VINEYARD MID-ATLANTIC

CONSTRUCTION AND OPERATIONS PLAN
VOLUME II APPENDIX

JANUARY 2025

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VINEYARD OFFSHORE

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Vineyard Mid-Atlantic COP

Appendix II-G Navigation Safety Risk Assessment

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Vineyard Mid-Atlantic

Navigation Safety Risk Assessment for Lease Area OCS-A 0544

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Vineyard Mid-Atlantic

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Executive Summary

Vineyard Mid-Atlantic LLC (the "Proponent") proposes to develop, construct, and operate offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0544 (the "Lease Area") along with associated offshore and onshore transmission systems. This proposed development is referred to as "Vineyard Mid-Atlantic."

Vineyard Mid-Atlantic includes 118 total wind turbine generator (WTG) and electrical service platform (ESP) positions within the Lease Area.[1] One or two of those positions will be occupied by ESPs and the remaining positions will be occupied by WTGs. Offshore export cables installed within an Offshore Export Cable Corridor (OECC) will transmit power from the renewable wind energy facilities to onshore transmission systems on Long Island, New York. The Offshore Development Area is comprised of Lease Area OCS-A 0544, the OECC, and the broader region surrounding the offshore facilities that could be affected by Vineyard Mid-Atlantic activities (Figure ES.1). Lease Area OCS-A 0512 is adjacent to Lease Area OCS-A 0544 along its northwestern boundary.

This document summarizes the methodology and findings of a Navigation Safety Risk Assessment (NSRA) conducted for Vineyard Mid-Atlantic as required by the United States Coast Guard (USCG). The USCG provides guidance on the information and factors that will be considered when reviewing an application for a permit to build and operate Offshore Renewable Energy Installation (OREI), such as Vineyard Mid-Atlantic. This information, which is outlined in USCG Navigation and Vessel Inspection Circular No. 02-23 Change 1 (NVIC 02-23 CH 1), is to be summarized through conducting an NSRA. The NSRA is intended to identify hazards to navigation and associated consequences that might be created by the potential project during the construction and installation, operations and maintenance, and decommissioning phases. Key considerations include: (1) safety of navigation; (2) the effect on existing uses of the waterway; and (3) the impact on maritime search and rescue (SAR) activities by the USCG and others.

Existing navigation features in the Offshore Development Area, including channels, International Maritime Organization (IMO) routing measures, aids-to-navigation (ATONs), and navigation hazards are described in the NSRA based on a variety of data sources, including the National Oceanic and Atmospheric Administration (NOAA) Coast Pilot and relevant navigation charts.

Vineyard Mid-Atlantic consists of the following infrastructure components in the marine environment:

- 118 total WTG and ESP positions (one or two of which may be occupied by ESP[s]), with monopile foundations supporting the WTGs, and monopile or piled jacket foundations supporting the ESP(s);
- Inter-array cables and potentially inter-link cables; and
- Offshore export cables installed within the OECC.

The WTG includes the following components:

- Turbine blades that rotate under wind power;
- Nacelle that encloses the electrical generator (which transforms the kinetic energy of the moving turbine blades to electric energy), drivetrain, brake, and motors that yaw and pitch the WTG; and

[1] Six WTG/ESP positions along the northwestern boundary of Lease Area OCS-A 0544 are contingent upon the final layout of the neighboring Empire Wind 2 project. Vineyard Mid-Atlantic will not develop these contingent WTG/ESP positions if the final Empire Wind 2 layout includes WTGs at immediately adjacent positions within Lease Area OCS-A 0512.

- Tower, typically comprised of multiple sections, that extends from the foundation to the nacelle.

Vineyard Mid-Atlantic is being permitted using a Project Design Envelope (PDE), which provides a reasonable range of project design parameters and installation techniques.

