.2 Impact Level Definitions for Wetlands and Other Waters of the United States

Definitions of impact levels are provided in Table 3.5.8-2. Table F-10 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts to wetlands and other waters of the U.S.

Table 3.5.8-2. Impact level definitions for wetlands

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on wetlands would be so small as to be unmeasurable and impacts would not result in a detectable change in wetland quality and function.
Minor	Adverse	Impacts on wetlands would be minimized and would be relatively small and localized. If impacts occur, wetlands would completely recover.
Moderate	Adverse	Impacts on wetlands would be minimized; however, permanent impacts would be unavoidable. Compensatory mitigation required to offset impacts on wetland functions and values and would have a high probability of success.
Major	Adverse	Impacts on wetlands would be minimized; however, permanent impacts would be regionally detectable. Extensive compensatory mitigation required to offset impacts on wetland functions and values would have a marginal or unknown probability of success.

All disturbances from construction activities would be conducted in compliance with the approved Stormwater Pollution Prevention Plan (SWPPP) for the Project. Any work in wetlands would require a CWA Section 404 permit from the USACE; for unavoidable impacts, compensatory mitigation may be required to replace the loss of wetlands and associated functions. In addition, a project-specific application for Water Quality Certification from the State of Delaware will be required, as well as the appropriate wetlands and subaqueous lands permits and leases.

3.5.8.3 Impacts of Alternative A – No Action on Wetlands and Other Waters of the United States

3.5.8.3.1 Impacts of Alternative A – No Action

Under the No Action Alternative, baseline conditions for wetlands and waters of the U.S. would continue to follow regional current trends and respond to IPFs introduced by other ongoing actions. Ongoing activities within the geographic analysis area that contribute to impacts on wetlands and waters of the U.S. are generally associated with land disturbance (i.e., for construction of structures, roads, and other infrastructure), accidental releases of pollutants and debris from land or water sources such as vehicles and vessels, and climate change. Impacts from these activities increase sedimentation and contamination of wetlands and waters of the U.S.

3.5.8.3.2 Cumulative Impacts of Alternative A – No Action

Ongoing and planned non-offshore wind activities that may affect wetlands and waters of the U.S. in the geographic analysis area include additional land disturbance and dredging projects (Appendix D, Section D.2 contains a description of ongoing and planned actions). BOEM expects other offshore wind activities to affect wetlands and waters of the U.S. through the following primary IPFs.

Accidental releases: During onshore construction of offshore wind projects in the geographic analysis area, oil leaks and accidental spills from construction equipment are potential sources of wetland water contamination. While many wetlands act to filter out contaminants, any significant increase in contaminant loading could exceed the capacity of a wetland to perform its normal water quality functions. Although degradation of water quality in wetlands could occur during construction, decommissioning, and, to a lesser extent, O&M, due to the small volumes of spilled material anticipated these impacts would all be short term until the source of the contamination is removed. Compliance with applicable state and federal regulations related to oil spills and waste handling would minimize potential impacts from accidental releases. These include the Resource Conservation and Recovery Act, U.S. Department of Transportation (USDOT) Hazardous Material regulations, and implementation of an SPCC Plan for each project. Impacts from accidental releases on wetlands would be minor because accidental releases would be small and localized, and compliance with state and federal regulations would avoid or minimize potential impacts on wetland quality or functions.

Cable emplacement and maintenance: To the degree that Onshore Export Cable Routes for other offshore wind projects are installed in the geographic analysis area, construction would require clearing, excavating, trenching, fill, and grading, which could result in the loss or alteration of wetlands, causing adverse effects on wetland habitat, water quality, and flood and storage capacity functions. Fill material permanently placed in wetlands during construction would result in the permanent loss of wetlands, including any habitat, flood and storage capacity, and water quality functions that the wetlands may provide. If a wetland were partially filled and fragmented or if wetland vegetation were trimmed, cleared, or converted to a different vegetation type (e.g., forest to herbaceous), habitat would be altered and degraded (affecting wildlife use) and water quality and flood and storage capacity functions would be reduced by changing natural hydrologic flows and reducing the wetland's ability to impede and retain stormwater and floodwater.

On a watershed level, any permanent wetland loss or alteration could reduce the capacity of regional wetlands to provide wetland functions. Short-term wetland impacts may occur from construction activity that crosses or is adjacent to wetlands, such as rutting, compaction, and mixing of topsoil and subsoil. Where construction leads to unvegetated or otherwise unstable soils, precipitation events could erode soils, resulting in sedimentation that could affect water quality in nearby wetlands, as well as alter wetland functions if sediment loads are high (e.g., adverse habitat impacts from burying vegetation). The extent of wetland impacts would depend on specific construction activities and their proximity to wetlands. These impacts would occur primarily during construction and decommissioning; impacts during O&M would only occur if new ground disturbance was required, such as to repair a buried component. BOEM anticipates Onshore Export Cable Routes from other offshore wind projects would likely be sited in along existing roadways or utility ROWs, which would avoid and minimize wetland impacts. In addition, BOEM expects the offshore wind projects would be designed to avoid wetlands to the extent feasible, including through the use of trenchless cable installation methods such as HDD to avoid and minimize impacts. Offshore wind projects would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. Impacts from cable emplacement and maintenance on wetlands would be minor because wetland impacts are anticipated to be short term and would not require compensatory mitigation.

Land disturbance: The wetland impact types and mechanisms associated with land disturbance for onshore substations would be similar to those described for the cable emplacement and maintenance IPF, and impacts on wetland functions (i.e., water quality, habitat, and hydrology) would be similar. Land disturbance would be unlikely to cause permanent wetland impacts because it would be unlikely that a substation or other permanent facility would be constructed in tidal wetlands. Affected wetlands would be restored to pre-existing conditions per permitting requirements. BOEM also anticipates the offshore wind projects would be designed to avoid wetlands (including tidal wetlands) to the extent feasible. Offshore wind projects would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. Impacts from land disturbance on wetlands could be moderate because permanent wetland impacts may occur and compensatory mitigation would be required but this is unlikely due to federal, state, and local regulations.

3.5.8.3.3 Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, wetlands would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned actions. Land disturbance from onshore construction periodically would cause short-term and permanent loss of wetlands. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. Mitigation would be anticipated to compensate for wetland loss if impacts could not be avoided or minimized. BOEM anticipates that the impact on wetlands resulting from ongoing activities associated with the No Action Alternative would be **minor**.

Cumulative Impacts of Alternative A – No Action. Other offshore wind activities could cause impacts that would be similar to the impacts of the Project. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands, thereby avoiding or minimizing impacts. If impacts would not be entirely avoided, compensatory mitigation would be anticipated for projects that result in permanent impacts, resulting in overall moderate impacts.

Under the No Action Alternative, existing environmental trends and activities would continue, and wetlands would continue to be affected by natural and human caused IPFs. Considering the IPFs and regulatory requirements for avoiding, minimizing, and mitigating impacts on wetlands, BOEM anticipates the No Action Alternative combined with all planned actions (including other offshore wind activities) would result in **moderate** impacts, primarily through land disturbance. Offshore wind activities are expected to contribute to the impacts through land disturbance, accidental releases, and cable emplacement and maintenance, although most of these IPFs would be attributable to ongoing activities.

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

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in similar or lesser impacts than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum-Case Scenarios*) would influence the magnitude of the impacts on wetlands:

- The Inshore and Onshore export cable routing variants within the Onshore Project area

An Onshore Export Cable Route with less wetlands within or adjacent to the ROW would have less potential for direct and indirect impacts on wetlands.

The US Wind has committed to measures to minimize impacts on wetland resources, as described in Appendix G, Table G-1. These measures include use of HDD at the landfall site, establishment of buffers around wetland areas and preparation and enforcement of a Project-specific SPCC Plan and SWPPP.

3.5.8.5 Impacts of Alternative B – Proposed Action on Wetlands and Other Waters of the United States

3.5.8.5.1 Impacts of Alternative B – Proposed Action

BOEM expects the proposed offshore wind development activities to affect land use and coastal infrastructure through the following primary IPFs. The land disturbance IPF discusses impacts on freshwater/non-tidal wetlands landward of the mean high water line. The cable emplacement and maintenance IPF discusses impacts on tidally influenced wetlands below the mean high water line.

As discussed in Section 3.5.8.1, the evaluation of wetlands and other waters of the U.S. focuses on tidal and non-tidal wetlands. For simplicity of analysis, these are considered “onshore” resources. The IPFs related to wetlands are therefore discussed as Onshore Activities and Facilities. Open waters other than tidal wetlands are discussed in Section 3.5.2, *Benthic Resources*, and are considered offshore activities and facilities.

Construction and Installation

Accidental releases: Onshore construction activities would require heavy equipment use and HDD activities, and potential spills could occur as a result of an inadvertent release from the machinery or during refueling activities. Frac-outs also have the potential to occur during HDD activities. A drilling fluid fracture contingency plan will be in place prior to the start of HDD activities. The US Wind would enforce its Project-specific SPCC Plan and SWPPP to minimize impacts on wetlands. In addition, all wastes generated onshore would comply with applicable federal regulations, including the Resource Conservation and Recovery Act and USDOT Hazardous Material regulations. Therefore, the Proposed Action would result in minor and temporary impacts on wetlands as a result of releases from heavy equipment during onshore construction.

Cable emplacement: Offshore export cable transition would occur at proposed 3R’s Beach landfall site. When the offshore cables reach the landfall, they will be installed via HDD, which would avoid disturbance of tidal areas. Construction at the landfall site could affect wetlands through sedimentation or other runoff from the work site (i.e., the 3R’s Beach parking lot).

The Bethany Beach firefly (*Photuris bethaniensis*) is on Delaware’s Endangered Species List and is restricted to the interdunal wetlands along Atlantic Ocean beaches near Bethany. There is a strong habitat association between the Bethany Beach firefly and the rare interdunal swale wetland habitat found along oceanfront beaches (DEDFW 2015). By avoiding direct alteration of interdunal swale wetlands effect on critical habitat for Bethany Beach firefly would be minimized.

In addition to the proposed Inshore Export Cable Route will traverse Indian River Bay. Similar to the landfall transition the inshore export cable installed between 3R’s Beach landfall and Indian River Bay (Old Basin Cove) and between Indian River (Deep Hole) the Indian River substation will in Indian River) will be installed using HDD thus avoiding impacts to estuarine and freshwater wetlands bordering the Indian River. Implementation of US Wind’s Project-specific SPCC Plan, SWPPP, and other sediment control measures and BMPs (Appendix G, Table G-1), cable emplacement and maintenance from Proposed Action construction would have short-term, negligible impacts on wetlands.

To achieve the target burial depth, US Wind and its contractors have determined dredging for barge access in locations along the Inshore Export Cable Routes would be necessary preceding cable installation (US Wind, Maryland Offshore Wind Project, Indian River Bay, Export Cables Dredging Plans, January 16, 2024). The maximum volume of dredging, assuming all four cables were installed within the southern Inshore Export Cable Routes is estimated to approximately 73,676 cubic yards (56,329 cubic meters).

Land disturbance: The types of impacts on wetlands and related functions from construction of the Proposed Action's onshore substation would be similar to those described in Section 3.5.8.3. Substation construction would result in vegetation clearing, excavation, rutting, compaction, and mixing of topsoil and subsoil. The Inshore Export Cable Route between the Indian River and the substation site would be accomplished via HDD (COP, Volume I, Section 2.6.2; US Wind 2024) and thus would not affect wetlands (except in the case of accidental release of HDD materials). The construction associated with the substation expansion, proposed substations, temporary workspace and access roads adjacent to the Indian River Power Plant would avoid alternation to adjacent estuarine and freshwater wetlands.

Use of HDD for the export cable landfall would avoid permanent impacts on wetlands near the 3R's Beach parking lot landfall site.

Dredged material will be piped via temporary dredge pipeline to a dewatering staging area at the US Wind substations, within the planned limits of construction disturbance. This pipeline may traverse across a portion of existing tidal wetland. These potential impacts would be minimized to the extent practical and temporary in nature. Dredged materials will be dewatered and placed in trucks for disposal/placement at an upland landfill location within 1,000 miles (161 kilometers) of the US Wind substations area. Dewatering will be achieved by a passive method using large geobags which would allow dredged material to dewater over approximately 30-60 days prior to removal and placed into dump trucks. Alternatively, mechanical dewatering using a temporary system of separators (shakers), clarifiers, mixing tanks, and belt presses could be sized to meet target daily dredge production and continuously remove material to one or more upland disposal facilities. A combination of passive and mechanical dewatering methods may be used, pending final design.

Wetlands adjacent to the substation site, HDD sites, and other workspaces may also be affected by sedimentation from nearby exposed soils. US Wind would use erosion and sedimentation controls and BMPs and would develop and implement a Project-specific SWPPP to avoid and minimize impacts during onshore construction (Appendix G, Table G-1). In summary, Proposed Action construction would have localized, minor impacts on wetlands.

Operations and Maintenance

Accidental releases: Onshore O&M activities would require periodic maintenance at the onshore substation site, landfall site, and along the Inshore Export Cable Route. Use of heavy equipment during these activities could result in potential spills. The impacts of these spills would be similar to those described for this IPF in Construction and Installation. Therefore, the Proposed Action would result in negligible and temporary impacts on wetlands as a result of releases from heavy equipment during onshore O&M.

Cable emplacement and maintenance: Onshore O&M activities would require periodic maintenance of the Inshore Export Cable Route. These activities could impact wetlands through sedimentation or other runoff from work sites. With continued implementation of US Wind's Project-specific SPCC Plan, SWPPP, and other sediment control measures and BMPs (Appendix G, Table G-1), cable emplacement and maintenance from Proposed Action O&M would have short-term, negligible impacts on wetlands.

Conceptual Decommissioning

The impacts of onshore and Offshore Project decommissioning on wetlands and waters of the U.S. would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. Impacts from cable removal could be negligible to minor if some offshore or inshore export cables are retired in place rather than removed.

3.5.8.5.2 Cumulative Impacts of Alternative B – Proposed Action

Accidental Release: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative accidental release impacts on wetlands from ongoing and planned activities including offshore wind. Impacts would likely be short term and minor due to the low risk and localized nature of the most likely spills, the use of SPCC Plans and SWPPPs for projects, and regulatory requirements for the protection of wetlands.

Cable Emplacement: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a minimal effect on the cable emplacement and maintenance cumulative impacts from ongoing and planned activities including offshore wind. Impacts of the Proposed Action and other ongoing or planned activities from cable emplacement and maintenance would be long-term, localized, and negligible.

Land Disturbance: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a minimal effect to the land disturbance cumulative impacts from ongoing and planned actions including offshore wind. Impacts due to onshore land use changes are expected to include a gradually increasing amount of wetland alteration and loss. Based on regional trends, land disturbance due to onshore residential, nonresidential, and infrastructure development other than offshore wind is anticipated to be substantially greater than that of the Proposed Action (Section 3.6.5, *Land Use and Coastal Infrastructure*). Impacts on land use and coastal infrastructure would be additive only if onshore structures (e.g., substations) associated with one or more other projects occurs in close spatial and temporal proximity. Impacts of the Proposed Action and other ongoing or planned actions from land disturbance would be long-term, localized, and moderate.

3.5.8.5.3 Conclusions

Impacts of Alternative B – Proposed Action. The Proposed Action may affect wetlands through short-term or temporary disturbance from activities within or adjacent to these resources. These impacts would be minimized to the extent practicable and temporary in nature. HDD, buffers, and BMP's will be used to minimize impacts to wetlands. Considering the avoidance, minimization, and mitigation measures required under federal and state statutes (e.g., CWA Section 404), construction of the Proposed Action would likely have **minor** impacts on wetlands, due to the potential need for compensatory mitigation resulting from temporary wetland impacts.

Cumulative Impacts of Alternative B – Proposed Action. In the context of other reasonably foreseeable environmental trends, ongoing and planned action, the Proposed Action would contribute a minimal effect to the overall cumulative impacts on wetlands. BOEM anticipates the overall impacts associated with the Proposed Action when combined with the impacts on wetlands from ongoing and planned actions including offshore wind would likely be **moderate**. The Proposed Action would contribute to the overall impact rating primarily through temporary impacts on wetlands from onshore land disturbance that requires compensatory mitigation.

3.5.8.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes Alternative on Wetlands and Other Waters of the United States

3.5.8.6.1 Impacts of Alternative C

Alternative C-1 would use the Towers Beach landfall instead of the 3R's Beach landfall, and a terrestrial-based Onshore Export Cable Route (route 2) from the Towers Beach landfall to the Indian River substation (Figure 2-6 in Section 2.1.3, *Alternative C – Landfall and Onshore Export Cable Routes Alternative*). The substation site is located in a previously developed area. US Wind would install the Towers Beach landfall using HDD. Alternative C-2 would use the same 3R's Beach landfall and Indian River substation site as Alternative B but would select from three different terrestrial-based Onshore Export Cable Routes (routes 1a, 1b, or 1c) to reach the substation site (Figure 2-7). Table 3.5.8-3 summarizes wetland impacts of each Onshore Export Cable Route under Alternatives C-1 and C-2.

While the extent of impacts under each Onshore Export Cable Route would differ, the types of impacts would be the same as described for Alternative B. Alternatives C-1 and C-2 would avoid impacts on wetlands within and adjacent to Indian River Bay and the Indian River, but would have additional wetland impacts along each Onshore Export Cable Route (Figure 3.5.8-4 and Figure 3.5.8-5).

Onshore Export Cable Corridor 2 (Alternative C-1):

There are a total of eight (8) waterbody crossings along Onshore Export Cable Route 2, including Love Creek, Burton Pond on Route 24, the Lewes and Rehoboth Canal, Sarah Run, Unity Branch, Guinea Creek, Indian River, and an unnamed stream flowing into Sarah Run. Approximately 2.4 miles (4.3 kilometers) of the 17-mile (28-kilometer) route would traverse areas of wetlands which are often immediately adjacent to the roadway ROW.

Onshore Export Cable Corridor 1a (Sub Alternative C-2):

There are a total of four (4) waterbody crossings along Onshore Export Cable Route 1a, including the Assawoman Canal at Central Avenue, Vines Creek on Route 26, Blackwater Creek, and an unnamed tributary into Salt Pond. Approximately 3 miles (4.8 kilometers) of the 16 mile (26-kilometer) route would traverse areas of wetlands which are often immediately adjacent to the roadway ROW.

Onshore Export Cable Corridor 1b (Sub Alternative C-2):

There are a total of seven (7) waterbody crossings along Onshore Export Cable Route 1b. The first two of the crossings are the same as route 1a (Assawoman Canal and an unnamed tributary into Salt Pond). The other five (5) crossings include Blackwater Creek, Vines Creek, Herring Branch, Pepper Creek, and Island Creek. Approximately 4.7 miles (7.6 kilometers) of the 16-nmile (26-kilometer) route would traverse areas of wetlands which are often immediately adjacent to the roadway ROW.

Onshore Export Cable Corridor 1c (Sub Alternative C-2):

There are a total of 32 waterbody crossings along Onshore Export Cable Route 1c, including the Assawoman Canal, Blackwater Creek, Vines Creek, Herring Branch, Pepper Creek, and Island Creek. Additional crossings include unnamed streams or creeks and multiple retention ponds associated with adjacent residential developments. If Onshore Export Cable Route 1c is selected, in areas with multiple retention ponds around residential developments, US Wind would microsite the route around these ponds. Approximately 5.8 miles (9.3 kilometers) of the 17-mile (27-kilometer) route would traverse areas of wetlands which are often immediately adjacent to the roadway ROW.

Impacts on wetlands were calculated by assuming a maximum worst-case scenario of a 50-foot (15.2-meter) construction corridor centered on the route alignment. Total impacts would be less than described below.