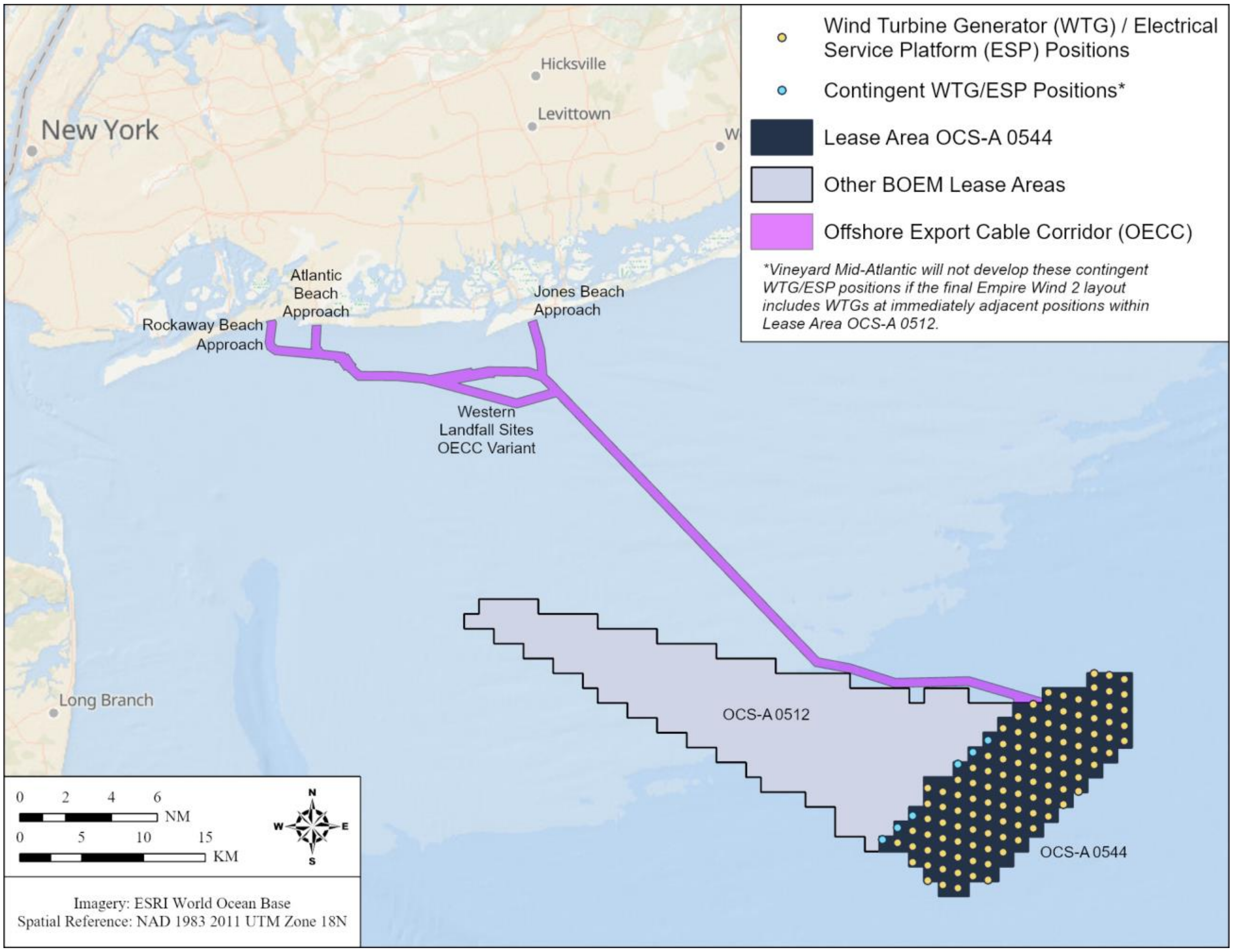

Figure ES.1: Lease Area, Structure Locations, and Offshore Export Cable Corridor

The WTGs and ESP(s) will be aligned in a uniform grid pattern with west-northwest to east-southeast rows, north to south columns, and 0.68 nautical mile (NM) (1.3 kilometer [km]) spacing between positions. This 0.68 x 0.68 NM WTG/ESP layout provides two common lines of orientation with the layout proposed for neighboring Lease Area OCS-A 0512 (where the Empire Wind projects will be installed), in accordance with the stipulations in Lease OCS-A 0544. This arrangement also creates diagonal navigation paths in the northwest-southeast direction with a width of 0.66 NM (1.23 km), and in the southwest-northeast direction with a width of 0.53 NM (0.98 km). It also creates north-south navigation paths with a width of 0.66 NM (1.22 km). Figure ES.2 shows the relative arrangement of the WTGs and ESP(s).

Inter-array cables will connect strings of multiple WTGs to the ESP(s), and if two ESPs are used, they may be connected with inter-link cables; the inter-array and inter-link cables are not shown. The offshore export cables, which will be installed within the OECC, will connect the ESP(s) to the potential landfall sites, as shown in

Figure ES.2. Two of the three shown potential landfall sites will be used. Up to six high-voltage alternating current (HVAC) cables, two high-voltage direct current (HVDC) cable bundles, or a combination of up to four HVAC cables/HVDC cable bundles will be installed within the OECC.

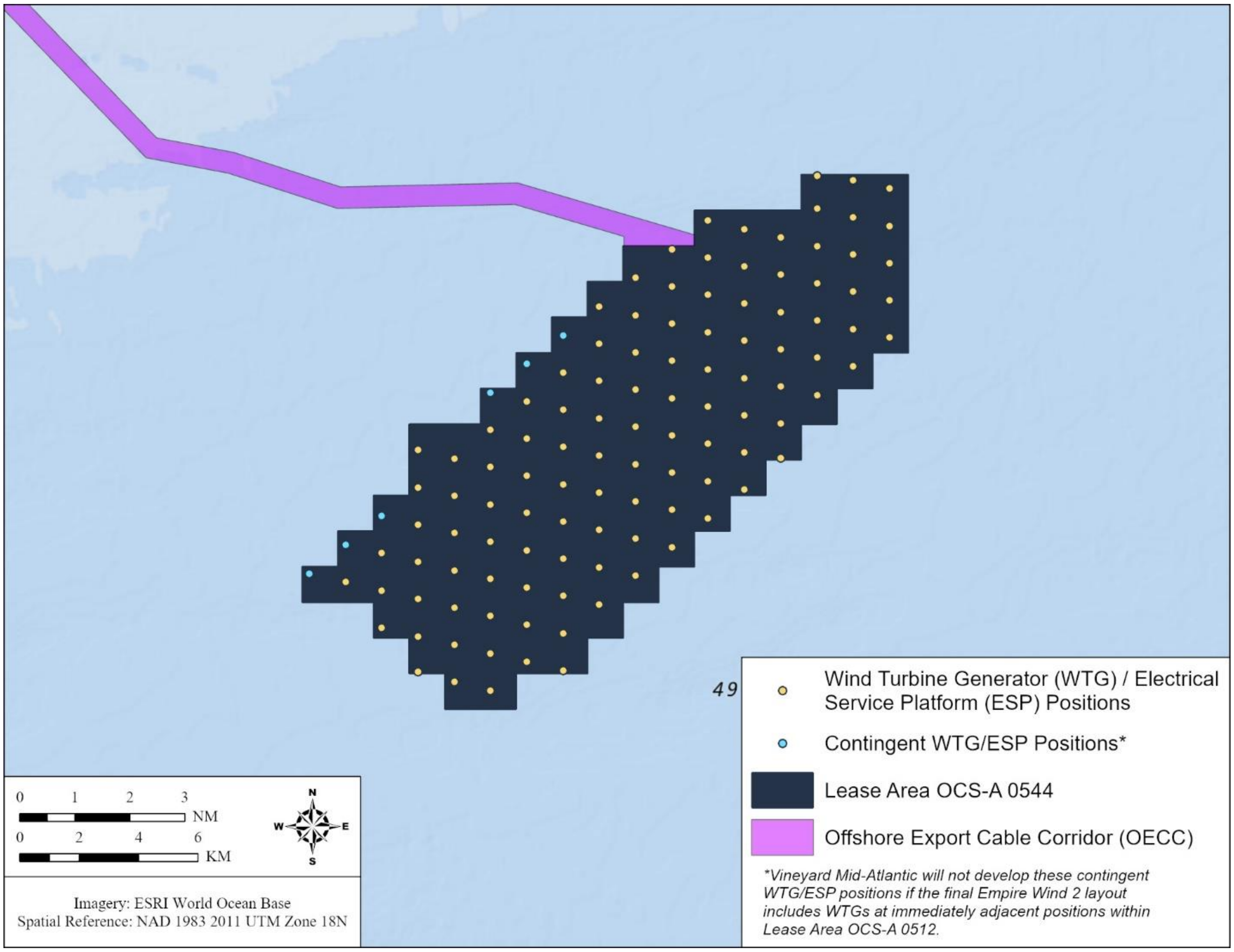

Figure ES.2: WTG and ESP Layout

The Lease Area is adjacent to two traffic separation schemes (TSSs) with one way traffic lanes with a separation zone between them (Figure ES.3): the Nantucket to Ambrose TSS to the north and the Hudson Canyon to Ambrose TSS to the southwest. The TSSs have been implemented by the USCG and are recognized by the International Maritime Organization (IMO) to help minimize collision risks for traffic transiting into and out of New York Harbor and the Port of New York / New Jersey. Most commercial cargo vessels use these TSSs. East and westbound traffic also uses the Nantucket to Ambrose Fairways, consisting of eastbound and westbound lanes, which connects from the Nantucket to Ambrose TSS to a separate TSS located south of Nantucket (also known as the Nantucket to Ambrose TSS). Together these routing measures result in the majority of larger vessels generally not transiting through the Lease Area. In addition to these existing measures, additional routing measures have been proposed as part of the USCG Consolidated Port Access Routes Study (CPARS) (USCG 2023a) including a Barnegat to Narragansett Fairway to the immediate southeast of the Lease Area and a Hudson Canyon to Ambrose Southeastern Fairway as an extension to the Hudson Canyon to Ambrose TSS as well as a precautionary area at the intersection of these two fairways as shown in Figure ES.4. The Barnegat to Narragansett Fairway follows the route frequently used by tug-tows transiting through or near the Lease Area from southwest to northeast (and the return reciprocal course). A Long Island Fairway located along the southern shore of Long Island which is crossed by the OECC and an Ambrose Anchorage, located in the area presently used as an anchorage, which is west of the proposed OECC.

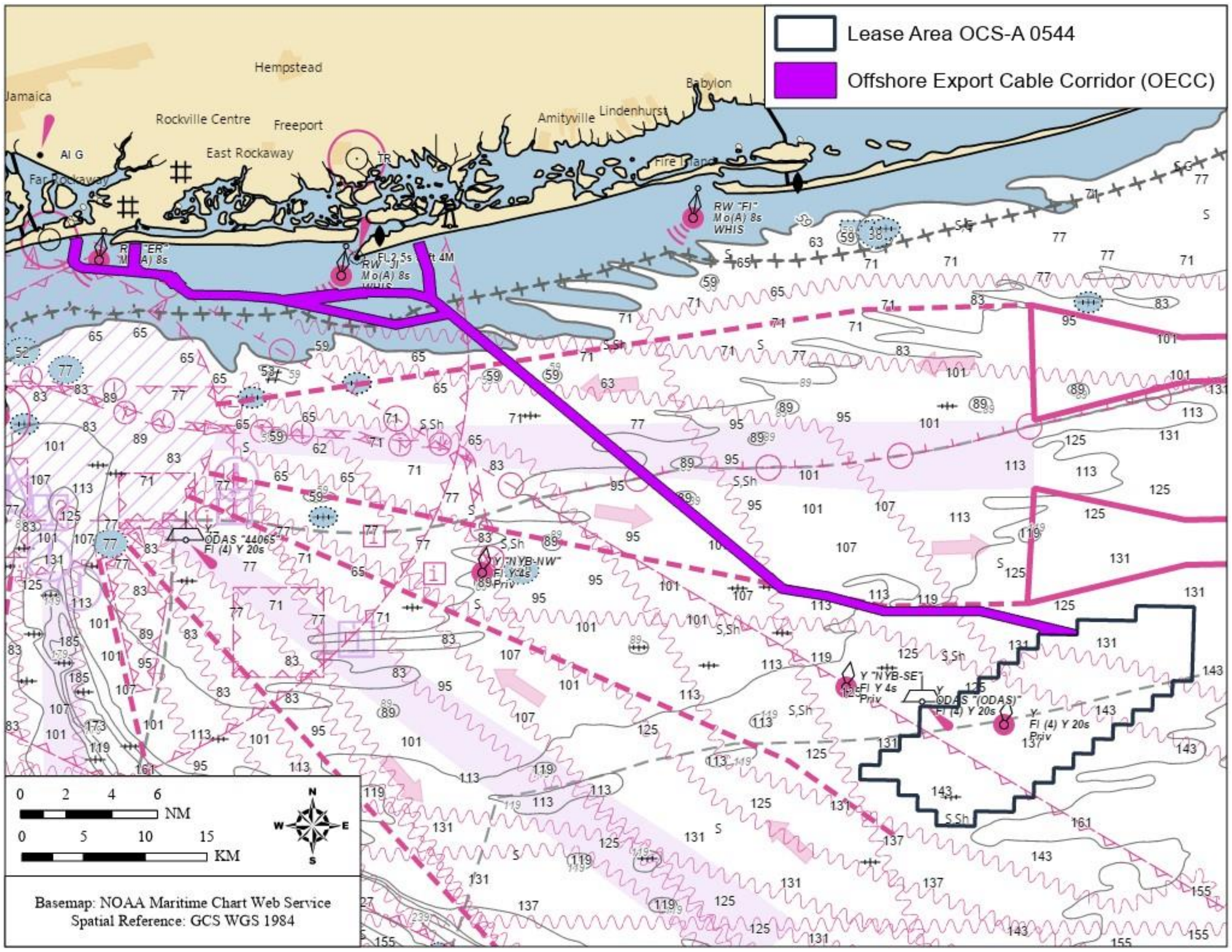

Figure ES.3: Location of Vineyard Mid-Atlantic Shown in NOAA Maritime Chart Web Service Map