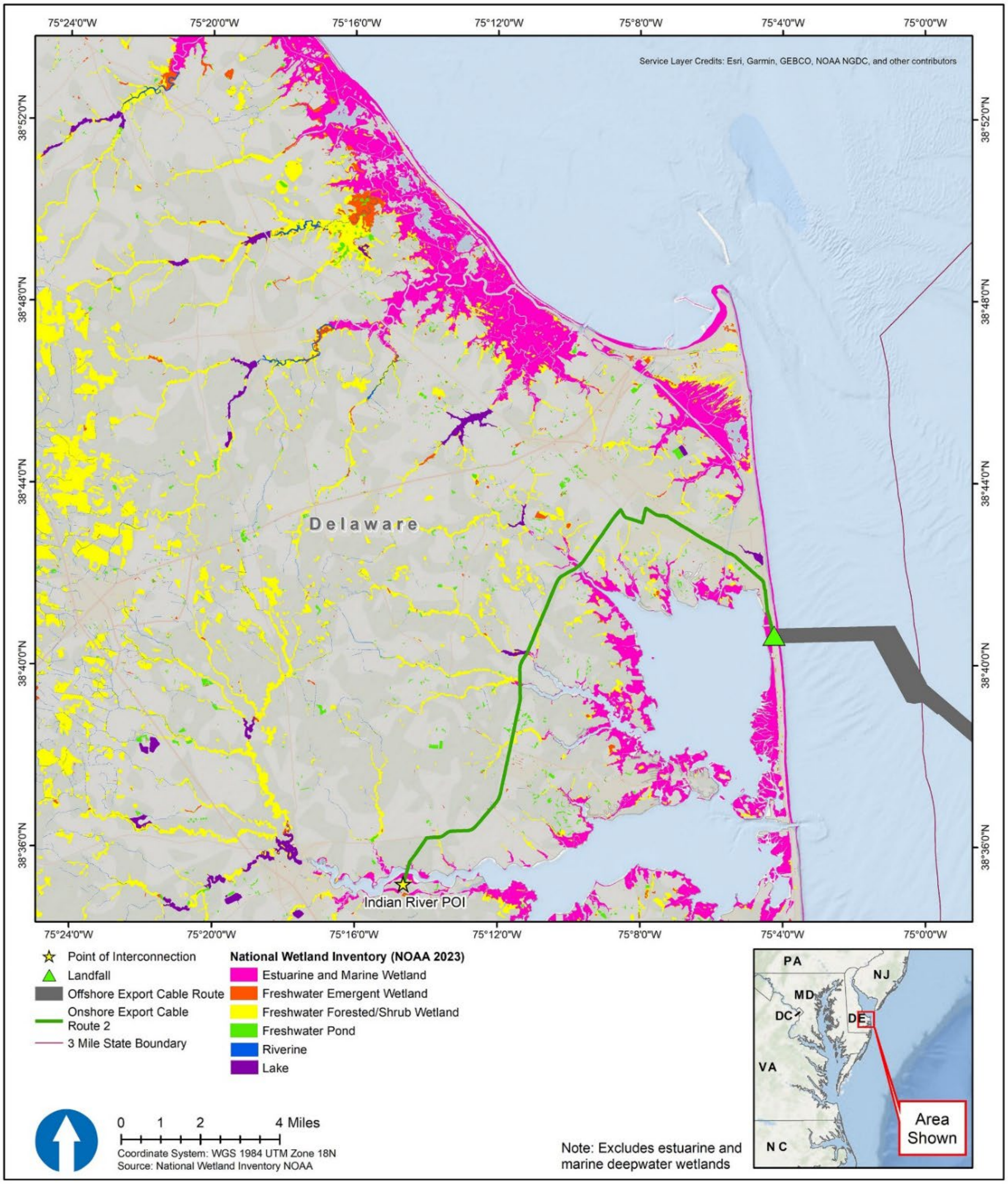

Figure 3.5.8-4 National wetland inventory wetlands along the Onshore Export Cable Routes associated with Alternative C-1

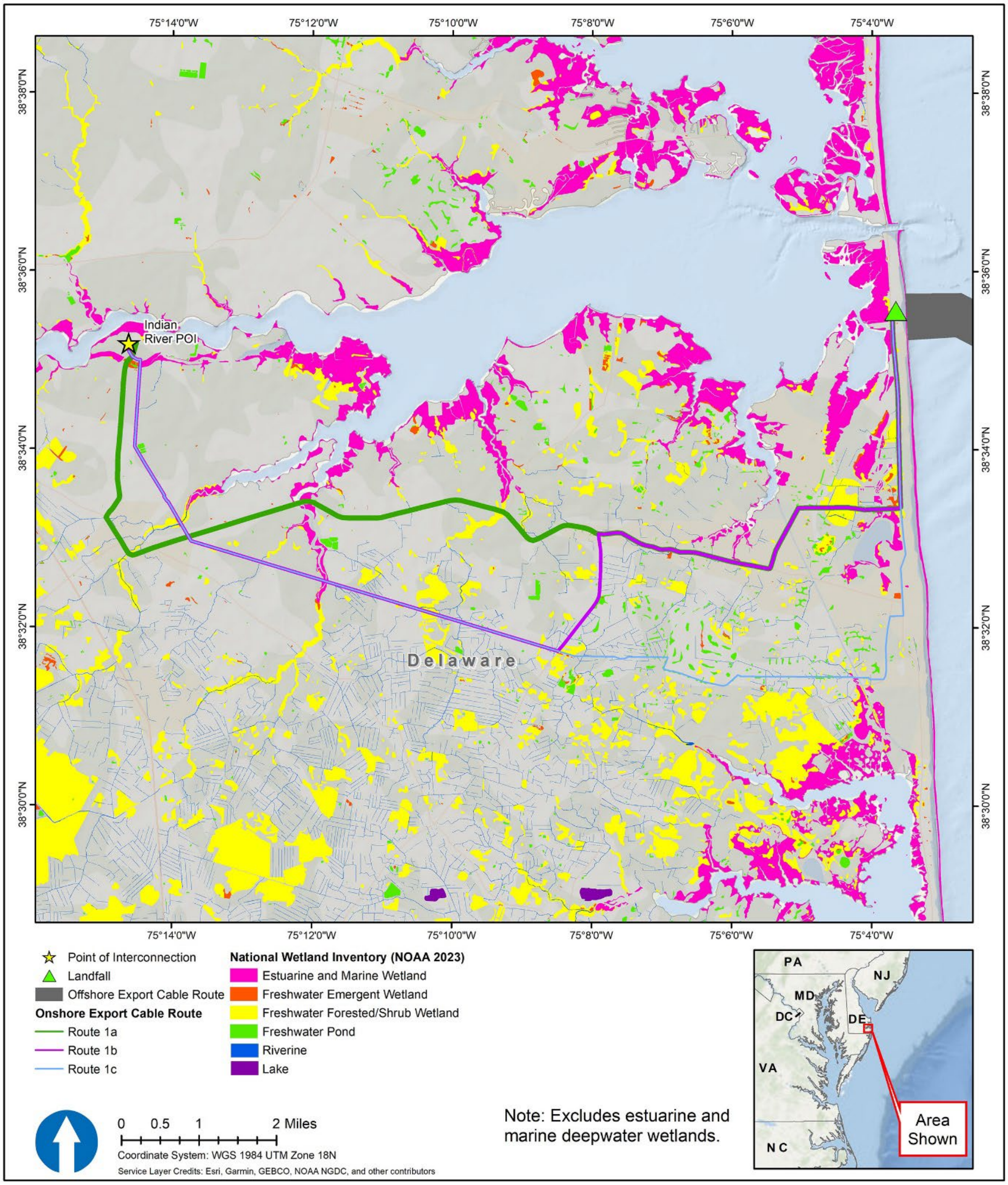

Figure 3.5.8-5. National wetland inventory wetlands along the Onshore Export Cable Routes associated with Alternative C-2

Table 3.5.8-3. Wetland impacts (acres) from Alternatives C-1 and C-2 Onshore Export Cable Routes

Wetland Community	Alternative C-1 Onshore Export Cable Route		Alternative C-2 Onshore Export Cable Route	
	2	1a	1b	1c
Non-tidal				
Freshwater emergent wetland	0.0	0.0	0.260	0.342
Freshwater forested/scrub-shrub wetland	0.082	0.138	1.846	2.468
Riverine	0.108	0.200	0.693	1.084
Lake	0.0	0.0	0.0	0.0
Freshwater pond	0.0	0.0	0.0	2.528
Total non-tidal wetlands	0.190	0.338	2.799	6.422
Tidal				
Emergent scrub-shrub tidal wetland	1.715	0.291	0.542	0.816
Total tidal wetlands	3.007	0.739	0.903	1.005
Total wetlands	3.197	1.077	3.702	7.427

3.5.8.6.2 Cumulative Impacts of Alternative C

The use of terrestrial, onshore cable routes under Alternative C would result in greater impacts to wetlands and waters of the US than those discussed under the Proposed Action, but the overall impact rating would not change. As discussed in Section 3.5.8.6.1 above, BOEM anticipates the overall impacts associated with the Proposed Action when combined with the impacts on wetlands from ongoing and planned actions including offshore wind would likely be **moderate**. The Proposed Action would contribute to the overall impact rating primarily through temporary impacts on wetlands from onshore land disturbance that requires compensatory mitigation.

3.5.8.6.3 Conclusions

Impacts of Alternative C. Based on the acres of impacted wetlands in Tables 3.5.8-3, while Alternatives C-1 and C-2 would have marginally different impacts, they would have the same impact rating as Alternative B: **minor**.

Cumulative Impacts of Alternative C. In the context of reasonably foreseeable environmental trends, ongoing and planned actions, Alternatives C-1 and C-2 would occur under the same scenario (Appendix D) as Alternative B. As a result, the overall impact of Alternatives C-1 and C-2 on wetlands when combined with past, present, and reasonably foreseeable activities would therefore be **moderate**.

3.5.8.7 Impacts of Alternatives D and E on Wetlands and Other Waters of the United States

3.5.8.7.1 Impacts of Alternative D and E

Alternatives D and E would not impact any onshore component of the Proposed Action; therefore, the impacts associated with the Proposed Action (as described in Section 3.5.8.5) would not change under Alternatives D and E.

3.5.8.7.2 Cumulative Impacts of Alternative D and E

Alternatives D and E would not impact any onshore component of the Proposed Action; therefore, the cumulative impacts associated with the Proposed Action (as described in Section 3.5.8.5) would not change under Alternatives D and E.

3.5.8.7.3 Conclusions

Impacts of Alternatives D and E. Alternatives D and E would have the same impact rating as Alternative B: **minor**. In the context of reasonably foreseeable environmental trends, Alternatives D and E would occur under the same scenario (Appendix D) as Alternative B.

Cumulative Impacts of Alternatives D and E. The overall impact of Alternatives D and E on wetlands and waters of the U.S. when combined with past, present, and reasonably foreseeable activities would therefore be **moderate**.

3.5.8.8 Comparison of Alternatives

Impacts of Alternatives. As described in Section 3.5.8.5, the impacts of the Proposed Action in combination with ongoing and planned actions would likely be similar to the impacts expected under the No Action Alternative. The Proposed Action would impact wetlands and waters of the U.S. primarily through land disturbance. Under the No Action Alternative, these impacts would not occur.

As stated in Section 3.5.8.6, compared to Alternative B, Alternatives C-1 and C-2 would have slightly different areal extent of impacts on wetlands but the impact designation would remain the same as the Proposed Action (**minor**). Alternatives D and E would have the same impacts as the Proposed Action (**minor**).

Cumulative Impacts of Alternatives. In the context of reasonably foreseeable environmental trends, ongoing and planned actions, the overall impact of the action alternatives on wetlands and waters of the U.S. when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **moderate**.

If BOEM requires the mitigation measures beyond the design features described in Section 3.5.8.4, then adverse Project impacts on wetlands and waters of the U.S. could be further reduced; however, overall impact ratings would remain the same as described in this section.

3.5.8.9 Proposed Mitigation Measures

No additional measures to mitigate impacts on wetlands and other waters of the United States have been proposed for analysis.

3.6.3 Demographics, Employment, and Economics

This section discusses potential impacts on demographics, employment, and economics from the Proposed Action, action alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area includes the counties and cities most likely to experience beneficial or adverse economic impacts from the Proposed Action. The geographic analysis area (Figure 3.6.3-1) includes the following counties and cities:

- Where proposed onshore infrastructure and primary construction ports are located: Baltimore, Maryland (Sparrows Point); Ocean City, Maryland; Gulf of Mexico (e.g., Ingleside, Texas, or Houma, Louisiana or Harvey, Louisiana); and Brewer, Maine.
- Where O&M ports are located: Ocean City Maryland; Lewes, Delaware; Hampton Roads area, Virginia; Hope Creek (New Jersey Wind Port), New Jersey; and Port of New York/New Jersey.
- Where visual impacts are most likely to occur: Sussex County, Delaware and Worcester County, Maryland.

3.6.3.1 Description of the Affected Environment

The geographic analysis area for demographics, employment, and economics includes 14 counties and cities in eight states (Figure 3.6.3-1). Tables 3.6.3-1 through 3.6.3-5 provide the following demographic information for these states and counties:

- Table 3.6.3-1: Demographic trends;
- Table 3.6.3-2: Income and Employment;
- Table 3.6.3-3: Housing;
- Table 3.6.3-4: Employment of Residents (i.e., jobs held by residents of the jurisdiction, regardless of where the jobs are actually located); and
- Table 3.6.3-5: At-Place Employment (i.e., jobs in a jurisdiction, regardless of where employees live).

Tables 3.6.3-6 through 3.6.3-8 provide NOAA's "Ocean Economy" data, which track economic activity dependent upon the ocean. This economic sector generally includes 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. These three tables provide the following data relevant to the Ocean Economy:

- Table 3.6.3-6: NOAA Ocean Economy Data
- Table 3.6.3-7: NOAA Ocean Economy Employment by Industry
- Table 3.6.3-8: NOAA Ocean Economy Data by State

Ocean economy data for offshore mineral extraction and ship and boat building were suppressed (not provided) for the jurisdictions in the geographic analysis area and are therefore not reported in Tables 3.6.3-6 through 3.6.3-8.

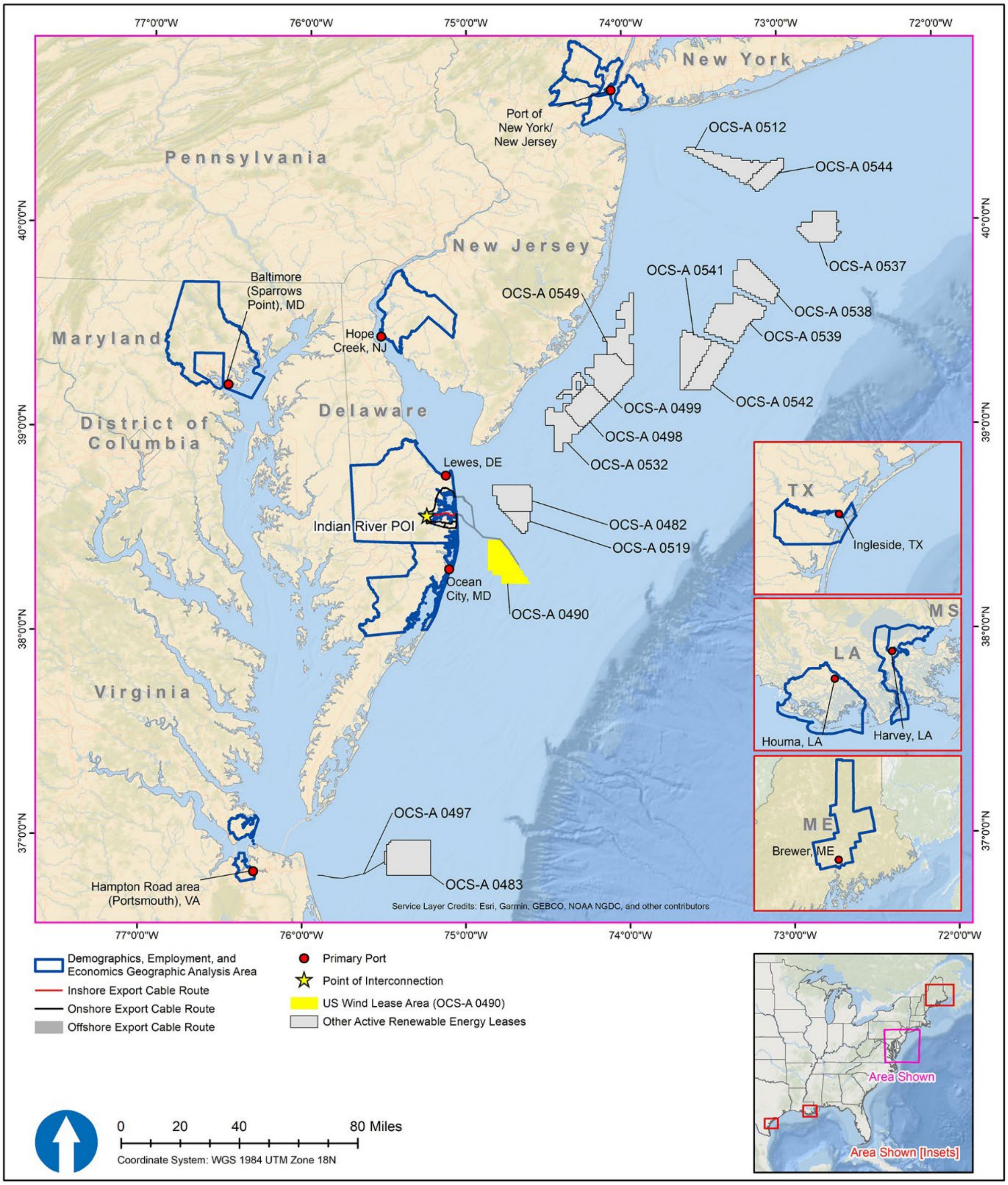

Figure 3.6.3-1. Demographics, employment, and economics geographic analysis area

Table 3.6.3-1. Demographic trends, 2010–2022

Jurisdiction	Population			2022 Population by Age (percent)			Median Age
	2010	2022	Percent Change, 2010 2022	Under 18	18 to 64	65 or Older	(2022)
Delaware	881,278	993,635	12.8	20.8	59.6	19.6	41.4
Sussex County	190,846	240,668	26.1	18.1	52.8	29.2	51.3
Maryland	5,696,423	6,161,707	8.2	22.1	61.9	16.0	39.1
Worcester County	51,133	52,827	3.3	17.1	54.8	28.0	50.6
Baltimore County	799,195	850,737	6.5	21.6	60.8	17.6	39.5
Louisiana	4,429,940	4,640,546	4.8	23.3	60.7	16.0	37.6
Terrebonne Parish	111,131	108,862	(2.0)	25.1	59.8	15.1	36.9
Jefferson Parish	431,019	436,171	1.2	22.1	60.1	17.8	39.8
Maine	1,327,665	1,366,949	3.0	18.4	60.2	21.5	44.8
Penobscot County	152,934	152,640	(0.2)	17.8	62.8	19.4	42.4
New Jersey	8,721,577	9,249,063	6.1	23.1	61.6	16.6	40.0
Essex County	780,872	853,374	9.3	25.0	62.7	13.8	37.6
Hudson County	622,123	712,029	14.5	21.2	67.7	12.2	35.6
Salem County	65,982	64,840	(1.7)	22.7	59.6	18.8	41.8
Union County	529,547	572,079	8.0	24.6	62.0	14.6	39.0
New York	19,229,752	19,994,379	4.0	22.0	62.3	17.0	39.3
Kings County	2,466,782	2,679,620	8.6	23.6	62.9	14.5	35.9
Richmond County	463,450	492,925	6.4	22.9	61.8	16.6	40.3
Texas	24,311,891	29,243,342	20.3	25.3	61.8	12.9	35.2
Nueces County	334,370	353,245	5.6	24.1	60.9	15.0	36.2
Virginia	7,841,754	8,624,511	10.0	21.8	62.2	16.0	38.7
City of Portsmouth	96,785	97,384	0.6	23.1	61.9	15.1	35.6

Source: U.S. Census Bureau 2022

Table 3.6.3-2. Income and employment data

Jurisdiction	Population (2022)	Population Density (2020) (per square mile)	Per Capita Income (2022)	Jobs (2021)	Labor Force Participation1 (2022)	Unemployment1 (2022)
Delaware	993,635	508.0	$42,180	408,714	61.9%	5.4%
Sussex County	240,668	253.6	$42,958	73,524	54.2%	5.0%
Maryland	6,161,707	636.1	$49,865	2,283,019	66.6%	5.1%
Worcester County	52,827	112.0	$48,769	19,119	58.8%	6.5%
Baltimore County	850,737	1,428.1	$46,603	317,997	65.9%	5.2%
Louisiana	4,640,546	107.8	$32,981	1,592,665	58.7%	6.6%
Terrebonne Parish	108,862	89.1	$32,143	41,463	59.1%	5.9%
Jefferson Parish	436,171	1,464.6	$35,720	169,655	63.1%	6.0%
Maine	1,366,949	44.2	$39,718	504,710	62.0%	4.0%
Penobscot County	152,640	44.8	$34,423	56,435	59.8%	4.3%
New Jersey	9,249,063	1,263.0	$50,995	3,570,543	65.9%	6.2%
Essex County	853,374	6,850.4	$45,946	266,154	66.2%	8.5%
Hudson County	712,029	15,691.5	$51,277	227,571	69.8%	5.8%
Salem County	64,840	195.4	$37,904	16,855	60.5%	8.0%
Union County	572,079	5,598.6	$49,666	187,879	68.8%	6.2%
New York	19,994,379	29,303.3	$47,173	7,887,280	62.8%	6.2%
Kings County	2,679,620	39,437.8	$43,165	643,139	63.7%	7.3%
Richmond County	492,925	8,618.2	$43,199	101,903	59.9%	5.4%
Texas	29,243,342	111.6	$37,514	10,798,364	64.6%	5.2%
Nueces County	353,245	420.9	$32,284	131,192	61.2%	5.7%
Virginia	8,624,511	218.6	$47,210	3,340,509	63.8%	4.4%
City of Portsmouth	97,384	2,940.3	$31,457	ND	58.1%	6.6%

Source: U.S. Census Bureau 2022

[1] The proportion of the total population 16 years and older that are in the labor force (i.e., working or actively seeking work).