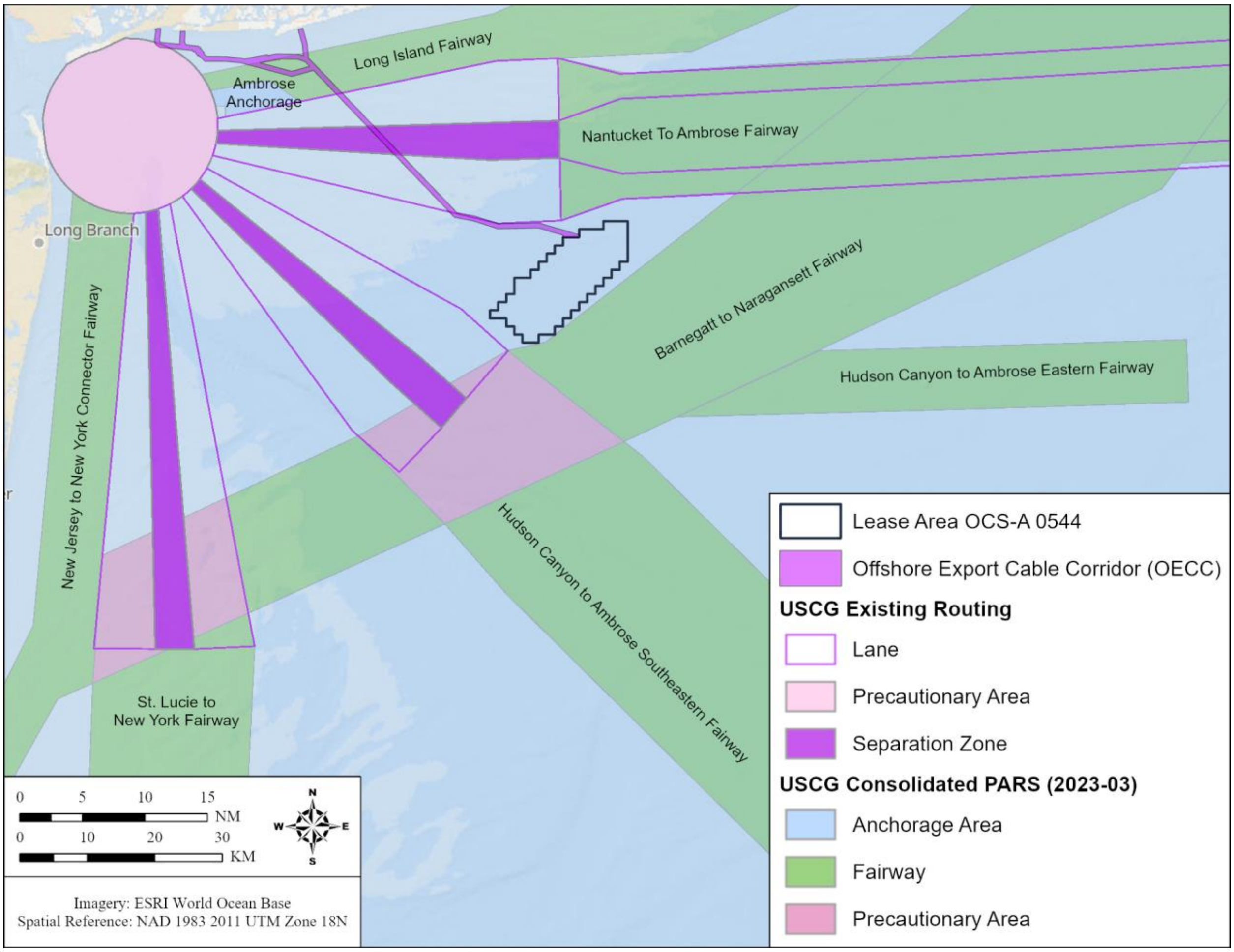

Figure ES.4: Proposed Routing Measures from CPAPARS (USCG 2023)

Vessel traffic in the vicinity of the Lease Area was analyzed based on Automatic Identification System (AIS) vessel tracking data. AIS data from the NOAA Marine Cadastre dataset were analyzed in a regional subset of the data extracted for longitudes between 71.85° W to 75.24° W and latitudes between 38.79° N to 40.69° N. In total, over the five-year period that was assessed between July 2017 and June 2022, there were a total of 1,195 unique vessels in the dataset that passed through the Lease Area. Table ES.1 provides a summary of the unique vessels and unique fishing vessels by year over the AIS data period. Commercial fishing vessels and recreational vessels dominate the traffic in the area, representing 78% of the unique tracks.

Table ES.1: Summary of AIS Dataset Analyzed (Data Source: Marine Cadastre) in the Lease Area

Year	*2017	2018	2019	2020	2021	*2022	**July 2017-June 2022
Number of Unique Vessels	191	247	298	320	315	150	1,195
Number of Unique Fishing Vessels	63	65	80	137	73	24	251

**Note that the data in 2017 is from July 1 to December 31, and the data in 2022 is from January 1 to June 30.*

***Note that the number of unique vessels for a given year as compared to the total number of unique vessels per 2017-2022 will not add up to the same number since the same vessel may frequent the area in different years.*

Vineyard Mid-Atlantic is being developed by the same team that developed Vineyard Wind 1, the nation's first and most advanced commercial-scale offshore wind project, and Vineyard Northeast. This team has considerable experience in stakeholder consultation. As example, Vineyard Mid-Atlantic modified and refined the OECC through numerous consultations with agencies, including USCG, as well as stakeholders (including fishermen), and based on their feedback, consolidated the offshore export cables with other developers' proposed cables to the extent feasible.

Vineyard Mid-Atlantic employs a Marine Liaison Officer who is responsible for safe marine operations and ensuring that the Proponent is a good neighbor while on the water. The Marine Liaison Officer currently serves as the Proponent's point of contact for all external maritime agencies, partners, and stakeholders, including USCG, US Navy, port authorities, state and local law enforcement, and commercial operators (e.g., ferry, tourist vessels, and other offshore wind developers). The Marine Liaison Officer is also a member of NYSERDA's Maritime Technical Working Group (M-TWG).

Vineyard Mid-Atlantic has consulted with a number of fisheries organizations and individuals during the planning stages and has translated that experience into a robust communication strategy. A Fisheries Communication Plan (FCP) has been developed to facilitate effective and regular engagement with fisheries stakeholders throughout the life of Vineyard Mid-Atlantic.

The meteorological/oceanographic (metocean) environment in the Offshore Development Area is provided in Section 4 of this NSRA. No substantive impacts on the metocean environment are expected from Vineyard Mid-Atlantic.

To aid marine navigation and aviation, the WTGs, ESP(s), and their foundations will be marked and lighted in accordance with USCG, Federal Aviation Administration (FAA), and BOEM requirements. The Proponent expects to paint each foundation (above sea level) in high-visibility yellow paint. AIS will be used to mark the WTGs and ESP(s) (virtually or using physical transponders). Mariner Radio Activated Sound Signals (MRASS) will be located on select foundations for low-visibility conditions. Each WTG and ESP will be maintained as a private aid-to-navigation (PATON) (all PATONs will be permitted through USCG) and provided to NOAA for incorporation on appropriate navigation charts.

A desktop analysis of the recommended maximum vessel length that can be accommodated by the navigation paths created by the 0.68 by 0.68 NM (1.3 by 1.3 km) WTG/ESP layout[2] was completed based on the methodology outlined in the Port Access Route Study: Northern New York Bight (NNYBPARS) (USCG, 2021b), Port Access Route Study for the Seacoast of New Jersey (NJPARS) (USCG, 2021a), the Massachusetts and Rhode Island Port Access Route Study (MARIPARS) (USCG, 2020), and international guidance (e.g., PIANC, 2018). The analysis of the navigation path width considers spacing for a navigation path, a ship-collision avoidance zone, a safety margin for vessel turning, and an additional buffer around each turbine. With a 164 ft (50 m) buffer assumed, all navigation paths would accommodate all fishing vessels in the existing fleet. The navigation paths will also accommodate most of the recreational fleet with a 164 ft (50 m) buffer, other than approximately the largest 0.2% of the vessels in the 0.66 NM navigation paths and 3.5% of the vessels in the 0.53 NM southwest-northeast navigation paths. It is noted that while these largest vessels are classified as recreational by AIS category, these large recreational vessels are expected to be crewed by licensed professional mariners. It is very important to recognize that the navigation path widths are notional

[2] The minimum spacing between turbines is 0.68 by 0.68 NM (1.3 by 1.3 km) but the widths of the nominal navigation paths are 0.66 NM (1.2 km) in two directions and 0.53 NM (0.98 km) in a third direction.

and not actual channels with continuous physical limits at the channel edges. Vessels can certainly navigate from one navigation path to the next without restriction in most locations (i.e., except at the WTGs/ESPs themselves).

It is anticipated that larger commercial vessel (e.g., cargo, tanker, passenger, military, and tug tow) traffic will navigate around the Lease Area toward and along existing shipping routes rather than through the turbine field. It has been estimated that this diversion will add less than 11 minutes to the overall journey time based on the average vessel speed. Various paths for re-routing of fishing and recreational vessels were also assessed should some of these vessels choose to divert around the Lease Area rather than travel through it. For most rerouting paths for fishing vessels and recreational vessels, the increase in transit time was a matter of a few minutes. The largest increase in transit time was approximately eight minutes for fishing or recreational vessels that currently travel directly through the Lease Area under existing conditions.

The potential navigational impacts from Vineyard Mid-Atlantic have been analyzed with a computer-based statistical model which is based on existing traffic, as determined from AIS analysis, and assumed modifications to traffic patterns following construction of Vineyard Mid-Atlantic. The analysis includes hazards of collision and allision (striking a fixed object). The results of the model show that the overall risk for potential marine accidents is relatively low for both pre-construction and post-construction conditions, and that the bulk of the risk is for fishing and cargo vessels. The risk of a potential accident changes from an average of one in every 219 years to one in every 127 years and is primarily attributed to operations and maintenance (O&M) traffic and allisions with WTGs. This translates to one additional accident every 300 years.

The historic incidents of USCG SAR and marine environmental response (MER) in the vicinity of the Lease Area are described in this NSRA. The Vineyard Mid-Atlantic WTGs and ESPs are not expected to impact the travel time to the vicinity for vessels or aircraft involved in SAR operations, and surface vessels are expected to continue to be able to operate within the Lease Area without restriction although search patterns may need to be adjusted to accommodate the presence of the structures. Similarly, search patterns for aerial SAR operations will require modification. Various mitigations have been identified to support SAR as noted below. As example, the structures have been laid out in a regular pattern consistent with the adjacent lease creating clear navigation paths at three different orientations.

MER operations are not expected to be significantly impacted by the WTGs and ESPs.

A series of proposed measures to mitigate risk during both the construction and operation of Vineyard Mid-Atlantic have been developed based on the NSRA's findings, as summarized below. Vineyard Mid-Atlantic will investigate and work with USCG and other agencies to assess and identify mitigation for potential impacts that Vineyard Mid-Atlantic may have on HF radars.