Table 3.6.3-3. Housing data, 2022

Jurisdiction	Total Housing Units	Occupied	Vacant	Vacancy Rate	Seasonal Vacant Housing Units[1]	Non-seasonal Vacant Housing Units	Median Value[2]	Median Monthly Rent[2]
Delaware	451,556	402,334	63,470	14.1%	38,839	24,631		
Sussex County	144,210	99,858	44,352	30.8%	37,713	6,639	$324,400	$1,162
Maryland	2,531,075	2,375,984	183,073	7.2%	54,466	128,607		
Worcester County	56,399	23,457	32,942	58.4%	30,216	2,726	$310,300	$1,144
Baltimore County	349,471	328,611	20,860	6.0%	1,040	19,820	$310,800	$1,479
Louisiana	2,080,371	1,816,902	296,276	14.2%	54,255	242,021		
Terrebonne Parish	47,314	41,505	5,809	12.3%	1,338	4,471	$174,400	$956
Jefferson Parish	193,740	176,165	17,575	9.1%	2,565	15,010	$231,700	$1,121
Maine	741,803	605,338	146,359	19.7%	118,316	28,043		
Penobscot County	75,119	63,687	11,432	15.2%	5,784	5,648	$176,700	$932
New Jersey	3,756,340	3,516,978	268,119	7.1%	132,358	135,761		
Essex County	334,136	312,942	21,194	6.3%	606	20,588	$466,500	$1,404
Hudson County	311,964	290,054	21,910	7.0%	2,602	19,308	$486,900	$1,722
Salem County	27,739	24,744	2,995	10.8%	124	2,871	$208,200	$1,165
Union County	209,928	199,996	9,932	4.7%	366	9,566	$458,000	$1,570
New York	8,494,452	7,774,308	811,476	9.6%	315,085	496,391		
Kings County	1,079,551	997,957	81,594	7.6%	9,328	72,266	$865,300	$1,715
Richmond County	183,524	170,000	13,524	7.4%	813	12,711	$637,100	$1,602
Texas	11,654,971	11,087,708	1,047,668	9.0%	210,492	837,176		
Nueces County	151,836	130,122	21,714	14.3%	4,702	17,012	$177,700	$1,175
Virginia	3,625,285	3,380,607	304,626	8.4%	77,556	227,070		
City of Portsmouth	43,096	38,962	4,134	9.6%	188	3,946	$213,300	$1,225

Source: U.S. Census Bureau 2022

[1] Vacant seasonal housing units are those that are offered for seasonal, recreational, or occasional use that are vacant.
[2] Median value is for owner-occupied units; median rent is for renter-occupied units.

Table 3.6.3-4. Percent Employment of residents by industry, 2022

Industry	Delaware	Sussex County	Maryland	Worcester County	Baltimore County	Virginia	City of Portsmouth	New Jersey	Essex County	Hudson County	Salem County	Union County	New York	Kings County	Richmond County	Texas	Nueces County	Louisiana	Terrebonne Parish	Jefferson Parish	Main	Penobscot County
Agriculture, forestry, fishing and hunting, mining	1.1	2.4	0.6	2.6	0.4	0.9	0.1	0.3	0.1	0.1	1.7	0.2	0.6	0.1	0.1	2.6	2.2	3.4	9.5	1.0	2.5	1.7
Construction	7.1	10.0	7.4	9.6	5.6	6.5	7.0	6.1	6.6	5.6	7.4	7.0	5.8	4.9	7.2	8.7	10.8	8.1	7.2	9.7	7.6	8.2
Manufacturing	7.5	7.9	4.7	4.6	5.7	7.1	12.2	8.1	6.8	6.6	11.4	8.7	5.8	2.9	2.3	8.5	6.3	7.5	7.0	5.4	9.0	4.5
Wholesale trade	1.8	1.8	1.7	2.2	2.0	1.7	2.1	3.1	2.5	2.9	3.9	3.3	2.1	2.0	1.8	2.6	2.0	2.5	1.7	3.4	1.9	1.8
Retail trade	12.0	12.7	9.2	9.4	10.2	9.9	12.8	10.7	9.6	9.3	9.7	10.1	9.8	8.9	9.2	11.3	12.3	11.3	16.4	10.8	12.9	13.5
Transportation, warehousing, utilities	6.0	4.6	5.0	2.8	6.0	4.8	6.3	6.5	8.3	7.5	10.4	10.3	5.7	6.7	7.8	6.4	5.1	5.7	6.4	6.6	4.3	4.8
Information	1.1	1.0	1.8	0.9	1.7	1.8	1.1	2.6	3.0	3.8	1.0	2.2	2.8	4.8	2.5	1.6	1.1	1.4	0.4	1.2	1.6	1.1
Finance, insurance, real estate, renting, and leasing	9.4	6.0	6.0	6.9	7.7	6.4	4.8	8.6	8.0	12.8	4.9	8.5	8.0	7.6	8.6	6.9	5.3	5.1	4.4	6.1	6.4	4.6
Professional scientific management; administrative and waste management	11.2	11.0	16.1	11.8	13.1	16.4	10.4	14.1	14.2	18.0	8.4	12.9	12.6	15.1	11.3	12.2	9.4	9.5	7.2	11.3	9.6	6.4
Educational, health care, social assistance	24.6	23.1	23.6	20.1	27.2	22.1	22.6	24.0	24.6	18.8	26.6	21.5	28.8	28.9	32.3	21.5	24.0	25.0	23.0	23.2	27.4	34.6
Arts, entertainment, recreation, accommodation, food services	8.3	9.4	7.8	19.0	7.4	8.3	6.9	7.3	7.0	7.5	5.6	6.5	8.6	9.2	6.4	8.7	10.5	9.8	8.6	11.0	7.8	8.4
Other services, except public administration	4.3	4.9	5.3	3.0	5.0	5.2	5.5	4.2	4.9	4.0	3.4	4.8	4.6	5.0	4.1	5.0	5.6	5.2	4.8	5.6	4.5	5.4
Public administration	5.7	5.1	11.0	7.1	8.0	8.9	8.3	4.3	4.4	3.0	5.5	4.0	4.7	3.9	6.4	4.1	5.5	5.5	3.4	4.7	4.4	5.0
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: U.S. Census Bureau 2022

Table 3.6.3-5. Percentage of At-place employment by industry, 2020

Industry	Delaware	Sussex County	Maryland	Worcester County	Baltimore County	Virginia	Portsmouth	New Jersey	Essex County	Hudson County	Salem County	Union County	New York	Kings County	Richmond County	Texas	Nueces County	Louisiana	Terrebonne Parish	Jefferson Parish	Main	Penobscot County
Agriculture, forestry, fishing and hunting	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.1	0.6	1.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Mining, quarrying, oil & gas	0.1	0.2	0.0	0.0	0.0	1.9	0.2	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.1	0.1	0.0
Utilities	0.6	0.5	0.4	0.0	0.5	0.7	0.4	0.2	0.5	1.3	0.5	0.9	0.5	11.7	0.7	0.5	0.7	0.9	0.5	0.5	0.4	0.1
Construction	5.7	7.6	7.1	5.2	7.7	8.4	6.0	6.7	5.6	5.9	4.4	4.1	2.2	7.5	5.4	4.5	4.4	8.8	6.5	10.8	5.9	8.3
Manufacturing	6.9	13.7	4.3	3.3	4.2	7.0	4.0	6.6	10.4	4.7	5.9	5.8	3.0	11.4	7.1	4.9	2.3	1.1	7.4	4.9	7.2	4.8
Wholesale trade	4.5	2.3	3.7	1.1	4.0	4.3	6.3	5.1	3.5	3.7	7.4	4.9	6.9	7.6	9.7	3.9	3.7	1.7	4.7	4.8	3.0	2.1
Retail trade	13.1	18.3	12.4	19.5	15.3	13.7	15.7	14.9	16.2	19.6	12.3	9.4	10.1	9.9	13.7	10.8	11.5	19.5	12.2	13.4	12.6	13.3
Transportation, warehousing	4.8	4.3	3.8	0.5	3.0	4.2	5.4	6.7	3.2	4.6	5.7	11.6	11.2	13.4	7.9	3.3	3.4	5.8	5.1	2.9	3.7	7.9
Information	1.5	0.7	2.0	0.8	1.6	1.2	0.9	0.6	2.0	1.5	2.2	1.8	3.3	0.2	1.3	3.8	1.8	1.6	2.3	1.1	2.8	0.5
Finance and insurance	10.2	2.8	4.5	3.1	5.9	4.0	5.3	2.5	5.9	3.5	5.8	6.9	18.9	2.2	2.8	6.9	2.5	3.0	5.5	3.3	5.0	1.3
Real estate, rental/leasing	1.6	2.2	2.0	2.5	2.4	1.7	2.0	2.9	1.5	1.4	1.7	1.8	1.7	1.4	1.7	2.2	2.8	1.0	1.9	2.3	1.6	1.4
Prof., scientific, tech. services	8.0	4.1	13.0	3.6	8.6	6.1	6.3	5.3	5.5	3.4	8.9	6.9	6.6	3.1	8.5	8.1	3.8	3.4	7.2	5.3	15.6	6.0
Mgmt. of companies and enterprises	1.6	0.5	2.3	0.0	3.2	1.6	2.3	1.6	2.1	3.4	3.2	1.2	3.1	0.1	3.3	2.3	0.5	0.3	2.9	0.6	2.4	0.4
Admin./support and waste management services	7.8	6.2	9.7	2.4	7.6	6.5	7.7	5.6	4.5	4.1	10.1	6.0	6.0	2.5	5.5	9.2	3.6	5.8	9.7	7.0	7.9	7.3
Educational services	1.5	0.5	3.4	0.7	2.2	2.9	2.4	0.6	3.4	3.0	2.9	4.4	3.0	0.7	2.1	4.9	5.5	4.0	1.9	0.9	2.3	0.8
Health care, social assistance	17.6	17.0	16.6	12.7	19.5	18.4	18.6	17.5	21.2	26.3	16.5	21.0	11.8	15.7	17.0	21.5	41.1	29.6	14.7	21.0	13.9	28.5
Arts, entertainment, rec.	1.8	1.8	1.4	4.4	1.3	1.3	1.6	0.8	1.3	1.4	1.3	1.3	1.3	0.6	1.2	1.4	1.2	1.1	1.2	1.4	1.4	0.7
Accommodation and food services	9.1	13.9	8.7	34.4	8.3	11.5	10.7	11.6	9.0	8.2	7.4	7.1	7.4	8.3	7.0	7.4	6.6	7.5	10.7	14.6	9.4	9.5
Other services (except public administration)	3.5	3.2	4.5	5.7	4.6	4.3	4.2	5.5	3.6	3.2	3.9	4.9	2.7	3.5	5.0	4.4	4.6	4.9	4.0	4.1	4.7	7.0
Industries not classified	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: U.S. Census Bureau 2022

Table 3.6.3-6. Ocean economy data by county and city, 2020

Jurisdiction	Ocean Economy GDP			Percent of Total Ocean Economy GDP		
	Recreation and Tourism	Living Resources	Total, All Sectors	Recreation and Tourism	Living Resources	Ocean Economy GDP as Share of Total GDP
Sussex County, Delaware	$598,361,000	$6,629,000	$637,662,000	93.8%	1.0%	4.8%
Worcester County, Maryland	$412,300,000	$1,758,000	$422,354,000	97.6%	0.4%	16.6%
Baltimore County, Maryland	$214,219,000	$27,252,000	$821,526,000	26.1%	3.3%	1.6%
Jefferson Parish, Louisiana	$541,011,000	$22,982,000	$1,024,055,000	52.8%	2.2%	4.5%
Terrebonne Parish, Louisiana	$117,527,000	$28,961,000	$811,691,000	14.5%	3.6%	15.9%
Penobscot County, Maine	ND	ND	ND	ND	ND	ND
Essex County, New Jersey	$180,050,000	$25,157,000	$616,434,000	29.2%	4.1%	1.2%
Hudson County, New Jersey	$622,014,000	$13,180,000	$1,091,632,000	57.0%	1.2%	2.4%
Salem County, New Jersey	$18,040,000	$0	$100,892,000	17.9%	0.0%	1.8%
Union County, New Jersey	$123,583,000	$1,272,000	$1,281,779,000	9.6%	0.1%	3.5%
Kings County, New York	$1,663,035,000	$174,287,000	$1,946,904,000	85.4%	9.0%	2.0%
Richmond County, New York	$269,864,000	$8,595,000	$344,369,000	78.4%	2.5%	2.1%
Nueces County. Texas	$481,284,000	ND	$946,127,000	50.9%	ND	5.2%
City of Portsmouth, Virginia	$75,516,000	ND	$1,223,825,000	6.2%	ND	20.2%

Source: BEA 2024, NOAA 2023
GDP = gross domestic product; ND = no data

Table 3.6.3-7. Ocean economy employment by industry, 2020

Jurisdiction	Marine Construction	Living Resources	Recreation and Tourism	Marine Transportation	Total, All Sectors*	Ocean Economy Employment as Percent of Total County Employment
Sussex County, Delaware	ND	86	9,816	ND	10,213	13.9%
Worcester County, Maryland	47	13	6,182	ND	6,281	32.9%
Baltimore County, Maryland	137	208	4,713	ND	12,303	3.9%
Jefferson Parish, Louisiana	385	256	13,856	2,081	18,116	10.7%
Terrebonne Parish, Louisiana	ND	340	3,804	472	9,850	23.8%
Penobscot County, Maine	ND	ND	ND	ND	ND	ND
Essex County, New Jersey	310	169	3,558	2,023	6,330	2.4%
Hudson County, New Jersey	82	119	13,305	3,663	18,147	8.0%
Salem County, New Jersey	ND	ND	531	1,193	1,738	10.3%
Union County, New Jersey	453	17	2,678	3,999	10,208	5.4%
Kings County, New York	155	1,227	24,315	2,869	28,566	4.4%
Richmond County, New York	138	73	5,331	252	5,794	5.7%
Nueces County. Texas	109	86	11,644	558	14,911	11.4%
City of Portsmouth, Virginia	516	ND	2,345	ND	15,172	64.4%

Sources: BEA 2024, NOAA 2023
ND = no data
*Self-employment data are suppressed.

Table 3.6.3-8. Ocean economy data by state, 2020

Jurisdiction	State Ocean Economy GDP			Ocean Economy GDP, Percent of Total State Economy GDP		State Ocean Economy GDP
	Recreation and Tourism	Living Resources	Total, All Sectors	Recreation and Tourism	Living Resources	as Share of Overall State GDP
Delaware	$948,483,000	$22,699,000	$1,411,718,000	67.2%	1.6%	1.9%
Louisiana	$1,759,147,000	$456,050,000	$8,665,522,000	20.3%	5.3%	3.8%
Maine	$1,426,635,000	$433,083,000	$2,663,385,000	53.6%	16.3%	4.0%
Maryland	$3,000,000,000	$296,700,000	$9,400,000,000	31.9%	3.2%	2.4%
New Jersey	$3,600,752,000	$287,348,000	$11,068,643,000	32.5%	2.6%	1.9%
New York	$16,851,779,000	$520,013,000	$21,205,738,000	79.5%	2.5%	1.3%
Texas	$1,678,149,000	$447,789,000	$46,601,820,000	3.6%	1.0%	2.6%
Virginia	$2,100,000,000	$594,100,000	$9,000,000,000	23.3%	6.6%	1.7%

Source: NOAA 2022

3.6.3.1.1 Sussex County, Delaware

Sussex County, Delaware, is known for its history, coastal tourism, and industrial footprint. The county has more than 25 miles (40 kilometers) of coastline (Sussex County Land Trust 2022) and six main beach towns, including Bethany Beach, South Bethany Beach, Dewey Beach, Lewes, Rehoboth Beach, and Fenwick Island (Sussex County Government 2022). Millions visit Sussex County beaches each summer to swim, fish, surf, and sail, and many beach towns provide summer attractions including arts and music festivals and craft shows (Visit Southern Delaware 2022).

Sussex County is Delaware's largest county geographically, with an overall land area of 361 square miles (936 square kilometers) (Table 3.6.3-1). In 2021, the county had an overall population density of 253.6 people per square mile (656.8 people per square kilometer), an increase from 210.6 people per square mile (545.5 people per square kilometer) in 2010. Sussex County's population swells to approximately 400,000 during the summer season, from June through August, approximately a 62 percent increase (MacArthur 2017).

Sussex County accounts for nearly one-quarter of the total state population. The population of both Sussex County and Delaware increased significantly between 2010 and 2022. Sussex County's population is notably older than the state as a whole (Table 3.6.3-1).

Sussex County, Delaware, relies on tourism and seasonal visitors to boost its economy and has a higher proportion of seasonal housing than Delaware as a whole. As shown in Table 3.6.3-3, most of the vacant units in the county are seasonally vacant—i.e., occupied for a portion of the year, typically during the summer tourism season.

Education, health care, and social assistance occupations employ the largest share of Sussex County employees, followed by retail trade, Professional scientific management; administrative and waste management, and construction (Table 3.6.3-4). At-place employment (Table 3.6.3-5) follows a similar pattern, with the largest number of jobs in the education, health care and social assistance industry, followed by retail trade. The share of employees and jobs in agriculture, construction, manufacturing, and retail in Sussex County is higher than the statewide average, reflecting the county's economic focus on beach-oriented tourism along the Atlantic coastline, as well as agricultural and industrial activities farther inland.

Delaware's Ocean Economy relies heavily on tourism and recreation and while COVID-19 impacts affected the industry it still remains a key industry. 67.2 percent of Delaware's Ocean Economy gross domestic product (GDP) stemmed from tourism and recreation in 2020, compared to 70.2 in 2019. Tourism and recreation accrued $1 billion for the State of Delaware in 2019 and $948.5 million in 2020, signifying how important this industry is not only for the Ocean Economy, but the economy as a whole for Delaware. Sussex County's Ocean Economy reflects a similar trend. Nearly all the Ocean Economy gross domestic product and employment in Sussex County is from tourism and recreation (94.6 percent in 2019 and 93.8 percent in 2020) (Tables 3.6.3-6 through 3.6.3-8). The total Ocean Economy GDP in 2019 for Sussex County was $665.8 million, or 6.4 percent of the total county's GDP in 2019 and $637.7 million in 2020, or 6.1 percent of the total county's GDP (NOAA 2022). The Ocean Economy accounted for 15 percent of all employment within the county in 2019 and 13 percent in 2020, with recreation and tourism accounting for the largest share of employment.

3.6.3.1.2 Worcester and Baltimore Counties, Maryland

Worcester County

Worcester County, located on the Delmarva Peninsula, is bordered by Delaware to the north and Virginia to the south. Worcester County is the only Maryland County with coastline on the Atlantic Ocean, including the southern portion of Fenwick Island (the barrier island that includes the municipalities of Fenwick Island, Delaware, and Ocean City, Maryland) and the northern portion of Assateague Island. Worcester County is a nationally significant summer vacation destination due to the presence of Ocean City, as well as Assateague Island National Seashore, state parks, and other tourist resources (MdoC 2022). More than eight million people travel to Ocean City each year for beach and ocean activities and cultural events.