Construction & Installation

To mitigate navigation risk, the Proponent proposes to:

- Utilize a Marine Coordinator to manage all construction vessel logistics and implement marine communication protocols.
- Provide Offshore Wind Mariner Updates and coordinate with the USCG regarding the issuance of Local Notices to Mariners (LNMs) advising other vessel operators of Vineyard Mid-Atlantic's construction and installation activities.
- Regularly provide updates as to the locations of installed WTGs and ESP(s) to the USCG and NOAA for use in navigational charts.

- Identify the WTGs and ESP(s) as PATONs.
- Provide temporary lighting and marking on foundation structures as they are built, depending on the sequence and timing of construction.
- Engage with the USCG early in the permitting process and coordinate closely to address ATONs in proximity to or within the OECC. These ATONs will be avoided through micro-siting the offshore export cables (within the OECC) around the ATONs in accordance with USCG's Minimum Safe Distance requirements.
- Require all Vineyard Mid-Atlantic construction vessels and equipment to display required navigation lighting and day shapes.
- Potentially request that USCG establish safety zones around WTGs and ESP(s) during construction and/or maintenance activities, pursuant to 33 CFR Part 147. Additional details are provided in Section 8.1.1.
- When feasible, deploy one or more safety vessels to monitor vessel traffic approaching the construction areas.

Operations & Maintenance (O&M)

Proposed measures to mitigate navigation risk during O&M of Vineyard Mid-Atlantic are provided below.

Overall Marine and SAR Coordination

- Utilize a Marine Liaison Officer, who will act as the strategic maritime liaison between Vineyard Mid-Atlantic's internal parties and all external maritime partners and stakeholders.
- Provide Offshore Wind Mariner Updates and coordinate with the USCG regarding the issuance of LNMs advising other vessel operators of Vineyard Mid-Atlantic's O&M activities.
- Work with the USCG to develop an operational protocol that outlines the procedures for the braking system on requested Vineyard Mid-Atlantic WTGs to be engaged within a specified time upon request from the USCG during SAR operations and other emergency response situations. This emergency braking system will be satisfactorily tested at least twice per year.
- Coordinate with the USCG to identify ways for Vineyard Mid-Atlantic to support SAR efforts, which may include the use of cameras on WTGs and/or ESP(s) to aid in the detection of distressed mariners.
- Design the helipads on the ESP(s), if present, to accommodate USCG rescue helicopters.
- Operations center(s) will be maintained and continuously operated 24 hours per day throughout the life of Vineyard Mid-Atlantic. The center(s) can assist the USCG in the response to distress calls through active control over the WTG braking system.

Vessel Navigation

- Use of a uniform grid pattern for the 0.68 x 0.68 NM WTG/ESP layout provides two common lines of orientation with the layout proposed for neighboring Lease Area OCS-A 0512, which will allow fishing and recreational traffic which chose to navigate through the Lease Area (and neighboring Lease Area OCS-A 0512) to maintain constant headings through the Lease Area.
- The locations of the WTGs and ESP(s) and air draft heights of the WTGs will be provided to the USCG and NOAA for identification on relevant navigational charts. USCG can advise NOAA of any other relevant notes or precautionary statements to be published on relevant navigational charts.
- The USCG can also advise on other restrictions and recommendations by means of LNMs.

WTG and ESP Marking and Lighting

- The WTGs and ESP(s) and their foundations will be equipped with marine navigation lighting and marking in accordance with USCG and BOEM requirements. Each WTG and ESP will be maintained as a PATON per the requirements of the USCG.
- Each structure will be marked with a unique alphanumeric identifier to aid in visual confirmation of vessel location. Alphanumeric marking of structures is expected to be consistent across the Offshore Development Area.
- MRASS and AIS transponders are included in the design of the offshore facilities to enhance safety; the number, location, and type of these items will be determined in coordination with the USCG, BOEM, and Bureau of Safety and Environmental Enforcement (BSEE) for the final WTG/ESP layout.
- The WTGs and ESP(s) will include an aviation obstruction lighting system in compliance with FAA and BOEM requirements.

Marine Radar and AIS

BOEM recently sponsored a study by the National Academies of Sciences, Engineering, and Medicine to evaluate the impacts of WTGs on marine vessel radar and identify potential mitigation measures. The study provides a comprehensive overview of marine radar impacts and lays out potential mitigation measures as well as providing recommendations for further work. Mitigation for radar impacts (if needed) as well as communications consistency measures are expected to be based on regional efforts, which would be implemented in conjunction with other developers. Possible mitigation measures that may be considered are presented below; however, it is noted that these are preliminary concepts, and it is expected that such regional mitigation measures will be refined and updated pending ongoing consultations with BOEM, USCG, and other relevant agencies:

- Communications and training could be provided to local marine radar users regarding spurious signals and clutter that can occur in the vicinity of offshore structures as well as the recommended approaches for reducing these effects.
- Investigation of the use of more advanced radar systems that may provide improved filtering of spurious signals and the tracking of small vessels.
- Investigation of the use of AIS in smaller vessels as a more reliant means of navigating in a turbine field.