The population of Worcester County grew by approximately 3.3 percent from 2010 to 2021 (Table 3.6.3-1), although the county's population accounts for less than 1 percent of the statewide population. The county's median age and share of population age 65 or older are substantially higher than statewide values.

Worcester County's economy relies on tourism and visitors. This is reflected by the large number of seasonal vacant housing units in the county, which account for more than half of all such units in the state (Table 3.6.3-3).

Education, health care, and social assistance jobs employ the largest share of Worcester County residents and provide the largest share of jobs in the county (as is the case for every state and nearly every county in the geographic analysis area). Consistent with Worcester County's identity as a tourist destination, arts, entertainment, recreation, accommodation, and food services also provide significant numbers of jobs (Tables 3.6.3-4 and 3.6.3-5).

Out of all the geographic aeras of interest, Worcester County's Ocean Economy contributes the most to the county's total GDP; the Ocean Economy accounts for 16.6 percent of the county's total GDP. In Worcester County, tourism and recreation accounted for nearly all (98 percent) of the overall Ocean Economy GDP (NOAA 2022), signifying the county's reliance on tourism and recreation. Worcester County's Ocean Economy accounts for 32.9 percent of the county's total employment, which is the second highest percentage of all the geographic aeras of interest. Tourism and recreation are the largest employers within the Ocean Economy and account for 6,182 jobs. This reflects how tourism and recreation are vital to the county's total GDP and county's total employment.

Baltimore County

Baltimore County is located in northern Chesapeake Bay at the mouth of the Patapsco River. Baltimore County is the third most populous county in Maryland, with an overall land and water area of 598 square miles (1,549 square kilometers) (Table 3.6.3-1). In 2021, the county has an overall population density of 1,428.1 people per square mile (3,698.8 people per square kilometer), an increase from 1,366 people per square mile (3,537.9 people per square kilometer) in 2010 (Open Data Network 2018). Chesapeake Bay is accessible in southern Baltimore County, and attracts boating, fishing, swimming, and hiking. The bay, along with state and local parks make Baltimore County a popular recreation destination (COP, Volume II, Section 17.3.1; US Wind 2024).

The population of both Baltimore County and Maryland increased between 2010 and 2021 (Table 3.6.3-1). The age distribution of Baltimore County's population was similar to the state, although the county had a slightly higher percentage of residents aged 65 or older (Table 3.6.3-2). Baltimore County accounts for nearly 14 percent of the total Maryland population. In 2020, labor force participation and unemployment in Baltimore County was comparable to the state level, while per capita income was slightly lower than the state. Baltimore County has relatively little seasonal housing. Rents and housing values were lower than the statewide average.

Educational services, healthcare and social assistance employ the largest number of residents and account for the largest number of at-place jobs in both Baltimore County and Maryland, followed by professional services (Tables 3.6.3-4 and 3.6.4-5). Out of the geographic areas of interest Maryland's Ocean Economy contributes the highest to the state's total GDP. The Ocean Economy contributes 2.4 percent to Maryland's total state GDP. Tourism and recreation contributed $3,000,000,000 to Maryland's economy in 2019, reflecting the importance of tourism and recreation in this state. Similarly, Baltimore County's tourism and recreation account for approximately one-quarter of the overall Ocean Economy GDP (NOAA 2022) (Tables 3.6.3-6 and 3.6.3-7). The total Ocean Economy GDP in 2019 for Baltimore County accounted for 1.6 percent of the total county's economy (NOAA 2022). Compared to other geographic areas of interest, Baltimore County's Ocean Economy contributes considerably less to the total county GDP. The Ocean Economy share of Baltimore County's employment is disproportionately high relative to its contribution to the total county GDP. The Ocean Economy in Baltimore County accounts for 3.9 percent of total employment in the county.

3.6.3.1.3 Jefferson and Terrebonne Parishes, Louisiana

Terrebonne Parish (Houma)

Terrebonne Parish encompasses Houma and is located in south Louisiana bordered by the Gulf of Mexico to the south, the Atchafalaya river to the northwest and Atchafalaya Bay to the west. Terrebonne Parish has approximately 1,229.9 square miles (3185.4 square kilometers) of land area and is the 5th largest county in Louisiana by total area (U.S. Census Bureau 2022a). Population density for Terrebonne Parish is 89.1 people per square mile, making the area fairly rural and slightly less dense than the state. The Parish decreased in population from 2010 to 2022 by 2 percent, compared to the states increase of 4.8 percent.

The age distribution of Terrebonne Parish's population is similar to the state (Table 3.6.3-2), while the median age in the parish was approximately one year younger than the state. The largest percentage of employment by residents in Terrebonne Parish is Educational, health care, social assistance followed by retail trade and Agriculture, forestry, fishing and hunting, mining (Table 3.6.3-4).

The Ocean Economy in Jefferson Parish totals more than $1 billion and accounts for 15.9 percent of the total county GDP. The recreation and tourism sector comprises less than a quarter of the county's total Ocean Economy GDP (Table 3.6.3-7). The Ocean Economy provides more than 9,000 jobs in Terrebonne Parish, more than one third of which are in the recreation and tourism sub-sector. These jobs account for more than 20 percent of total employment in the parish (Table 3.6.3-8).

Jefferson Parish (Harvey)

Jefferson Parish encompasses Harvey and is located in southeast Louisiana, bordered by Lake Pontchartrain to the north and the Gulf of Mexico to the South and includes substantial portions of the New Orleans metropolitan area. Jefferson Parish is approximately 300.9 square miles (779.3 square kilometers) of land area and had a population density of 1,464.6 people per square mile making it substantially denser than the state. The parish grew by 1.2 percent between 2010 and 2022, slower than the state's 4.8 percent increase (Table 3.6.3-1). The age distribution of Jefferson Parish population similar to the state (Table 3.6.3-2), while the median age in the parish was approximately 2 years older than the state. The largest percent of employment by residents in Jefferson Parish is Educational, health care, social assistance followed by Professional scientific management; administrative and waste management and Arts, entertainment, recreation, accommodation, food services and retail trade (Table 3.6.3-4).

The Ocean Economy in Jefferson Parish totals more than $1 billion and accounts for 4.5 percent of the total county GDP. The recreation and tourism sector comprises more than half percent of the county's total Ocean Economy GDP (Table 3.6.3-7). The Ocean Economy provides more than 18,000 jobs in Jefferson Parish, more than three-quarters of which are in the recreation and tourism sub-sector. These jobs account for more than 10 percent of total employment in the parish (Table 3.6.3-8).

3.6.3.1.4 Nueces County, Texas

Nueces County encompasses Ingleside and the City of Corpus Christi and surrounding areas in the southern portion of the Texas Gulf Coast. The county includes the south side of Corpus Christi Bay and Nueces Bay, portions of the northern side of Corpus Christi Bay—including the Port of Ingleside—as well as Mustang Island (the barrier island between Corpus Christi Bay and the Gulf of Mexico). The County has a population density of approximately 421 people per square mile (Table 3.6.3-2), making it four times as dense as the state. From 2010 to 2021, the population in Nueces County grew by 5.4 percent, slower than the statewide growth rate of more than 20 percent (Table 3.6.3-1). Approximately 80 percent of all vacant housing units in Nueces County were seasonal (Table 3.6.3-3).

The Ocean Economy in Nueces County totals approximately $946 million and accounts for more than 5 percent of the total GDP (Table 3.6.3-7). The recreation and tourism sector comprises approximately half of the county's total Ocean Economy GDP, and the living resources sector does not contribute measurably to the Ocean Economy GDP. The Ocean Economy provides nearly 15,000 jobs in Salem County (most of them in recreation and tourism) and accounts for more than 11 percent of total county employment.

3.6.3.1.5 Penobscot County, Maine

Penobscot County is located in central Maine, encompassing Brewer and the upper portions of the Penobscot River, as well as the cities of Bangor and Brewer.

NOAA does not consider Penobscot County to be a "coastal" county and thus does not publish Ocean Economy data for the county.

3.6.3.1.6 Hampton Roads area including City of Portsmouth, Virginia

The City of Portsmouth is an independent city in southeastern Virginia and occupies approximately 46.7 square miles (121.0 square kilometers) of land (Table 3.6.3-1). Portsmouth is bordered by the Elizabeth River and Norfolk to the east, the James River to the north, Suffolk County to the west, and the City of Chesapeake to the south. In 2020, the population density was 2,940.3 people per square mile, an increase of 3.6 percent from 2010 (Table 3.6.3-1). Portsmouth is an "Official Coast Guard City," which is representative of the city's over 200-year relationship with the Coast Guard (City of Portsmouth 2023a). Visitors travel to Portsmouth for its rich cultural heritage, festivals, museums, casino, and outdoor activities, including golfing, walking, biking, and fishing (City of Portsmouth 2023b). The first permanent casino in Virginia, the Rivers Casino, is also located in Portsmouth.

From 2010 to 2021, the population in Portsmouth increased by 2.2 percent, to over 97,600 people. The median age is 35.5, and over 61 percent of the population is between 18 and 65 years of age. The per capita income is $28,520, the lowest of the jurisdictions in the geographic analysis area. As of 2020, the labor force rate in Portsmouth was 63.5 percent, and the unemployment rate was 6.3 percent (Table 3.6.3-2).

Out of the 48,879 housing units in Portsmouth, 36,650 are occupied and only 78 of the vacant units are known to be seasonal housing units. The median owner-occupied home is valued at $174,200, and the median monthly rent for renter-occupied units is $1,083 (Table 3.6.3-3).

Over 21 percent of residents in Portsmouth are employed in the educational, health care, and social services industry, followed by manufacturing (14.3 percent) and public administration (11.5 percent). Retail trade positions account for 12.4 percent of the jobs in Portsmouth (Tables 3.6.3-4 and 3.6.3-5).

The overall GDP of the Ocean Economy in Portsmouth is $1.2 billion, the highest in the geographic analysis area, and the Ocean Economy accounts for over 20 percent of Portsmouth's total GDP (Table 3.6.3-6). The Ocean Economy provides over 15,000 jobs in Portsmouth (more than 64 percent of the total jobs in the city).

3.6.3.1.7 Salem County, New Jersey

Salem County encompasses Hope Creek and is located in southern New Jersey on the Delaware Bay. The county has a population density of 195.4 people per square mile, making it substantially less dense than the state (Table 3.6.3-2). From 2010 to 2021, the population in Salem County decreased by 1.7 percent (Table 3.6.3-1). The county's median age of 41.8 was slightly higher than the statewide average, as was the share of the population over 65 years of age (Table 3.6.3-1). Nearly all vacant housing units in Salem County were seasonal (Table 3.6.3-3).

The Ocean Economy in Salem County totals approximately $101 million and accounts for 1.8 percent of the total GDP (Table 3.6.3-7). The recreation and tourism sector comprises approximately 18 percent of the county's total Ocean Economy GDP, and the living resources sector does not contribute measurably to the Ocean Economy GDP. The Ocean Economy provides more than 1,700 jobs in Salem County (most of them in marine transportation) and accounts for more than 10 percent of total county employment.

3.6.3.1.8 Port of New York and New York Harbor Area

Essex, Hudson, and Union Counties, New Jersey

Edison, Hudson, and Union Counties are adjacent to each other in northeastern New Jersey along the Hudson River, within the New York City metropolitan area. These counties are largely urban and suburban and are densely developed, with population densities ranging from approximately 5,600 to 15,700 people per square mile (Table 3.6.3-1). The three counties have substantial commercial and industrial concentrations, including several of the Port of New York and New Jersey's maritime terminals and businesses that rely on shipping access through those terminals.

The population of Essex, Hudson, and Union counties grew substantially (by 9.3, 14.5, and 8.0 percent, respectively) from 2010 to 2021, while the population of New Jersey as whole increased by 5.4 percent (Table 3.6.3-1). The proportion of residents aged 65 or older was slightly lower in each of the three counties than the state average, as were the median ages in these counties (Table 3.6.3-1). Labor force participation in the three counties was higher than the state, as was unemployment (Table 3.6.3-2).

New Jersey's Ocean Economy contributes 1.9 percent to the total state GDP and between 1.2 and 2.4 percent of the GDP of Essex, Hudson, and Union counties. The share of county-specific GDP from recreation and tourism was generally comparable to the share of state GDP from this activity, while living resources comprised a smaller share of the ocean economy in these counties than in the state as a whole (Tables 3.6.3-6 and 3.6.3-8).

Kings and Richmond Counties, New York

Kings County (i.e., Brooklyn) and Richmond County (i.e., Staten Island) are two of New York City's five boroughs. Between 2010 and 2021, the population of the two boroughs grew faster (8.6 and 6.4 percent, respectively) than the state (4.0 percent) (Table 3.6.3-1). Brooklyn is a very densely developed urban borough, with more than 39,000 people per square mile. Staten Island is more suburban in character with a population density (more than 8,600 people per square mile) that is substantially smaller than the state as a whole. Both boroughs have a diverse economy that with substantial commercial and industrial activity, including Port of New York and New Jersey terminals and businesses that rely on shipping access through those terminals.

Kings County has over 1 million housing units; of these, 9,703 are seasonal. The median home value in Kings County is twice the New York State average, and the median monthly rent price in both Richmond and Kings County is higher than the New York state average (Table 3.6.3-3). Over 2 million New York state residents are employed in the educational services, and health care and social assistance industry (Table 3.6.3-4). There are more than 640,000 jobs in New York in professional, scientific, and technical roles statewide, of which 12,761 are in Richmond County and more than 103,000 are in Kings County (Table 3.6.3-4). More than 17 percent of jobs in Richmond County and more than 14 percent of Kings County jobs are in health care and social assistance.

The Ocean Economy provides a small share (approximately 2 percent) of the GDP of both boroughs, although this share is higher than the Ocean Economy's contribution to statewide GDP (1.3 percent).

3.6.3.2 Impact Level Definitions for Demographics, Employment, and Economics

Definitions of impact levels for demographics, employment, and economics are provided in Table 3.6.3-9. Table F-13 in this Appendix identifies potential IPFs, issues, and indicators to assess impacts on demographics, employment, and economics.

Table 3.6.3-9. 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.
Negligible	Beneficial	Either no effect or no measurable benefit.
Minor	Adverse	Impacts on the affected activity or geographic place would not disrupt the normal or routine functions of the affected activity or geographic place.
Minor	Beneficial	Small but measurable benefit on demographics, employment, or economic activity.
Moderate	Adverse	The affected activity or geographic place would have to adjust somewhat to account for disruptions due to impacts of the Project.
Moderate	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.
Major	Beneficial	Large local or notable regional benefit to the economy as a whole.

3.6.3.3 Impacts of Alternative A – No Action 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.

3.6.3.3.1 Impact of Alternative A – No Action

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 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 on 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 throughout the geographic analysis area. Conversely, ongoing activities that disrupt economic activity, such as climate change, may adversely affect businesses, resulting in impacts on employment and wages.

Appendix D, Table D1-9 provides a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for demographics, employment, and economics.

3.6.3.3.2 Cumulative Impacts of Alternative A- No Action

Offshore wind is an emerging industry for the Atlantic states and the nation. Although most offshore wind component manufacturing and installation capacity exists outside of the U.S., domestic capacity is likely to increase. This EIS uses available data, analyses, and projections to make informed conclusions on offshore wind's potential economic and employment impacts within the geographic analysis area.

During the initial implementation of offshore wind projects along the U.S. northeast coast, a base level of 35 percent of jobs, with a high probability of up to 55 percent of jobs, would likely be sourced from within the U.S. (BVG Associates 2017). The proportion of jobs filled within the U.S. would increase as the offshore wind energy industry grows due to growth of a supply chain and supporting industries along the east coast, as well as a growing number of local operations jobs for established wind facilities. By 2030 and continuing through 2056, approximately 65 to 75 percent of jobs associated with offshore wind are projected to be within the U.S. Overseas manufacturers of components and specialized ships based overseas that are contracted for installation of foundations and WTGs would fill jobs outside of the U.S. (BVG Associates 2017). As an example of the mix of local, national, and foreign job creation, for the 5-turbine Block Island Wind Farm, turbine blade manufacturing occurred in Denmark, generator and nacelle manufacturing occurred in France, tower component manufacturing occurred in Spain, and foundation manufacturing occurred in Louisiana (Gould and Cresswell 2017).

A January 2023 National Renewable Energy Laboratory study outlined the domestic supply chain roadmap for offshore wind (NREL 2023). The report recommended actions within short-, medium-, and long-term timeframes to help the offshore wind industry create a robust and sustainable supply chain, including workforce training, the creation of domestic manufacturing facilities, and outreach and education opportunities with existing suppliers. According to this study, the National Renewable Energy Laboratory found that at least 34 manufacturing facilities would need to be constructed, and over $22.4 billion in investment would be needed to produce critical infrastructure to meet demand by 2030.

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 U.S. This figure depends on the extent of offshore wind installation and supply chain growth, as well as the level of investment by overseas companies that manufacture or assemble 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— including more than $1.3 billion of announced domestic investments in wind energy manufacturing facilities, ports, and vessel construction as of 2020—there would be nationwide effects as well (AWEA 2020). AWEA (2020) analyzed base and high scenarios for offshore wind direct impacts, turbine and supply chain impacts, and induced impacts. The base scenario assumed 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 would support $14.2 billion in economic output and $7 billion in value added by 2030 under the base scenario and $25.4 billion in economic output and $12.5 billion in value added under the high scenario (AWEA 2020).

The University of Delaware (2021) projects that offshore wind power will generate 30 GW along the Atlantic coast through 2030. 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. This initiative would require capital expenditures of $100 billion over the next 10 years (University of Delaware 2021).

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 (i.e., 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 2021) 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.

AWEA estimates that in 2030, offshore wind would support 45,500 (base scenario) to 82,500 (high scenario) full-time equivalent jobs nationwide, including direct, indirect (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. LLC 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.

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 (Appendix D, *Planned Activities Scenario*). 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.

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. As indicated in Appendix D, *Planned Activities Scenario*, Table D2-1, approximately 4.4 GW of capacity is estimated to occur in the Delaware and Maryland lease 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 187 WTGs and 6 OSSs other than the Proposed Action could be visible from some beaches, coastlines, and elevated inland areas in Worcester County, Maryland or Sussex County, Delaware, 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 3.6.9, *Visual Resources*, field observations indicate that under clear sky conditions, FAA hazard lighting may be visible at a distance of 40 mi (64.4 kilometer) or more from the viewer. A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 mi (24.1 kilometer) from the viewer would not have significant impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). A subsequent study of beachgoers found that impacts declined with distance from the observer, with nearly 70 percent of respondents stating that WTGs more than 15 mi (24.1 kilometer) offshore would neither worsen nor improve their experience (Parsons et al. 2020). WTG 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 (Section 3.6.9, Visual Resources). 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 4 offshore wind projects would potentially be visible from Worcester and Sussex counties between 2023 and 2030, 3 of which could be under construction concurrently during 2024 (Appendix D, *Planned Activities Scenario*, Table D2-1). Vessel lights would be visible from coastal businesses, especially near the ports used to support offshore wind construction.

Offshore lighting could affect employment and economics if the visibility of lighting discourages visits or vacation home rentals or purchases in coastal locations where lighting is visible. While lighting from offshore activities under the No Action Alternative would be visible, this lighting is unlikely to disrupt typical rental or purchase activity, especially if ADLS is implemented. As a result, lighting from the No Action Alternative would have a minor impact on demographics, employment, and economics, which could be reduced to negligible if ADLS is implemented.

Cable emplacement and maintenance: Cable installation for each project in the Delaware and Maryland lease areas 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. About 3,719 acres (1,505 hectares) of seafloor disturbance would occur within the Maryland and Delaware Lease Areas (not including the Proposed Action) associated with offshore cable and inter-array cable installation (Appendix D, *Planned Activities Scenario*, Table D2-2). In the long term, concrete mattresses covering cables in hard-bottom areas could hinder commercial trawlers and dredgers (Section 3.6.1, *Commercial Fisheries and For-Hire Recreational Fishing*). 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. 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, as described in Section 3.5.5, *Finfish, Invertebrates and Essential Fish Habitat*. Impacts of onshore export cable installation would depend on the specific location but could temporarily disrupt beaches and other recreational coastal areas. Disruptions from new cable emplacement would have localized, short-term, minor impacts on demographics, employment, and economics. Maintenance is anticipated to have long-term intermittent, negligible impacts on demographics, employment, and economics.