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Acronyms

AIS	Automatic Identification System
ADLS	Aircraft Detection Lighting System
AHTS	Anchor handling tug supply
ALARP	As Low As Reasonably Practicable
ASCC	Air Station Cape Cod
ATON	Aids to Navigation
BOEM	Bureau of Ocean Energy Management
CBRA	Cable Burial Risk Assessment
CFR	Code of Federal Regulations
CPAPARS	Consolidated Port Approaches and International Entry and Departure Areas Port Access Route Study
CL	Chain Length
COLREGS	International Regulations for Preventing Collisions at Sea
COP	Construction and Operations Plan
CTV	Crew Transfer Vessel
CVA	Certified Verification Agent
dB	Decibels
DOD	Department of Defense
DSC	Digital Selective Calling
ECA	Emission Control Area
ECDIS	Electronic Chart Display and Information System
EMF	Electromagnetic Field
ENC	Electronic Navigational Chart
ERP	Emergency Response Plan
ESP	Electrical Service Platforms
ESRI	Environmental Systems Research Institute
ETV	Emergency Towing Vessels
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FCP	Fisheries Communication Plan
FDR	Facility Design Report
FIR	Facility Installation Report
ft	feet
GIS	Geographic Information System
GNSS	Global Navigation Satellite Systems

GPS	Global Positioning System
HAT	Highest Astronomical Tide
HLV	Heavy lift vessel
hr	hour
HDD	Horizontal Directional Drilling
HSC	High Speed Craft
HTV	Heavy transport vessel
HVAC	High-voltage alternating current
HVDC	High-voltage direct current
Hz	Hertz
IALA	International Association of Lighthouse Authorities
IMO	International Maritime Organization
JBCC	Joint Base Cape Cod
kts	Knots - vessel speed in nautical miles per hour
LOA	length overall
LNM	Local Notice to Mariners (USCG publication)
LSV	Length of Servicing Vessel
m	meter
mi	miles
MA WEA	Massachusetts Wind Energy Area
MARIPARS	Massachusetts and Rhode Island Port Access Route Study
MER	Marine Environmental Response
MGN	Marine Guidance Note
MHHW	Mean Higher High Water
MISLE	Marine Information for Safety and Law Enforcement
MKD	Minimum Keyboard and Display
MLLW	Mean Lower Low Water
MMSI	Maritime Mobile Service Identity
MRASS	Mariner Radio Activated Sound Signal
MSD	Minimum Safe Distance
NAD	North American Datum
NDBC	National Data Buoy Centre
NJPARS	New Jersey Port Access Route Study
NM	Nautical Mile
NNYBPARS	Northern New York Bight Port Access Route Study
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration

NORM	Navigational and Operational Risk Model
NSRA	Navigation Safety Risk Assessment
NVIC	Navigation and Vessel Inspection Circular
NYSERDA	New York State Energy Research and Development Authority
O&M	Operations and Maintenance
ODAS	Oceanographic Data Acquisition System
OECC	Offshore Export Cable Corridor
OPAREA	Operating Area
OREI	Offshore Renewable Energy Installation
OSRO	Oil Spill Response Organization
PATON	Private Aids to Navigation
PDE	Project Design Envelope
PIANC	World Association for Waterborne Transport Infrastructure
POI	Point of Interconnection
PIW	Person in Water
RACON	Radar Transponder Beacon
RCS	Reactive Compensation Station
RI/MA WEA	Rhode Island/Massachusetts Wind Energy Area
SAR	Search and Rescue
SATV	Service Accommodation and Transfer Vessels
SMC	Search and Rescue Mission Coordinator
SOLAS	International Convention for the Safety of Life at Sea
SOV	Service Operational Vessel
SPS	Significant Peripheral Structures
TOW	Taking on Water
TSS	Traffic Separation Scheme
UK	United Kingdom
UKC	Under Keel Clearance
UNCLOS	United Nations Convention on the Law of the Sea
USACE	US Army Corps of Engineers
USCG	US Coast Guard
USCG NAVCEN	US Coast Guard Navigation Center
USGS	US Geological Survey
UTM	Universal Transverse Mercator
VHF	Very High Frequency (Radio)
VTR	Vessel Trip Report
VTS	Vessel Traffic Services

VMS	Vessel Monitoring System
WEA	Wind Energy Areas
WIG	Wing in Ground
WTG	Wind Turbine Generator
WTRIM	Wind Turbine Radar Interference

1. Introduction

1.1 Overview of Vineyard Mid-Atlantic

Vineyard Mid-Atlantic LLC (the “Proponent”) proposes to develop, construct, and operate offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0544 (the “Lease Area”) along with associated offshore and onshore transmission systems. This proposed development is referred to as “Vineyard Mid-Atlantic.”

Vineyard Mid-Atlantic includes 118 total wind turbine generator (WTG) and electrical service platform (ESP) positions within the Lease Area.[3] One or two of those positions will be occupied by ESPs, and the remaining positions will be occupied by WTGs. In accordance with Proponent’s lease stipulations, the WTGs and ESP(s) will be oriented in west-northwest to east-southeast rows and north to south columns with 0.68 nautical mile (NM) (1.3 kilometer [km]) spacing between positions. The WTGs will be supported by monopiles and ESP(s) will be supported by monopiles or piled jacket foundations. The base of the foundations may be surrounded by scour protection. Submarine inter-array cables will transmit power from groups of WTGs to the ESP(s). If two ESPs are used, they may be connected with inter-link cables. Two to six offshore export cables will then transmit the electricity collected at the ESP(s) to shore.

The WTGs, ESP(s), and their foundations, as well as the inter-array cables, inter-link cables (if used), and a portion of the offshore export cables, will be located in Lease Area OCS-A 0544. The Lease Area is one of six New York Bight Lease Areas identified by BOEM, following a public process and environmental review, as suitable for offshore wind energy development. At its closest point, the 174 square kilometer (km^2) (43,056 acre) Lease Area is approximately 38 km (24 miles [mi]) south of Fire Island, New York.

Between the Lease Area and shore, the offshore export cables will be installed within an Offshore Export Cable Corridor (OECC). Up to six high-voltage alternating current (HVAC) cables, two high-voltage direct current (HVDC) cable bundles, or a combination of up to four HVAC cables/HVDC cable bundles will be installed within the OECC. The OECC extends from the northern end of the Lease Area, continues west along the boundary of neighboring Lease Area OCS-A 0512, and then proceeds northwest across the Ambrose to Nantucket and Nantucket to Ambrose Traffic Lanes towards the southern shore of Long Island, New York. As the OECC approaches shore, it splits into three variations to connect to three potential landfall sites (of which, up to two will be used): the Rockaway Beach Landfall Site, the Atlantic Beach Landfall Site, and the Jones Beach Landfall Site. The Proponent has also identified a “Western Landfall Sites OECC Variant” that may be used for routing offshore export cables to the Rockaway Beach and Atlantic Beach Landfall Sites.