Land disturbance: Land disturbance could result in localized, temporary disturbances of businesses near landfall sites, 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 (through jobs and revenues to local businesses that participate in onshore construction) and adverse (through lost revenue due to construction disturbances). Land disturbance impacts on demographics, employment, and economics would be minor.

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 Proposed Action vessel trips, construction of each offshore wind project would generate between 20 and 65 vessels operating at any given time. Noise from vessel traffic during the construction and O&M phases and from pile driving during construction could affect species important to commercial/for-hire fishing, recreational fishing, and marine sightseeing activities as described in Section 3.5.5, *Finfish, Invertebrates and Essential Fish Habitat* and 3.5.6, *Marine Mammals*. These impacts would be greater if multiple construction activities occur in close spatial and temporal proximity. An estimated 238 foundations (WTGs and substations) would be installed within the Delaware and Maryland lease areas between 2023 and 2030 (Appendix D, *Planned Activities Scenario*, Table D-3).

Onshore construction noise could possibly result in a short-term reduction of economic activity for businesses near installation sites for onshore export cables or substations, temporarily inconveniencing workers, residents, and visitors. Overall, noise would have intermittent, short-term, 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 ports in Baltimore (Sparrows Point) and the Ocean City Harbor. 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 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, minor 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 have short- to long-term minor adverse impacts on commercial shipping.

Presence of structures: Under the No Action Alternative, the addition of up to 113 offshore wind structures (WTGs and OSSs), other than the Proposed Action, within the Maryland and Delaware Lease Areas, with 61 acres (24.7 hectares) of foundation and scour protection and 27 acres (10.9 hectares) of offshore export cable hard protection, would increase the risk of gear loss connected with cable mattresses and structures along the east coast (Appendix D, *Planned Activities Scenario*, Table D2-2). Fisheries using bottom gear may be permanently disrupted, which would increase economic impacts on the commercial/ for-hire recreational fishing industries, as discussed in Section 3.6.1.3, *Commercial Fisheries and For-Hire Recreational Fisheries*. 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 (Section 3.6.6, *Navigation and Vessel Traffic*). 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. As a result, 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. Impacts may be most pronounced in areas that are not close to the coastline, highlighting the potential for broad, regional socioeconomic impacts (Hoagland et al. 2015).

The potential for 113 additional foundations within the Delaware and Maryland lease areas could encourage fish aggregation and generate reef effects that attract recreational fishing vessels (Section 3.5.5, *Finfish, Invertebrates, and Essential Fish Habitat*; Appendix D, *Planned Activities Scenario*, Table D2-1; COP, Volume II, Section 8.2.2 [US Wind 2024]). 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 result in broad changes in recreational fishing practices if these effects are widespread enough to encourage more participants to travel farther from shore. The offshore wind foundations within the Delaware and Maryland lease areas could also create foraging opportunities for sea turtles and marine birds, with this impact is anticipated to be negligible to minor and is not anticipated to attract recreational sightseeing vessels (Sections 3.5.3 and 3.5.7).

Fish aggregation and reef effects associated with the presence of offshore wind structures would have long-term beneficial and adverse 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 minor beneficial 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. Construction of 3 offshore wind projects could occur within the Delaware and Maryland lease areas between 2023 and 2030, with a maximum of 3 projects under construction concurrently during 2024 (Appendix D, *Planned Activities Scenario*, Table D2-1). Increased vessel traffic would have continuous, beneficial impacts during all project phases.

Vessel traffic related to offshore wind would occur within ports (including ports outside the geographic analysis area) and offshore wind work areas, which include the WTG areas (or routes to and from those areas) as well as the cable installation routes. Short-term increases in vessel traffic during construction could lead to 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, minor impacts during construction, operations, and decommissioning.

3.6.3.3.3 Conclusions

Impacts of Alternative A – No Action. Under the No Action Alternative, the geographic analysis area would continue to be influenced by regional demographic and economic trends. Ongoing 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 geographic analysis area, especially Sussex and Worcester counties. Marine industries such as commercial fishing and shipping would continue to be active and important components of the regional economy.

BOEM anticipates 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. BOEM expects ongoing 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 U.S. 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. However, some construction workers will likely be able to maintain longer-term employment opportunities by working on multiple offshore wind projects. Long-term benefits of offshore wind activities include long-term O&M jobs; 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 there will be minor adverse and minor 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.

Cumulative Impacts of Alternative A – No Action. BOEM anticipates the No Action Alternative, when combined with all past, present, and reasonably foreseeable activities (including other offshore wind activities), would result in **minor** adverse and **minor beneficial** impacts, with adverse 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.

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

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

- Overall size of project: up to 2,200 MW, 121 WTGs, 4 OSSs, and 1 Met Tower;
- The extent to which US 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.

US Wind has committed to mitigation measures to minimize impacts on demographics, employment, and economics, including (Appendix G, Table G-1):

- Concentrating onshore construction activities outside of the summer recreation season to the greatest extent practicable and coordinating with DNREC Parks and Recreation to minimize interference of cable installation with beach activities;
- Siting and developing Project elements to minimize disturbance to resources, to the extent practicable, enjoyed by residents of and visitors to the region; and
- Committing to creating full and equitable business opportunities for minority, women-owned, veteran-owned, and HUBZone businesses in the development of the Project.

The impact determinations in Section 3.6.3.5 include implementation of these mitigation measures. Appendix G, Table G-1 provides more detailed descriptions of these and other measures to which US Wind has committed.

3.6.3.5 Impacts of Alternative B – Proposed Action on Demographics, Employment, and Economics

3.6.3.5.1 Impacts of Alternative B – Proposed Action

US Wind utilized the Impact Analysis for Planning (IMPLAN) model to predict the performance of economic variables for two scenarios under the Proposed Action for Maryland's economy (COP, Volume II, Section 17.2; US Wind 2024). Scenario 1 was based on using up to 114 WTGs, each with a nominal 14.7 MW generating capacity (for a total of approximately 1,675 MW). Scenario 2 is based on the PDE maximum of 121 WTGs, each with a nominal 18 MW generating capacity (for a total of approximately 2,178 MW). Table 3.6.3-10 summarizes the total projected economic impacts of these scenarios over the seven-year Proposed Action construction period. Table 3.6.311 summarizes the total economic impacts of these scenarios over the 25-year O&M period. The economic impacts summarized in Tables 3.6.3-10 and 3.6.3-11 include direct economic impacts as well as indirect (supplier-based) and induced (consumer spending from additional local income) impacts.

Table 3.6.3-10. Economic modeling results for Proposed Action construction scenarios

Factor	Scenario 1[1]	Scenario 2[1]
Job-Years[2, 3]	16,783	18,717
Spending (millions)[3]	$3,440.1	$3,861.5
State and County Tax Revenues (millions, 2021$)[3]	$147.2	$162.8
Labor Income (millions, 2021$)[3]	$1,246.9	$1,386.1
Value added (regional GRP, in millions 2021$)[3]	$1,918.9	$2,127.5

Source: COP, Volume II, Section 17.1.2.1; US Wind 2024
GRP = gross regional product
[1] Cumulative impacts over a 7-year construction period.
[2] One job-year is equivalent to a single full-time job held for 1 year.
[3] Includes summation of direct, indirect, and induced impacts.

Table 3.6.3-11. Economic modeling results for Proposed Action operations and maintenance (O&M) scenarios

Factor	Scenario 1			Scenario 2		
	Avg	Min	Max	Avg	Min	Max
Annual FTE [1, 2]	587	413	636	740	518	803
Annual spending (millions 2021$)[2]	$86.5	$62.9	$93.2	$108.9	$78.7	$117.3
Annual labor income (millions 2021$)[2]	$44.1	$31.6	$47.7	$277.9	$39.5	$60.1
Annual value added (regional GRP, in millions 2021$)[2]	$54.9	$39.7	$59.1	$345.1	$49.6	$74.5

Source: COP, Volume II, Section 17.1.2.2; US Wind 2024
Avg = average; FTE = full time equivalent employees; GRP = gross regional product; max = maximum; min = minimum
[1] One FTE is equivalent to a single full-time job held for 1 year.
[2] Includes summation of direct, indirect, and induced impacts.

The Proposed Action would generate employment during construction and installation of the Project. Construction, O&M, and decommissioning would support a range of positions for professionals such as engineers, environmental scientists, financial analysts, administrative personnel; and trade workers such as electricians, technicians, steel workers, welders, and ship workers. Most of the Project's employment and economic impacts would occur during the construction phase (COP, Volume II, Section 17.1.2.1; US Wind 2024).

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. A 2022 NREL study estimated that meeting the nation's current target of 30 GW of US-installed offshore wind capacity by 2030 would require employment of 15,000 to 58,000 direct and indirect full-time equivalent employees, depending on what percent of workers are US residents. Nearly all of these jobs are anticipated to be in the offshore wind manufacturing and supply chain sectors (Stefek et al. 2022). 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 annual 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 for housing, food, transportation, entertainment, and other goods and services. A large number of seasonal housing units are available in the vicinity of the Project, although these units are typically intended for seasonal tourism, rather than temporary workers. 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.

Construction and Installation

Onshore Activities and Facilities

Cable emplacement and maintenance: Onshore cable emplacement would require HDD operations and interconnection cable installation. Cable emplacement could disturb businesses and roads near the landfall and interconnection construction sites; however, impacts would be localized and short term.

Land disturbance: Construction of the Proposed Action would require HDD operations, interconnection cable installation, substation construction and construction of the O&M Facility. The Project's interconnection cables would be installed between the Inshore Export Cable Route landfall in the Indian River and the US Wind substations adjacent to the Indian River substation. The construction at the onshore substation and landfall could result in construction traffic on local roads and up to 15.08 acres (6.1 hectares) of disturbance and the onshore substation and 0.69 acres (0.28 hectares) at the landfall (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). The employment and economic impact of the Proposed Action caused by disturbance of businesses near the landfall, interconnection, substation, and O&M Facility construction sites would result in localized, short-term, minor impacts.

Lighting: Onshore construction lighting would generally occur near areas with existing lighting (i.e., roads, the Indian River Power Plant, and neighborhoods) and would be brief in duration. As a result, impacts related to onshore construction lighting would have localized, short-term, and negligible impacts on demographics, employment, and economics.

Noise: Noise from construction of onshore facilities is not likely to impact local businesses near the substation site or along the Inshore Export Cable Route within Indian River Bay. Cable laying and trenching would have localized, intermittent, short-term, and negligible impacts on demographics, employment, and economics.

Port utilization: The proposed Project's activities at ports would support port investment and employment and would also support jobs and businesses in supporting industries and commerce. The primary construction and O&M ports are listed in Tables 2-4 and 2-5. Primary port facilities used during construction include Baltimore (Sparrows Point) and the Ocean City, Maryland; Brewer, Maine; and one of three Gulf of Mexico terminals (Ingleside, Texas or Houma or Harvey, Louisiana). The primary port used during Project O&M would be the O&M Facility in Ocean City, Maryland, while some deep draft vessel activity in support of O&M activities could occur at Lewes, Delaware; Hope Creek, New Jersey (the New Jersey Wind Port); the Port of New York/New Jersey; and Portsmouth, Virginia (representative of ports in the Hampton Roads area) (COP, Volume I, Section 3.1; US Wind 2024). Development and operation of the offshore wind facility in Baltimore (Sparrows Point) is discussed in Section 3.6.3.5.2, *Operations and Maintenance*. 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.

Offshore and Inshore Activities and Facilities

Cable emplacement and maintenance: The Proposed Action's cable emplacement would generate vessel anchoring and dredging at offshore worksites and within the Indian River, 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.

The approximately 232.25 acres (949 hectares) of temporary seafloor disturbance (associated with offshore cable, inter-array cable and inshore 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 within the Indian River could disrupt fish stocks and hinder recreational vessel traffic, potentially reducing income for businesses relying on river-based tourist and recreational activity.

Cable installation would have localized, short-term, minor impacts on demographics, employment, and economics.

Lighting: Offshore Project construction would result in increased vessel traffic (which would require lighting at night), as well as lighting of work areas around foundations and cable routes. This offshore lighting would be visible from coastal locations, as well as locations near the ports used to support Proposed Action construction (Section 3.6.9, *Visual Resources*). Short-term vessel lighting and construction 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.

Noise: Noise from cable installation would affect marine life populations, which would in turn affect commercial and recreational fishing businesses. The contribution of the Proposed Action to noise from survey activities, O&M, pile driving, trenching, and vessels would affect certain marine business activities associated with commercial and for-hire recreational fishing, marine sightseeing, and recreational boating. As a result, the Proposed Action would have intermittent, short-term, negligible noise impacts on visitors, workers, and residents.

Traffic: The Proposed Action would generate vessel traffic in the Project area and to and from the ports supporting project construction. US Wind estimates that construction activity would generate a maximum of 44 vessels operating at any given time (Section 3.6.6, *Navigation and Vessel Traffic*, contains 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. 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.

Operations and Maintenance

Onshore Activities and Facilities

Cable emplacement and maintenance: Routine inspection and maintenance of the Proposed Action's inshore export cables would generate vehicle traffic and could disrupt roads or public rights-of-way. This could, in turn, disrupt onshore businesses. These activities would be periodic, and impacts would be limited to the area being maintained. Therefore, maintenance of the Proposed Action's inshore export cables would have intermittent, long-term, negligible impacts.

Energy generation and security: The Proposed Action would produce up to approximately 2,200 MW of electricity, including up to 1,108 MW (300 MW for MarWin, and 808 MW for Momentum Wind) under contract with the State of Maryland. Up to 1,092 MW would be generated from the remaining positions within the Lease Area, although US Wind does not have a contract for that capacity. Offshore Wind Renewable Energy Credits (ORECs) for the MarWin component of the Project were awarded at a levelized price of $131.93 per megawatt-hour for 20 years (Maryland PSC 2017), while ORECs for Momentum Wind were awarded at a levelized price of $54.17 per megawatt-hour (Maryland PSC 2021). MarWin is projected to accrue 913,845 ORECs per year while Momentum Wind is expected to accrue 2,513,752 ORECs per year. The combined state commitments to both phases of US Wind and Skipjack Wind could increase energy costs for Maryland ratepayers—including approximately $2.28 per month for residential customers and around 2.3 percent annual increases for commercial and industrial customers (Maryland PSC 2022). These rate increases would result in a minor adverse impact. At the same time, offshore wind energy projects could produce energy at long-term fixed costs, which could provide stability against fossil fuel price volatility (and subsequent rate increases) once built. As a result, the Proposed Action would also have a minor beneficial impact on energy generation and security.

Land disturbance: The Project's landfall site, onshore substations and inshore export cables will require O&M resulting in land disturbance. The disturbance of businesses near the landfall and substations would result in intermittent, localized, short-term, negligible impacts on employment and economics.

Lighting: Onshore structures emit light that could be visible from some beaches, coastlines, and elevated inland areas, depending on vegetation, topography, weather, and atmospheric conditions. Lighting impacts on demographics, employment and economics are discussed above.

Noise: Noise from onshore operations would have localized, intermittent, long-term, negligible impacts on demographics, employment, and economics.

Port utilization: The proposed Project activities at ports would support port investment and employment and would also support jobs and businesses in supporting industries and commerce. The O&M Facility in Ocean City Maryland will provide CTVs during construction and will be the most used port during O&M. The ports in Lewes, Delaware, Hampton Roads area, Virginia, Hope Creek (New Jersey Wind Port), New Jersey and Port of New York/New Jersey will provide facilities to accommodate deep draft vessels during O&M that cannot be accommodated at the O&M Facility in Ocean City Maryland because of limited water depths and quayside infrastructure. US Wind estimated that a maximum of 512 direct jobs would be supported by operations (COP, Volume II, Appendix L1; US Wind 2024). The O&M Facility would help to diversify the local economy by providing a source of skilled, year-round jobs. 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 Project.

As part of the Proposed Action, US Wind would develop a WTG manufacturing facility at Sparrows Point (the former site of a major steel manufacturing facility) in Baltimore County (CBS Baltimore 2021). The Sparrows Point Steel facility was previously the world's largest steel mill and will be built in conjunction with Momentum Wind, Ørsted's Skipjack Wind, and Tradepoint Atlantic (Ørsted 2019). The new manufacturing facility would be Maryland's first offshore wind energy staging center and would bring new manufacturing activity to the eastern coast of the U.S.

Presence of structures: The Proposed Action would add one onshore O&M Facility and new substation structures; the presence of onshore structures would have continuous, long-term, and negligible impacts on demographics, employment, and economics.

Offshore and Inshore Activities and Facilities

Cable emplacement and maintenance: Routine inspection and maintenance of the Proposed Action's cables would generate vessel anchoring and dredging along the Offshore and Inshore Export Cable Routes, 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. These activities would be periodic, and impacts would be limited to the area being maintained. Therefore, maintenance of the Proposed Action's inter-array and export cables would have intermittent, long-term, negligible impacts.

Energy generation and security: The Proposed Action would produce up to 1,108 MW of electricity (300 MW for MarWin, and 808 MW for Momentum Wind) or more than 1 GW of offshore energy under contract with the State of Maryland. Impacts on energy generation and security are discussed above.

Lighting: 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. US Wind has committed to implement an ADLS, effectively reducing the hours that FAA warning lights for the Proposed Action would be illuminated to approximately 0.1 percent of nighttime hours (Section 3.6.9, Visual Resources). This would greatly reduce the nighttime visibility of Proposed Action structures from shore (compared to traditional systems with constantly flashing lighting), thus reducing 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.

Noise: Noise from maintenance and repair operations may make the wind energy facilities less attractive to fish, but they are expected to rapidly return after maintenance activities, thus fishing operators and recreational boaters are not anticipated to be impacted (COP, Volume II, Section 17.5.2.2; US Wind 2024). Noise from O&M activities would have localized, intermittent, long-term, negligible impacts on demographics, employment, and economics.

Vessel noise during O&M could affect marine species relied on by commercial fishing businesses, marine recreational businesses, recreational boaters, and marine sightseeing activities. Most vessel traffic would travel to the WTG installation area, with fewer vessels needed along the cable installation routes. Noise from vessels would have short-term, intermittent, negligible impacts on demographics, employment, and economics.

Presence of structures: The permanent seafloor area displaced by WTGs (PDE of up to 121) under the Proposed Action is expected to be 2.84 acres, with an additional 22.7 acres for scour protection, totaling 25.5 acres (10.3 hectares) (Appendix C, *Project Design Envelope and Maximum-Case Scenario*, Table C-2). Four OSSs would be installed, and though the foundation has not yet been decided the total area of seafloor disturbance is up to 1.7 acres (0.7 hectares), assuming they are also monopile foundations, creating the maximum footprint. The Met Tower would displace an additional 435 square feet (40.41 square meters). In total, about 27.21 acres (10.61 hectares) of seafloor habitat would be permanently affected by the construction and installation of the WTGs, OSSs, and Met Tower foundations for the Proposed Action (Appendix C, Table C-2). The Proposed Action 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 3.6.1, *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 minor 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. US Wind has committed to coordinating with local stakeholders to develop opportunities for eco-tourism related to the Project (Appendix G, *Mitigation and Monitoring,* Table G-1). 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 transit routes.

The presence and views of WTGs could affect property values. Brunner et al. (2024) analyzes impacts to residential home values within a mile of commercial onshore wind farms in the United States, primarily in counties with population greater than 250,000. This study used data from commercial wind turbines and residential property transactions from 2005 to 2020. The study found that on average, homes located within 1 mile of a commercial wind turbine experience approximately an 11 percent decline in value following the announcement of a new commercial wind energy project, relative to homes located

3 to 5 miles away. However, the study found that although home property values declined following project announcement, they recover post project construction, with property value impacts becoming relatively small (approximately a 2 percent decline) and statistically insignificant 9 years or more after project announcement (roughly 5 years after operation began) (Brunner et al, 2024).

A study conducted in Denmark by Jensen et al. (2018) found that onshore wind turbines had a negative effect on the price of surrounding properties to a distance of 3 kilometers (1.9 miles). The study also found no significant effect on price for two properties with views of offshore WTGs approximately 9 kilometers (5.6 miles) away (Jensen et al. 2018).

Dong and Lang (2022) examined property value declines due to the loss of unobstructed ocean views off the coast of Rhode Island due to the installation of the Block Island Wind Farm. Based on assessment of values for properties between 17 and 27 miles (27.4 and 43.4 kilometers) of the Block Island project, the authors found "no evidence of negative impacts to property values" (Dong and Lang, 2022).

As discussed in more detail in Section 3.6.8.3.1 in the Recreation and Tourism section, two studies of the impacts of offshore wind on ocean-oriented recreation and tourism found some correlation between views of theoretical offshore WTGs and negative outcomes such as trip loss and reduced willingness to pay for rentals (Lutzeyer et al. 2017, Parsons and Firestone 2018).

The findings cited above were dependent on the perceived size of the WTG and the distance between the viewer and the WTG. In particular, the WTGs evaluated in these studies were substantially smaller than those included in the U.S. Wind Project. As a result, the direct applicability of these studies to the Project is limited. These limitations notwithstanding, the studies cited above indicate that views of WTGs could have adverse effects on the analysis area's tourist economy that depends on tourism, and specifically the subsegment of the economy that is driven by unobstructed views of the Atlantic Ocean.

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, property values, and income for some businesses and commercial real estate (i.e., rental properties).

Traffic: The Proposed Action would generate vessel traffic in the Project area and to and from the ports supporting O&M. US Wind will implement practices and operating procedures to reduce the likelihood of vessel accidents and fuel spills. During operations, the Proposed Action would generate up to four vessel trips per day (Section 3.6.6, *Navigation and Vessel Traffic*, contains 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 negligible beneficial impacts during operations. The level of vessel traffic associated with the Proposed Action O&M is not likely to result in periodic congestion within and near ports, or increased risk for collisions between vessels. As a result, vessel traffic from the Proposed Action would have continuous, short-term, and negligible impacts during operations.

Conceptual Decommissioning

The impacts of onshore and Offshore Project decommissioning on demographics, employment, and economics would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. Decommissioning would require onshore and offshore traffic, light, and noise, as well as port usage for removal of onshore and offshore structures. Land disturbance from inshore export cable removal could be negligible if some inshore export cables are retired in place rather than removed. The impacts of Proposed Action decommissioning would range from negligible to minor, with moderate beneficial impacts associated with port utilization.

3.6.3.5.2 Cumulative Impacts of Alternative B – Proposed Action

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.

Construction and Installation

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

Land disturbance: The exact extent of land disturbance associated with other projects would depend on the location of landfall, Onshore Export Cable Routes, and onshore substations for offshore wind energy projects. Therefore, in the context of reasonably foreseeable environmental trends, the cumulative impacts contributed by the Proposed Action to the cumulative 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.

Lighting: In the context of reasonably foreseeable environmental trends, the Proposed Action's onshore construction would contribute a noticeable amount to the cumulative lighting impacts from ongoing and planned activities including offshore wind, which would be negligible. Between 2023 and 2030, there may be 3 offshore wind projects within the Delaware and Maryland lease areas. Construction lighting for all of these offshore wind activities may be visible from coastal locations within the geographic analysis area. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable amount to the cumulative lighting impacts from ongoing and planned activities including offshore wind, which would be negligible.

Noise: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a marginal amount to the cumulative noise impacts on demographics, employment, and economics from ongoing and planned activities including offshore wind, which would be short term and negligible.

Port utilization: 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 the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable amount 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.

Traffic: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable amount to the cumulative impacts from ongoing and planned activities including offshore wind, which would be minor during construction. 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. 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.

Operations and Maintenance

Cable emplacement and maintenance: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable amount to the cumulative onshore export cable maintenance impacts on demographics, employment, and economics from ongoing and planned activities including offshore wind, which would be short term and negligible.

Energy generation and security: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable amount to the cumulative 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 impacts, as well as minor beneficial impacts on demographics, employment, and economics.

Land disturbance: The exact extent of O&M land disturbance associated with other projects would depend on the location of landfall sites and onshore export cables for offshore wind energy projects. Therefore, in the context of reasonably foreseeable environmental trends, the cumulative impacts contributed by the Proposed Action to the cumulative 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.

Lighting: Between 2023 and 2030, up to 121 WTGs, 4 OSSs, and 1 Met Tower from the PDE may be visible within the geographic analysis area for Demographics, Economics, and Employment. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable amount to the cumulative lighting impacts from ongoing and planned activities including offshore wind, which would be negligible.

Noise: While operational activity would overlap, noise impacts during operations would be far less than during construction. Therefore, in the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable amount to the cumulative noise impacts on demographics, employment, and economics from ongoing and planned activities including offshore wind, which would be short term and negligible.

Port utilization: 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 the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable amount to the impacts from other ongoing and planned activities, which would be long term, minor, 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: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable amount to the cumulative impacts on demographics, employment, and economics of new, onshore structures from other ongoing and planned activities including offshore wind, which would be long term and negligible. In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a substantial amount to the cumulative 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 whose employment and economic employment and economic outputs are substantially dependent on unobstructed ocean views.

Traffic: In the context of reasonably foreseeable environmental trends, the Proposed Action would contribute a noticeable amount to the cumulative impacts from ongoing and planned activities including offshore wind, which would be 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 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 negligible impacts during operations.

Conceptual Decommissioning

Proposed Action decommissioning would contribute a substantial amount of the cumulative onshore infrastructure impacts on demographics, employment, and economics from ongoing and planned activities including offshore wind. In the context of reasonably foreseeable environmental trends, ongoing and planned activities, the impacts of decommissioning of the Proposed Action in combination with past, present, and reasonably foreseeable activities would be short term and would range from negligible to minor, with moderate beneficial impacts associated with port utilization.

3.6.3.5.3 Conclusions

Impacts of Alternative B – Proposed Action. BOEM anticipates 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 last for the 35-year duration of the Project. Tax revenues, around $162.8 million during construction, would also provide a beneficial impact on public expenditures and local workforce and supply chain development for offshore wind (COP, Volume II, Section 17.1.2.1; US Wind 2024). Decommissioning of the Proposed Action would generate minor beneficial impacts on demographics, employment, and economics 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.

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. The Proposed Action would have adverse impacts on some individual businesses and communities. 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 some local communities within the region. The IPFs associated with the Proposed Action alone would also result in impacts on recreation and tourism businesses as well as commercial real estate (i.e., rental properties) whose employment and economic outputs are substantially dependent on unobstructed ocean views. The impacts of individual IPFs on these businesses and properties that range from negligible to moderate, 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 **minor beneficial** impacts on demographics, employment, and economics.

Cumulative Impacts of Alternative B – Proposed Action. In the context of other reasonably foreseeable environmental trends, ongoing and planned activities, the cumulative impacts contributed by the Proposed Action to the overall impacts on demographics, employment, and economics would range from undetectable to noticeable. BOEM anticipates overall impacts on demographics, employment, and economics in the geographic analysis area associated with the Proposed Action when combined with the impacts from past, present, and reasonably foreseeable activities, including offshore wind would be minor adverse and minor beneficial. The minor 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 adverse** and **minor beneficial**.

3.6.3.6 Impacts of Alternative C – Landfall and Onshore Export Cable Routes Alternative on Demographics, Employment, and Economics

3.6.3.6.1 Impacts of Alternative C.

Alternatives C-1 and C-2 would not affect the number or placement of WTGs or OSSs for the Project compared to Alternative B. Alternatives C-1 and C-2 would alter the routes of onshore and offshore export cables and could thus affect the exact length of cable installed and area of ocean floor and land disturbed. These changes could result in marginally different impacts on demographics, employment and economics compared to Alternative B. Depending on the route chosen, the Onshore Export Cable Routes associated with Alternatives C-1 and C-2 could disrupt traffic along Delaware SR 1 (the major thoroughfare for Bethany Beach, Dewey Beach, Rehoboth Beach, and Lewes, all of which are economically important beach communities in Sussex County), while Alternative C-2 could impact traffic on Delaware SR 26, the primary access route to Bethany Beach. Due to the potential for travel delays during cable installation and maintenance, Alternative C-2 would have a greater impact on economic conditions than the Proposed Action or Alternative C-1 due to its greater length and from impacts on SR 1 through both Dewey Beach and Rehoboth Beach—a corridor with extensive commercial development and significant vehicle traffic; however, the overall adverse impact would still be minor due to the short term nature of construction and maintenance activities.

3.6.3.6.2 Cumulative Impacts of Alternative C.

In the context of other reasonably foreseeable environmental trends, the cumulative impacts contributed by Alternative C to the overall impacts on demographics, employment, and economics would be similar to those for Alternative B: **minor** adverse and **minor beneficial**. While the contributions of Alternative C to cumulative impacts would be larger than for Alternative B, this difference would not change the overall magnitude of cumulative impacts.

3.6.3.6.3 Conclusions

Impacts *of Alternatives C.* Depending on the time of year of Onshore Export Cable Route installation along these routes, Alternative C-2 could have short-term, moderate adverse impacts on demographics, employment, and economics, specifically through the IPFs for traffic and land disturbance. Nonetheless, the overall impacts of Alternatives C-1 and C-2 on demographics, employment and economics would be the same as those of Alternative B: **minor** adverse impacts and **minor beneficial**.

Cumulative Impacts of Alternatives C. In the context of other reasonably foreseeable environmental trends, ongoing and planned activities, BOEM anticipates overall impacts on demographics, employment, and economics in the geographic analysis area associated with Alternatives C-1 and C-2 when combined with the impacts from past, present, and reasonably foreseeable activities, including offshore wind would be **minor** adverse and **minor beneficial**.

3.6.3.7 Impacts of Alternative D – No Surface Occupancy to Reduce Visual Impacts Alternative on Demographics, Employment, and Economics

3.6.3.7.1 Impacts of Alternative D

Alternative D would exclude all WTGs and OSSs within 14 miles (22.5 kilometers) of the shoreline, resulting in the exclusion of 32 WTGs and 1 OSS. The exclusion of 33 structures would reduce the magnitude of impacts on marine and coastal businesses (commercial fishing and recreational/tourism businesses) resulting from marine traffic, noise, seafloor disturbance, scour and cable hard protection, nighttime lighting, navigational complexity, and views of offshore structures, during construction, O&M, and decommissioning. A smaller total number of WTGs would also reduce beneficial impacts on energy generation/security, port investment, investment in supporting industries, and employment.

3.6.3.7.2 Cumulative Impacts of Alternative D

In the context of other reasonably foreseeable environmental trends, the cumulative impacts contributed by Alternative D to the overall impacts on demographics, employment, and economics would be similar to those for Alternative B: **minor** adverse and **minor beneficial**. Alternative D would result in fewer structures in the water (WTG and OSS), which would lead to marginally smaller impacts on offshore economic activity that currently occurs in the lease area compared to Alternative B; however, this difference in impacts would not change the overall magnitude of cumulative impacts compared to Alternative B.

3.6.3.7.3 Conclusions

Impacts of Alternative D. The changes described above notwithstanding, the overall level of impacts of Alternative D would likely remain the same as Alternative B: **minor** adverse and **minor beneficial**. In the context of reasonably foreseeable environmental trends, Alternative D would occur under the same scenario as Alternative B (Appendix D, *Planned Activities Scenario*).

Cumulative Impacts of Alternative D. The overall cumulative impact of Alternative D on demographics, employment, and economics when combined with past, present, and reasonably foreseeable activities would be similar to the cumulative impacts of the Proposed Action (Alternative B), and would therefore be **minor** adverse and **minor beneficial**.

3.6.3.8 Impacts of Alternative E – Habitat Impact Minimization Alternative on Demographics, Employment, and Economics

3.6.3.8.1 Impacts of Alternative E

Alternative E would result in the removal of up to 11 WTG positions, removal/realignment of associated inter-array cables (if applicable) and repositioning the Offshore Export Cable Route. The exclusion of 11 structures would reduce the magnitude of impacts on marine businesses volume of marine traffic, noise, seafloor disturbance, and scour and cable hard protection during construction, O&M, and decommissioning. The 11 positions that would be removed would not meaningfully change the impacts resulting from views of the WTGs or navigational complexity within the offshore lease area. A reduction in the total number of WTGs would reduce beneficial impacts on energy generation/security, port investment, investment in related industries, and employment.

3.6.3.8.2 Cumulative Impacts of Alternative E

In the context of other reasonably foreseeable environmental trends, the cumulative impacts contributed by Alternative E to the overall impacts on demographics, employment, and economics would be similar to those for Alternative B: **minor** adverse and **minor beneficial**. Alternative D would result in fewer structures in the water (WTG and/or inter-array cables), which would lead to marginally smaller impacts on offshore economic activity that currently occurs in the lease area compared to Alternative B; however, this difference in impacts would not change the overall magnitude of cumulative impacts compared to Alternative B.

3.6.3.8.3 Conclusions

Impacts of Alternative E. The changes described above notwithstanding, the overall level of impacts of Alternative E would likely remain the same as Alternative B: **minor** adverse and **minor beneficial**.

Cumulative Impacts of Alternative E. In the context of reasonably foreseeable environmental trends, ongoing and planned actions, Alternative E would occur under the same scenario (Appendix D). The overall impact of Alternative E on demographics, employment, and economics when combined with past, present, and reasonably foreseeable activities would therefore be **minor** adverse and **minor beneficial**.

3.6.3.9 Comparison of Alternatives

Impacts of Alternatives. As described in Section 3.6.3.5, the Proposed Action in combination with ongoing activities would likely be slightly smaller when compared to the impacts expected under the No Action Alternative but not appreciable enough to change the impact determinations (minor adverse and minor beneficial). The Proposed Action would impact demographics, employment, and economics primarily through port utilization and the visual effects of the presence of structures (i.e., changes in economic activity that could occur due to the visibility of the Proposed Action's WTGs, OSSs, and Met Tower). Under the No Action Alternative, these impacts would not occur.

Alternatives C-1 and C-2 would not affect the number or placement of WTGs or OSSs for the Project compared to Alternative B, and therefore would not result in meaningfully different impacts on demographics, employment and economics compared to Alternative B. Alternative D would result in changes to the total number of WTGs and OSSs, which could reduce some adverse impacts, but would not result in different impact magnitudes. As a result, the impacts of the action alternatives would likely remain the same as Alternative B: **minor** and **minor beneficial**.

Cumulative Impacts of Alternatives. The overall cumulative impact of Alternatives C, D, and E on demographics, employment, and economics when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **minor** and **minor beneficial**.

If BOEM requires the mitigation measures beyond the design features described in Section 3.6.3.4, then adverse Proposed Action impacts on demographics, employment, and economics could be further reduced and beneficial impacts could be increased; however, overall impact magnitudes would remain the same as described in this section.

3.6.3.10 Proposed Mitigation Measures

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

3.6.5 Land Use and Coastal Infrastructure

This section discusses potential impacts on land use and coastal infrastructure from the Proposed Action, action alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area (Figure 3.6.5-1) includes land areas affected by Proposed Action and Alternative C onshore facilities, including primary ports listed in Tables 2-4 and 2-5; the POI and substations in Sussex County, Delaware; landfall sites in Delaware Seashore State Park; and land areas in Sussex County affected by potential alternative Onshore Export Cable Routes. Primary port facilities to be used during construction include Baltimore (Sparrows Point) and the Ocean City Harbor, Maryland; Brewer, Maine; and one of three Gulf of Mexico terminals (Ingleside, Texas or Houma or Harvey, Louisiana). The primary port used during O&M would be Ocean City, while some vessel activity in support of operations could occur at Lewes, Delaware; Hampton Roads area (Portsmouth), Virginia; Baltimore (Sparrows Point), Maryland; Hope Creek, New Jersey (the New Jersey Wind Port); and the Port of New York/New Jersey (COP, Volume I, Section 3.1; US Wind 2024). These areas encompass locations where BOEM anticipates direct and indirect impacts associated with proposed onshore facilities and ports.

3.6.5.1 Description of the Affected Environment

Land use (which describes the actual or intended purpose of lands) is diverse within the geographic analysis area, ranging from agricultural and forest land to dense urban and industrial areas, and including a variety of residential, commercial, and tourist-oriented uses (See Section 3.6.8 of the EIS for a discussion of impacts to recreation and tourism). Important landscape features near the proposed landfall locations, Inshore and Onshore Export Cable Routes, and substations include a combination of natural views such as beaches, shorelines, and scenic vistas, and man-made views such as buildings, landscaping, parks, and other cultural features, which are described and analyzed in Section 3.6.9 of the EIS. Land cover (which describes the physical features of the landscape) includes water, coastal wetlands and beaches, inland wetlands, forest, urban, and agricultural land uses. Figure 3.6.5-2 shows land use/land cover (a combination of land use and land cover) within Sussex County, Delaware, and

Worcester County, Maryland, as mapped by the Multi-Resolution Land Characteristics (MRLC) consortium. Table 3.6.5-1 summarizes land use/land cover acreages within these two counties.

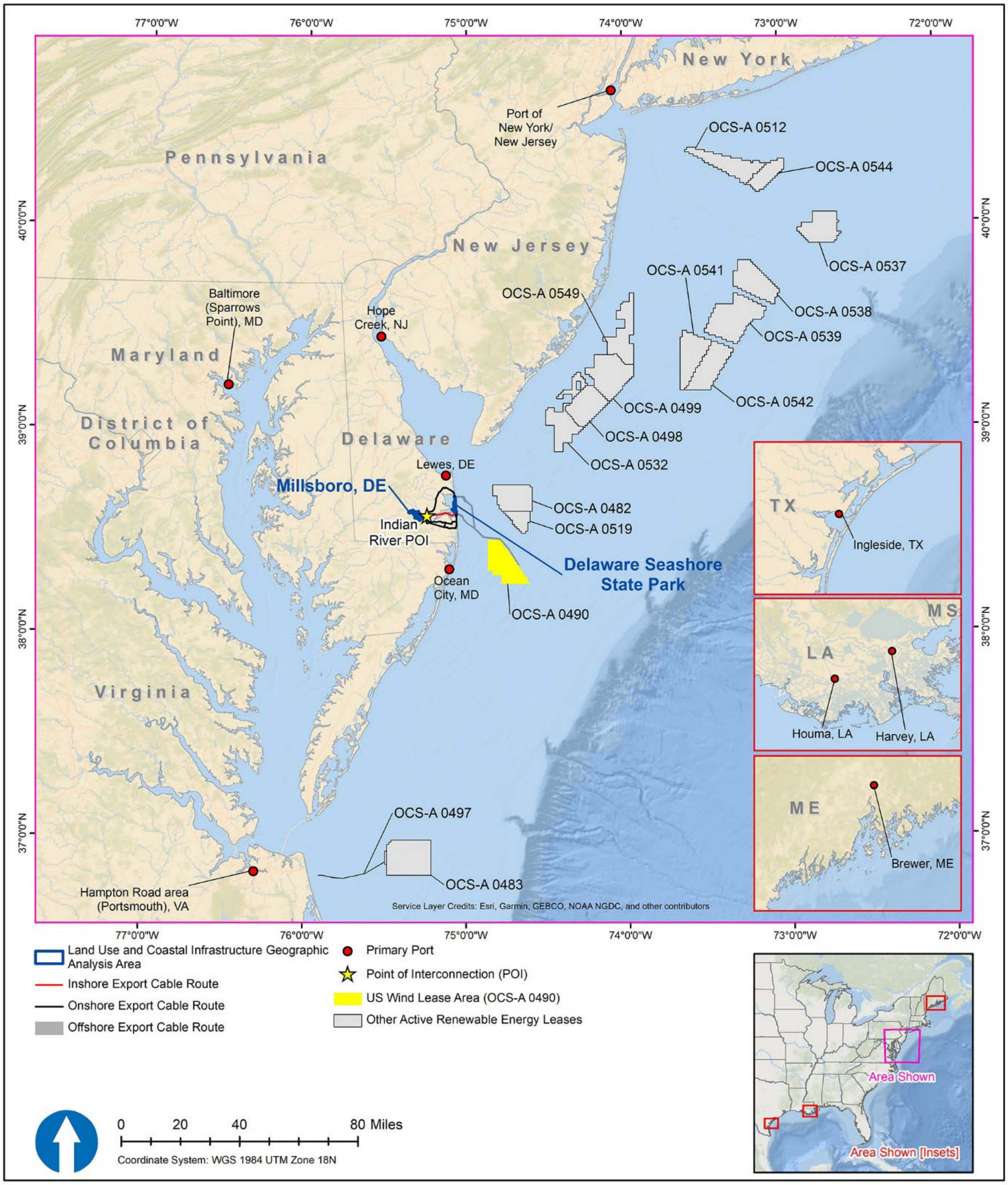

Figure 3.6.5-1. Land use and coastal resources geographic analysis area

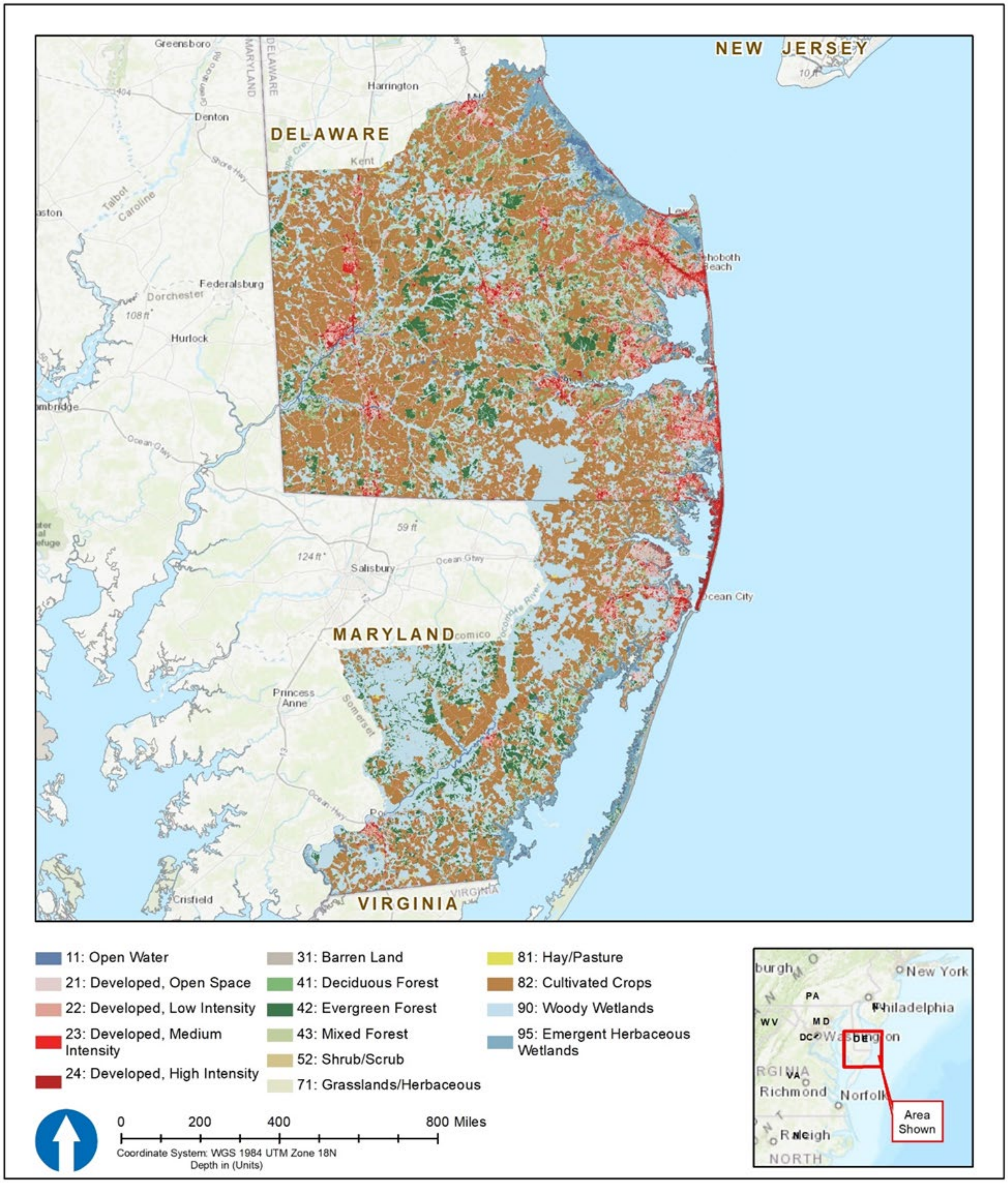

Figure 3.6.5-2. Land use/land cover types within the geographic analysis area

Source: MRLC 2021

Table 3.6.5-1. Land use/land cover acreage within the geographic analysis area

Land Use/Land Cover Category	Sussex County, Delaware		Worcester County, Maryland	
	Acres	Percent of Total	Acres	Percent of Total
Open Water	8,102.0	1%	5,043.6	2%
Developed, Open Space	43,377.3	7%	14,764.4	5%
Developed, Low Intensity	31,463.8	5%	6,938.5	2%
Developed, Medium Intensity	19,346.3	3%	4,388.9	1%
Developed, High Intensity	5,010.0	1%	2,591.6	1%
Barren Land	2,568.9	0%	2,987.5	1%
Deciduous Forest	15,727.1	3%	2,274.6	1%
Evergreen Forest	36,936.2	6%	24,912.1	8%
Mixed Forest	36,923.1	6%	12,245.9	4%
Shrub/Scrub	3,159.2	1%	1,195.6	0%
Grasslands/Herbaceous	1,624.2	0%	562.0	0%
Hay/Pasture	1,638.3	0%	932.0	0%
Cultivated Crops	254,786.2	42%	86,839.6	28%
Woody Wetlands	124,757.5	21%	123,467.0	41%
Emergent Herbaceous Wetlands	21,862.6	4%	15,650.6	5%
Total	607,282.7	100%	304,793.9	100%

Source: MRLC 2021

3.6.5.1.1 Sussex County Delaware

The Project would be interconnected to the onshore electric grid in Sussex County. The interconnection location for the Proposed Action is at the existing Delmarva Power and Light Indian River substation adjacent to the Indian River Power Plant, an existing, coal-fired power plant near Millsboro, Delaware. Alternative C includes possible use of two other Delmarva Power and Light substations: the Cool Spring substation in Milton, Delaware, and the Milford substation in Milford, Delaware. In addition to the use of existing substations, US Wind may construct new substations adjacent to the existing Indian River substation, adjacent to one of the two other Delmarva Power and Light substations, or on several properties of sufficient size within 0.5 miles (0.8 kilometers) of the Indian River substation. All proposed substations are located within Sussex County, Delaware (COP, Volume I, Section 2.6; US Wind 2024).

Land surrounding the Indian River substation and adjacent potential substation sites in Sussex County is forested, wetlands, or agriculture/farmland, except for the Indian River Power Plant and electrical transmission ROWs that serve it. The Cool Spring substation is adjacent to residential subdivisions and forested stream valleys. Land adjacent to the Milford substation is primarily rural residential and agricultural, in addition to multiple existing substations.

The Proposed Action landfall location is on a barrier island in Sussex County approximately 1 mile (1.6 kilometers) south of the Indian River Inlet, within a parking area associated with 3R's Beach. A second landfall option that would be used for Alternative C-1 is at Tower Road approximately 5 miles (7.7 kilometers) north of the Indian River Inlet, also on the coast of Sussex County, within a parking area for Towers Beach. Both beaches and parking areas are within Delaware Seashore State Park (DNREC 2014). There are no amenities at 3R's Beach other than the parking area. The beach is popular for surf fishing. Towers Beach has lifeguards, restrooms, picnic facilities and other amenities. Based on Delaware land cover data, land use is classified as Recreational at Towers Beach and Inland Natural Sandy Area at 3R's Beach (State of Delaware 2021).

The Sussex County Zoning Ordinance defines the permitted and intended uses of land in the county (outside of incorporated municipalities, which have their own zoning). Land use along the Indian River on either side of the proposed Inshore Export Cable Route is zoned for agricultural and residential use, including Agricultural Residential, Medium Residential, General Residential, High Density Residential (HR-1), (HR-2), and Vacation, Retire, Resident (VRP). The existing power station, substation and surrounding land is zoned Heavy Industrial (H-I-1); small areas zoned Marine (M), General Commercial (C-1) and Neighborhood Business (B-1), (B-2) are located along nearby roads and the riverfront (Sussex County 2022).

3.6.5.1.2 Worcester County, Maryland

The Project O&M Facility is located in West Ocean City, an unincorporated area on the mainland of Worcester County, Maryland. The O&M Facility will provide a suitable location to plan and coordinate WTG and OSS maintenance and servicing operations for the Project from the Ocean City, Maryland region. The O&M Facility will be comprised of onshore office, crew support, and warehouse spaces with associated parking in the Ocean City commercial harbor and will include quayside and berthing areas for four or more crew transfer vessels (CTVs). The O&M Facility will also house a Marine Coordination Center, which will serve to monitor the status of the WTGs and OSSs via SCADA systems, plan maintenance operations and dispatch CTVs, monitor marine activity in the Project area, coordinate drills and exercises, and communicate with outside agencies.

The Ocean City Inlet, which divides Fenwick Island (which contains the Town of Fenwick Island, Delaware, and Ocean City, Maryland) from Assateague Island, allows ocean-going vessels to access marinas in Ocean City and West Ocean City. Bayside marinas offer hundreds of boat slips with access to power hook-ups and fueling stations approximately 0.25 miles (0.4 kilometers) from the Atlantic Ocean.

Outside of Ocean City and the immediate surrounding area, land cover in Worcester County is primarily forest, wetlands, and agriculture (Table 3.6.5-1). Assateague Island contains about 22 miles (35.4 kilometers) of the county's Atlantic coast, while Fenwick Island/Ocean City contains about 10 miles (16.1 kilometers). U.S. Routes 13, 50, and 113 provide the primary land-based access in and out of Worcester County. The Bay Coast Railroad, Maryland & Delaware Railroad, and the Norfolk Southern Railway also serve Worcester County with freight service only. The small Ocean City Municipal Airport and the larger Salisbury-Ocean City Wicomico Regional Airport (in neighboring Wicomico County) offer air service a few miles outside of Ocean City and Snow Hill, respectively.

3.6.5.1.3 Port Facilities

US Wind anticipates using Baltimore (Sparrows Point), Maryland, as the primary staging and marshaling facility for offshore construction. Sparrows Point is an unincorporated community in Baltimore County built around the 3,300-acre (1,335-hectare) former Sparrows Point steel manufacturing facility. The steel facility began operation in 1891 and was operated from 1916 until 2012 by Bethlehem Steel. A portion of the Sparrows Point retired steel manufacturing site is being redeveloped by TPA as a multi-modal industrial complex. Sparrows Point has berths and an access channel within the Port of Baltimore and is also directly accessible by major highways, such as I-695, I-95, and I-70, and by rail, with direct connections to CSX and Norfolk Southern (TPA 2020). The proximity to multiple offshore wind lease areas, coupled with the multi-modal transportation resources at this site, allows TPA to be advantageous for offshore wind development, including component manufacture, assembly, staging, loading, and shipping (TPA 2021). US Wind has entered into an agreement with TPA for site control of more than 90 acres (36.4 hectares) at Sparrows Point; within this site, US Wind plans to facilitate funding of, and form a new venture to operate, a facility for the production of monopiles and other steel components for the offshore wind industry (US Wind 2021).

The O&M Facility in Ocean City, Maryland, reached via the Ocean City Inlet, would be the primary O&M port for support and crew vessels during construction. Ocean City Harbor is used by recreational vessels, charter vessels and commercial fishing vessels (Town of Ocean City 2018). Worcester County’s planning policies call for supporting and retaining marine commercial activities at Ocean City Harbor (Worcester County 2006).

In addition to Baltimore (Sparrows Point), Maryland, the following ports would support construction-related fabrication, assembly, storage, and shipping:

Brewer Maine: The OSS topsides will be assembled for shipment to the Lease Area at a redeveloped industrial site on the Penobscot River within the city of Brewer (PenBay Pilots 2021). OSS topsides would be shipped by barge.

Texas and Louisiana: US Wind has identified three potential marine terminals with access to the Gulf of Mexico, one of which will be the location where the fabricated Met Tower foundation would be loaded for shipping to the Lease Area. These ports include Ingleside, Texas, on Corpus Christi Bay; Houma, Louisiana, with access to the Gulf via the Intercoastal Waterway; and Harvey, Louisiana, on the Mississippi River.

During O&M, US Wind will primarily use the port facilities in West Ocean City, Maryland, with some potential use of Lewes, Delaware facilities for routine maintenance (support and crew transfer vessels). Major maintenance requiring deep-draft vessels would use the ports at Baltimore (Sparrows Point), Maryland; Hope Creek, New Jersey (New Jersey Wind Port); the Port of New York and New Jersey, and Hampton Roads area (Portsmouth), Virginia. Lewes, Portsmouth, and the Port of New York and New Jersey are existing port facilities. The New Jersey Wind Port is under construction on land adjacent to the Hope Creek and Salem nuclear generating stations in Salem County, New Jersey. This site will provide manufacturing and marine terminal facilities to support offshore wind (State of New Jersey 2024).

3.6.5.2 Impact Level Definitions for Land Use and Coastal Infrastructure

Definitions of potential impact levels for land use and coastal infrastructure are provided in Table 3.6.5-2. Table F-15 in Appendix F identifies potential IPFs, issues, and indicators to assess impacts on land use and coastal infrastructure.

Table 3.6.5-2. 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.
Negligible	Beneficial	Beneficial impacts on area land use would not be detectable.
Minor	Adverse	Adverse impacts would be detectable but would be localized.
Minor	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.
Moderate	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.
Major	Beneficial	Beneficial impacts would be detectable, long term, and extensive, and result in permanent land use change.

3.6.5.3 Impacts of Alternative A – No Action on Land Use and Coastal Infrastructure

3.6.5.3.1 Impacts of Alternative A—No Action

When analyzing the impacts of Alternative A (No Action Alternative) on land use and coastal infrastructure, BOEM considered the impacts of ongoing activities. Existing patterns of development and infrastructure would continue to support residential, recreational, commercial and industrial land use and activities. Ports in the geographic analysis area would continue to serve marine traffic that supports recreational boating, commercial fishing, and industries. Ongoing beach replenishment programs are important to protect waterfront properties and maintain beaches (Town of Ocean City 2023).

3.6.5.3.2 Cumulative Impacts of Alternative A—No Action

Under the No Action Alternative, land use and coastal infrastructure in the geographic analysis area would be affected by ongoing and planned activities, especially onshore and coastal development projects and port expansion. The geographic analysis area includes rural and developed communities that would experience ongoing commercial and residential development in accordance with established land use patterns and regulations. Ports in the geographic analysis area would experience periodic dredging and expansion projects. A channel-deepening project at the Port of Virginia in Portsmouth is currently underway and is anticipated to be completed in 2024 (Virginia Port Authority 2022). 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.

BOEM has reviewed available information regarding the potential for other offshore wind activities to result in coastal and onshore infrastructure within the geographic analysis area for land use and coastal infrastructure. Ørsted proposes an offshore wind project (Skipjack) to be located 20 miles (32.2 kilometers) off the coast of the Delmarva peninsula. The Project's first phase would connect to the PJM grid in Delaware, via a newly constructed interconnection facility in Fenwick Island State Park (Ørsted 2020). The first phase of the Skipjack project is expected to begin commercial operations in 2026 (Appendix D, *Planned Activities Scenario,* Table D-3). Similar to US Wind, Ørsted has proposed use of an O&M Facility in Ocean City, Maryland and identified that the Sparrows Point site may be used during construction (Ørsted 2021).

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, or hazardous materials may increase due to onshore construction (substations and onshore export cable routes) of offshore wind activities. Accidental release risks would be highest during construction but would still exist 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 sites, 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 localized and negligible, except in the case of very large spills that affect a large land or coastal area.

Land Disturbance: Offshore wind development would result in localized onshore ground disturbance during construction and installation of landfall sites, onshore export cable routes, and substations. Impacts on surrounding land uses would be adverse, short term, localized, and negligible (except where land is permanently converted to substations). BOEM assumes any such activity would be consistent with zoning or other land development regulations.

Lighting: As described in Section 3.6.9, *Visual Resources*, aviation hazard lighting from offshore wind projects other than the Proposed Action could be visible from beaches and coastal areas in the geographic analysis area. For the Proposed Action, use of ADLS would reduce the duration of the potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS (Capitol Airspace Group 2023). BOEM assumes that the use of ADLS on offshore wind projects other than the Proposed Action would result in similar limits on the frequency of WTG and OSS aviation warning lighting use. While aviation hazard lighting on WTGs could be visible from some shoreline locations in the geographic analysis area, WTG lighting would not result in changes to land use or zoning designations and would be unlikely to meaningfully change land use patterns.

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 localized and negligible.

Noise: Noise from offshore wind construction activities is not expected to reach the geographic analysis area. Onshore construction would result in localized, temporary noise typical of construction projects. Therefore, increased noise resulting from other offshore wind activities would not affect land use and coastal infrastructure and would have a negligible impact.

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 activity related to offshore wind.

Planned offshore wind use of facilities at Baltimore (Sparrows Point), Maryland would support beneficial re-use of a vacated industrial facility. Similarly, potential use of new manufacturing facilities and marine terminals built at the abandoned industrial site in Brewer, Maine would support beneficial redevelopment. The New Jersey Wind Port, a new facility adjacent to existing power generation plants, also provides beneficial, planned use of land in an industrial context. For larger ports (Hampton Roads area-Portsmouth, the Gulf of Mexico ports, and the Port of New York and New Jersey), offshore wind-related activities would make up a small portion of the total activities at the port; therefore, offshore wind activities would have a negligible impact on land use through port utilization at these ports. For smaller ports in the geographic analysis area, such as Ocean City and Lewes, port expansion or renovation of underused facilities may be necessary to accommodate the increased activity, resulting in changes to surrounding land use and coastal infrastructure as described below.

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 increase the marine and road traffic, noise, and air pollution in the area. Overall, offshore wind projects would have constant, long-term, beneficial impacts on port utilization due to the productive use of ports designated for offshore wind activity, as well as localized, short-term, minor adverse impacts in cases where individual ports are stressed due to simultaneous project activity.

Presence of structures: As described in Section 3.6.9, *Visual Resources*, WTGs from offshore wind projects other than the Proposed Action 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. 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 designations and would be unlikely to meaningfully change land use patterns.

Substations and above ground Onshore Export Cable Routes (if any) for multiple offshore wind projects would affect individual properties, depending on their location, but would result in only localized minor impacts on land use, because such structures would be constructed consistent with zoning and other land development regulations.

3.6.5.3.3 Conclusions

Impacts of Alternative A—No Action. Under the No Action Alternative, existing environmental trends and activities would continue. Land use and coastal infrastructure would continue to be affected by natural and human-caused IPFs resulting from onshore and coastal land uses. The No Action Alternative would result in **negligible** adverse and **minor beneficial** impacts on land use and coastal infrastructure.

Cumulative Impacts of Alternative A—No Action. The 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 expects planned activities other than offshore wind activities to have continuing temporary and permanent effects on land use and coastal infrastructure. These activities would result in **minor** adverse impacts and **minor beneficial** impacts on land use and coastal infrastructure. Construction activities, dredging, and vessel traffic could result in accidental releases and land disturbance, with temporary adverse impacts on local land uses but, overall, ongoing activity and development sustains the region's diverse mix of land uses and provides support for continued maintenance and improvement of coastal infrastructure.

BOEM anticipates 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 export 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).

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

This EIS analyzes the maximum-case scenario; any potential variances in the Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix C, *Project Design Envelope and Maximum Case Scenarios*) 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 action alternatives because the capacity or number of turbines would not affect onshore infrastructure or port utilization.

3.6.5.5 Impacts of Alternative B – Proposed Action on Land Use and Coastal Infrastructure

3.6.5.5.1 Impacts of Alternative B—Proposed Action

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 and substation construction; the visual impact of offshore WTGs; and the utilization of ports. The Proposed Action would not directly require any upgrades to port infrastructure but would make productive use of existing ports and the planned redevelopment project at Sparrows Point. 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.

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

Construction and Installation

All land use construction and installation impacts would be associated with onshore activities. While some IPFs associated with offshore activities (such as accidental releases) could affect land uses, those impacts are discussed as part of the associated offshore resource, such as water quality (Section 3.4.2, *Water Quality*).

Accidental releases: Accidental releases from the Proposed Action could include release of fuel/fluids/hazardous materials as a result of port usage and installation of the inshore export cables and substations. As described in Section 3.4.2.5.1, *Water Quality*, accidental releases in the offshore environment would be unlikely to affect land. Potential contamination may occur from unforeseen spills or accidents onshore or in port areas. Any such occurrence would be reported and addressed in accordance with the local authority. Accidental releases 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 and coastal infrastructure.

Land Disturbance: The Proposed Action's land-disturbing activities would include construction of landfall site, interconnection cables, substation sites, and the O&M Facility. The Project schedule would minimize adverse impacts on recreational land use. US Wind proposes concentrating construction activities for the landfall outside of the summer recreation season (Memorial Day to Labor Day) (COP, Volume II, Section 17.3.2; US Wind 2024). The Proposed Action landfall location is within the parking lot that serves the 3R's Beach public recreational site. HDD operations would make portions of the parking lot inaccessible during a period of approximately 8 months (mid-September to mid-May) when HDD operations, cable and transition vault installation and site restoration are ongoing (US Wind 2024). HDD operations could extend into a second year depending on weather and other unforeseen circumstances (US Wind 2024). Off-season beachgoers who would typically drive to 3R's Beach in Delaware Seashore State Park would have to temporarily find alternate parking, use alternate transportation, or use an alternate beach. Typical beach activities in this area include swimming, fishing, and beachcombing (COP, Volume II, Section 17.3.2.1; US Wind 2024).

The Inshore Export Cable Route would require cable installation within Indian River Bay, as described in Section 2.1.2.1. Cable ducts would be installed via HDD between the Atlantic Ocean and the landfall within the 3R's Beach parking lot; from the 3R's Beach parking lot into Indian River Bay; and from the Indian River to the onshore substation. Trenching would be used to install the cables within Indian River Bay and the Indian River. The in-water cable installation would generate vessel and equipment movements, noise, vibration, and emissions that would have temporary effects on the commercial, recreational, and residential land uses bordering Indian River. HDD installation from the Indian River to the substation would occur within the industrially zoned land area that surrounds the existing power station and substation (US Wind 2024).

Installation of the cable landfall sites and Inshore Export Cable Route would temporarily disturb neighboring land uses. These impacts are anticipated to last for the duration of construction; following construction, the cable route would be returned to its previous condition and use.

Construction of the substations would convert undeveloped land adjacent to the Indian River Power Station into impervious surface but would not alter overall land use patterns. The Proposed Action includes construction of three proposed substations totaling 10.3 acres (4.2 hectares). Construction of the interconnection facilities also includes the temporary construction laydown area of 4.0 acres (1.6 hectares), and a temporary access road of 0.76 acres (0.31 hectares).

Dredged material from the installation of the Inshore Export Cable will be piped via temporary dredge pipeline to a dewatering staging area at the US Wind substations, within the planned limits of construction disturbance. Dredged materials will be dewatered and placed in trucks for disposal/placement at an upland landfill location. This dredge material dewatering will occur within the disturbance footprint of the proposed substations.US Wind would work with local officials to develop a traffic management plan to reduce impacts on local traffic during construction. Accordingly, land disturbance from Proposed Action construction would have short-term, adverse, and minor impacts on land use and coastal infrastructure.

Noise: The Proposed Action would be required to comply with DNREC and local noise regulations (Delaware Administrative Code Title 7 Section 1149). The State of Delaware limits construction activities to the following hours: 7:00 a.m. until 10:00 p.m., Monday through Saturday, with no work on Sundays. Delaware regulations also limit construction noise levels at the boundary with residential areas to 65 A-weighted decibels during the day and 55 A-weighted decibels during the night. Sussex County has no construction noise regulations. Construction would also occur within the towns of Bethany Beach and Dagsboro. Bethany Beach limits construction to 8:00 a.m. until 5:30 p.m. Monday through Friday and 8:00 a.m. until 4:00 p.m. on Saturdays, while Dagsboro prohibits machines producing unreasonably loud noise at a distance greater than 25 feet (7.5 meters) (TRC 2023b).

US Wind has provided a preliminary Construction Noise Management Plan and will finalize the plan prior to construction to ensure that construction noise is within the limits (temporal and noise levels) required by state and local noise regulations (TRC 2023b). The Construction Noise Management Plan estimates the maximum construction noise level at the noise source for both cable installation and substation construction at 100 to 110 dB (TRC 2023b). US Wind will implement mitigations such as planning truck routes and parking areas to avoid proximity to residential areas, careful positioning of trucks and equipment, avoiding idling, using mufflers and noise shielding on equipment, using landforms or installing noise barriers, worker training, and periodic noise monitoring (Appendix G, Table G-1). 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 noise) but would not change existing land uses. Given the statutory noise limits and implementation of US Wind’s Construction Noise Management Plan (TRC 2023b), Proposed Action construction noise would have short-term, localized, minor impacts on land use and coastal infrastructure.

Port utilization: The Project would be only one of many users for the ports expected to be used during construction. 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.

Construction at the O&M Facility will include repairs to the existing concrete wharf (bulkhead repair and timber fender systems). Bulkhead repairs including steel sheet pile and an attached timber fender system will occur along the existing concrete wharf. New construction at the O&M Facility would occur from a barge mounted crane which is anticipated to include pile driving for the pier and installation of concrete pile caps, deck and curbs. There is no proposed dredging for the construction or operations of the pier.

Activities associated with Proposed Action offshore construction would generate noise, vibration, and vehicular traffic at the ports temporarily used for construction. 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 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.

Operations and Maintenance

Onshore Activities and Facilities

Accidental releases: Accidental releases from the Proposed Action could include release of fuel/fluids/hazardous materials as a result of port usage, maintenance of the inshore export 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.

Land disturbance: O&M would not result in land disturbance except in the event that substation repairs or cable maintenance or replacement is required. Therefore, Proposed Action O&M would have localized, short-term, and negligible impacts on land use and coastal infrastructure.

Lighting: Nighttime lighting of the onshore substations could affect the use of adjacent properties; however, the onshore substations would be constructed in locations where zoning and other land development regulations permit such uses and would be subject to local requirements for shielding the lighting and avoiding spillover to adjoining land uses. As a result, lighting during onshore O&M for the Proposed Action alone would have a long-term, continuous, minor impact on land use and coastal infrastructure in the geographic analysis area.

Noise: Onshore operational noise would result from port activity and substation operation. The Proposed Action O&M activities would comply with DNREC and local noise regulations to minimize impacts on nearby communities. Impacts would be localized, short term, and negligible.

Port utilization: Proposed Action O&M would require frequent activity at the O&M Facility in Ocean City, Maryland. Project operations would require an average of 4 daily vessel round trips during summer months and 1 to 2 round trips daily during other seasons (US Wind 2024). Vessel trips from Baltimore (Sparrows Point), Maryland would be less frequent, occurring when larger vessels are needed. This vessel traffic is typical for Ocean City Harbor and would not hinder other nearby land uses or use of coastal infrastructure. Overall offshore O&M 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.

Presence of structures: Construction of the substations would convert undeveloped land into impervious surface but would have a minimal impact on land use. The onshore substations would require permanent sites, including area for the substation equipment and buildings, equipment yards, energy storage, stormwater management, a parking area, an access road, and landscaping. Upgrades to the electrical transmission grid may be needed for interconnection; however, those upgrades would be consistent with the existing land use. Based on the potential substation locations and associated zoning described in Section 3.6.5.1, the presence of substation structures would have long-term, localized, minor impacts on land use.

The O&M Facility will be on the north side of Harbor Road in West Ocean City, and is anticipated to consist of new buildings, approximately three stories and no more than 45 feet (13.7 meters) in height on a 1.5 acre (0.6 hectares) site (COP, Volume I, Section 2.7; U.S. Wind 2024). The new structures, parking and other site improvements would comply with Worcester County land use regulations and would be consistent within the context of marine-related uses along the north side of Harbor Road.

Offshore and Inshore Activities and Facilities

Lighting: The Proposed Action would include the use of aviation hazard lighting mounted on top of the WTG nacelles and approximately midway up each WTG tower (COP, Volume II, Section 16.4 and Appendix K2; US Wind 2024). Each WTG, OSS, and Met Tower foundation would also have marine navigation lighting. The lighting is designed to be visible to distances ranging from 2 to 5 nautical miles (3.7 to 9.3 kilometers) during low-visibility conditions and would be visible from farther away under clear conditions. The Met Tower would have lighting visible at up to 10 nautical miles (18.5 kilometers) (COP, Volume II, Appendix K2; US Wind 2024). Aviation and navigation lighting would likely be visible from some coastal vantage points in the geographic analysis area depending on vegetation, topography, weather, and atmospheric conditions (Section 3.6.9.5, *Visual Resources*). US Wind has committed to implementing an ADLS; with ADLS, FAA warning lights for the Proposed Action would be illuminated approximately 0.1 percent of nighttime hours (Section 3.6.9.5, Visual Resources). This would greatly reduce the nighttime visibility of Proposed Action structures from shore (compared to traditional systems with constantly flashing lighting). While WTG and OSS lighting would be visible in some conditions, this lighting would not affect existing land uses and land development regulations onshore, due to the existing development patterns and limited remaining development potential within coastal portions of the geographic analysis area. The Proposed Action alone would have a long-term, continuous, negligible impact on land use and coastal infrastructure.

Presence of structures

Portions of all the Proposed Action WTGs and OSS could be visible from coastal and elevated areas of the geographic analysis area, depending on vegetation, topography, and atmospheric conditions. The closest Proposed Action WTGs would be approximately 10.5 miles (16.9 kilometers) from the coastal viewers. These WTGs would be plainly visible and could be the dominant feature in offshore views (Section 3.6.9.5, *Visual Resources*). As described in Section 3.6.3.5, *Demographics, Employment, and Economics*, and Section 3.6.8.5, *Recreation and Tourism*, views of WTGs and their presence in an area used for commercial fishing and (to a lesser extent) recreational boating could impact coastal businesses as well as recreation and tourism activities. As a result, the presence of structures could also impact long-term land use patterns, although the long-established nature of coastal development makes extensive changes unlikely, and meaningful changes to zoning and other underlying land development regulations are unlikely. As a result, the Proposed Action alone would have a long-term, continuous, minor impact on land use and coastal infrastructure.

Conceptual Decommissioning

The impacts of Onshore and Offshore Proposed Action decommissioning would be similar to—and would have similar or lower impact magnitudes as—the impacts described for construction. Decommissioning would require onshore traffic and equipment usage, as well as port usage for removal of onshore and offshore structures. Land and water disturbance from removal of the export cables could be negligible if export cables are retired in place rather than removed.

3.6.5.5.2 Cumulative Impacts of Alternative B—Proposed Action

Construction and Installation *and Operations and Maintenance*

Accidental Releases: In the context of reasonably foreseeable environmental trends, the Proposed Action would cumulatively contribute to the cumulative 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.

Land Disturbance: The Proposed Action would contribute a negligible amount to the combined land disturbance impacts of onshore infrastructure on land use and coastal infrastructure from ongoing and planned activities including offshore wind. Impacts on land use and coastal infrastructure would be additive only if maintenance of onshore infrastructure (cables or substations) associated with one or more other projects occurs in close spatial and temporal proximity.

In the context of reasonably foreseeable environmental trends, the Proposed Action would cumulatively contribute to the land disturbance impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind, due to construction-related disturbance along the Inshore Export Cable Route and at the onshore substation and landfall sites. However, 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. Impacts would be localized, short term, and minor.

Lighting: The land use impacts from the Proposed Action in the context of other offshore wind development would be similar to, but more extensive than, the impacts for the Proposed Action alone. In the context of reasonably foreseeable environmental trends, the onshore substation lighting and offshore aviation and navigation lighting for Proposed Action O&M would cumulatively contribute to the cumulative impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind. These impacts would be localized and minor.

Noise: In the context of reasonably foreseeable environmental trends, the Proposed Action would cumulatively contribute to the cumulative noise impacts on land use and coastal infrastructure from ongoing and planned activities, which would be short term, localized, and negligible to minor.

Port Utilization: The construction activity would have minor, temporary impacts on use of nearby piers and wharfs as marine operators avoid the construction area. 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. In the context of reasonably foreseeable environmental trends, the Proposed Action would cumulatively contribute to the cumulative impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind, which would be minor beneficial impacts.

Presence of Structures: Impacts on land use and coastal infrastructure from onshore components would be additive only if onshore structures (such as substations) associated with one or more other projects occur in close spatial and temporal proximity. WTGs and OSSs from the Proposed Action and other offshore wind projects may be visible from shorelines depending on vegetation, topography, weather, and atmospheric conditions. The land use impacts from offshore components of the Proposed Action in the context of other offshore wind development would be similar to, but more extensive than, the impacts for the Proposed Action alone, and would affect a wider extent of the geographic analysis area. In the context of reasonably foreseeable environmental trends, impacts of the Proposed Action and other ongoing or planned activities from the presence of structures would be long term, localized, and minor.

Conceptual Decommissioning

Proposed Action decommissioning would contribute a negligible amount to the cumulative onshore infrastructure impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind. Impacts on land use and coastal infrastructure would be additive only if onshore structures (such as substations) associated with one or more other projects occurs in close spatial and temporal proximity.

3.6.5.5.3 Conclusions

Impacts of Alternative B – Proposed Action. Overall, BOEM anticipates the Proposed Action's impacts on land use and coastal infrastructure would be minor adverse with **minor beneficial** impacts. Minor beneficial impacts would result from port utilization. The Proposed Action would have minor adverse impacts due to the potential for land use change resulting from the visibility of Proposed Action WTGs and OSSs from coastal and elevated locations. Other IPFs would contribute negligible to minor impacts, resulting in an overall range of **negligible** to **minor** adverse impacts.

Cumulative Impacts of Alternative B – Proposed Action. In the context of other reasonably foreseeable environmental trends, the cumulative contribution by the Proposed Action to the overall impacts on land use and coastal infrastructure would be noticeable. BOEM anticipates 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 past, present, and reasonably foreseeable activities, including offshore wind would range from **negligible** to **minor** adverse and **minor beneficial**. The main drivers for this impact rating are the minor beneficial impacts of port utilization, as well as minor impacts from the presence of structures.

3.6.5.6 Impacts of Alternatives C, D, and E on Land Use and Coastal Infrastructure

3.6.5.6.1 Impacts of Alternatives C, D, and E

Alternatives C-1 and C-2 would result in short-term and broad-based disruption of road traffic as the onshore cables are installed, primarily within existing road rights-of-ways (ROW) and including portions within power line and water line ROWs. Depending upon the location of existing utility lines, telecommunication lines, water and gas lines, the width of the road ROW, and the adjacent land conditions, cable installation would require excavation of travel lanes as well as road shoulders. Land-based cable installation for Alternatives C-1 and C-2 is anticipated to take two construction seasons and would include trenching, duct bank installation, pulling the cables through the duct banks, and road reconstruction and road reconstruction/paving (TRC 2023b). Roads that have only 2 lanes would likely need to be closed for construction, while roads with multiple lanes in each direction would have lane closures. The roads potentially disrupted by Alternative C include major traffic arteries—notably Delaware State Routes 1 (Coastal Highway) and 26—and pass through densely developed areas within and near the towns of Bethany Beach, Dewey Beach, Rehoboth, and Dagsboro, Delaware.

Due to road or lane closures, traffic disruption, and construction-related noise and traffic within developed areas, Alternative C would have greater construction impacts on land use and coastal infrastructure than the Proposed Action; however, because the construction impacts are short term and would avoid the summer season (mid-May through mid-September) these differences would not change the impact ratings compared to Alternative B.

The potential substations identified for Alternatives C-1 and C-2 are the same as the Proposed Action and are established uses; expansion of these substations could affect adjacent uses but would not alter overall land use patterns.

Under Alternative D, the closest WTGs would be 14 miles rather than 10.5 miles from the coastline and a total of 33 offshore structures would be excluded (32 WTGs and 1 OSS). Alternative D would marginally reduce impacts on land uses; however, the degree of change would not be sufficient to change overall level of impact on land use. Alternative E would reduce the number of WTGs by 11 but would not meaningfully change the views of WTGs from the coast and therefore would have the same level of impact as Alternative B.

3.6.5.6.2 Cumulative Impacts of Alternatives C, D, and E

Alternative C-1 or C-2 would cumulatively contribute to land disturbance impacts from ongoing and planned activities including offshore wind, due to construction-related disturbance along the Onshore Export Cable Route and at the onshore substation and landfall sites. Construction of these Alternatives could overlap in time with infrastructure construction planned by Sussex County and municipalities and would require coordination. If Project installation were to damage other infrastructure, the restoration of the right-of-way would need to include all necessary repairs to other infrastructure. Planned infrastructure projects along the Alternative C-1 and C-2 onshore cable routes include the following (COP, Volume II, Section 17.2.1, US Wind 2024):

- Alternative C-1: Pedestrian improvement projects in the Dewey Beach area in 2027-2028, intersection upgrades and road extension from Airport Road to State Route 24, and intersection improvements with turn lanes, bike paths, and pedestrian infrastructure at State Route 24 and Warrington Road.
- Alternative C-2: For Corridors 1a and 1b, sidewalk construction on Fred Hudson Road, sewer line and pump station installation on Vines Creek Road, and intersection improvement at State Route 26 and Falling Point Road.

Impacts on land use and coastal infrastructure from other offshore wind projects would be additive if onshore cable routes associated with one or more other projects were nearby and installed during the same time period. Impacts from cable installation would be localized, short term, and minor.

In the context of other reasonably foreseeable environmental trends, including offshore wind, the cumulative contribution by Alternatives C, D and E to the overall impacts on land use and coastal infrastructure would be similar to the contribution of the Proposed Action. BOEM anticipates the overall impacts on land use and coastal infrastructure in the geographic analysis area associated with Alternatives C, D and E, when combined with the impacts from ongoing and planned activities including offshore wind would be the same as the Proposed Action: negligible to minor adverse and minor beneficial.

3.6.5.6.3 Conclusions

Impacts of Alternatives C, D, and E. While Alternatives C and D would have marginally different impacts, they would have the same impact magnitudes as Alternative B. Alternative E would have the same impacts as Alternative B. As a result, the impacts of the action alternatives would likely remain the same as Alternative B: **negligible** to **minor** adverse and **minor beneficial**.

Cumulative Impacts of Alternatives C, D, and E. In the context of reasonably foreseeable environmental trends and planned actions, the action alternatives would occur under the same scenario (Appendix D) as Alternative B. As stated previously, the action alternatives would all have the same impact magnitudes as Alternative B. The overall impact of the action alternatives on land use and coastal infrastructure when combined with past, present, and reasonably foreseeable activities would therefore be **negligible** to **minor** adverse and **minor beneficial**.

3.6.5.7 Comparison of Alternatives

Impacts of Alternatives. As stated in Section 3.6.5.6, compared to Alternative B, Alternatives C and D would have different impacts on land use and coastal resources, while Alternative E would have the same impacts. Alternative C would have greater land disturbance impacts during installation of onshore cables. These differences notwithstanding, the impacts of the action alternatives would likely remain the same as Alternative B: **negligible** to **minor** adverse and **minor beneficial** impacts on land use and coastal infrastructure.

Cumulative Impacts of Alternatives. As described in Section 3.6.5.5, the impacts of the Proposed Action in combination with planned activities would the same (minor adverse as well as minor beneficial) when compared to the cumulative impacts expected under the No Action Alternative (minor adverse and minor beneficial). The Proposed Action would impact land use and coastal infrastructure primarily through land disturbance and the visual effects of the presence of structures (i.e., changes in land use that could occur due to the visibility of the Proposed Action's WTGs, OSSs, and Met Tower). Under the No Action Alternative, these impacts would not occur.

As explained in Section 3.6.5.6, the cumulative impacts of Alternatives C, D, and E would be the same as Alternative B. Although the onshore cables for Alternative C would use road ROWs that also have planned road, pedestrian, and sewer line projects, these planned activities would not substantially increase the impact of Alternative C. The cable installation would require coordination with county and municipal authorities to avoid conflicts in timing, as well as repairs upon completion of cable installation.

In the context of reasonably foreseeable environmental trends, ongoing and planned actions, the overall impact of the action alternatives on land use and coastal infrastructure when combined with past, present, and reasonably foreseeable activities would also be the same as Alternative B: **negligible** to **minor** adverse and **minor beneficial**.

3.6.5.8 Proposed Mitigation Measures

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

F.3 References

References for resource assessments in Section F.2 are provided in Appendix K.

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