Onshore export cables will connect up to two of the three potential landfall sites to two new onshore substations in Queens, Nassau County, and/or Suffolk County, New York. If HVAC cables are used, depending upon numerous technical considerations, an onshore reactive compensation station (RCS) may be located along each onshore export cable route to manage the export cables’ reactive power (unusable electricity), increase the transmission system’s operational efficiency, reduce conduction losses, and minimize excess heating. Grid interconnection cables will connect the new onshore substations to the existing East

[3] Six WTG/ESP positions along the northwestern boundary of Lease Area OCS-A 0544 are contingent upon the final layout of the neighboring Empire Wind 2 project. Vineyard Mid-Atlantic will not develop these contingent WTG/ESP positions if the final Empire Wind 2 layout includes WTGs at immediately adjacent positions within Lease Area OCS-A 0512.

Garden City Substation (Uniondale) Point of Interconnection (POI) in Uniondale, New York, the Ruland Road Substation POI in Melville, New York, or the proposed Eastern Queens Substation POI in Queens, New York.

Vineyard Mid-Atlantic is being developed and permitted using a Project Design Envelope (PDE) based on expected commercial and technological advancements. The PDE outlines a reasonable range of project design parameters (e.g., multiple foundation types) and installation techniques (e.g., use of various cable installation tools). The Proponent has developed the PDE and sited Vineyard Mid-Atlantic's facilities in consultation with multiple stakeholders. For example, the Proponent modified and refined the OECC through numerous consultations with federal and state agencies as well as fishermen and, based on their feedback, located the OECC alongside the Empire Wind Lease area and Empire Wind 2's proposed submarine export cable route to the extent feasible. Key elements of Vineyard Mid-Atlantic's PDE are shown in Figure 1.1.

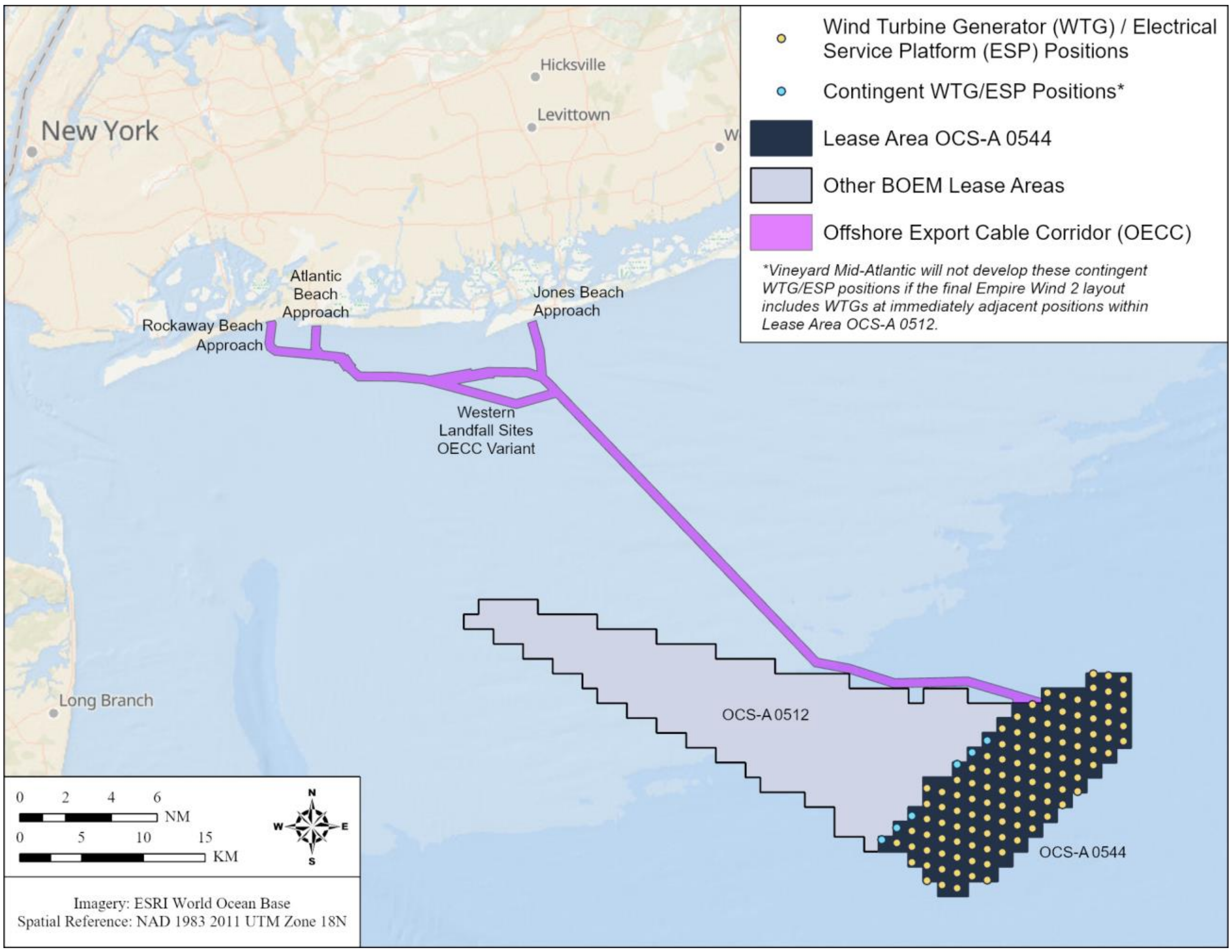


Figure 1.1: Overview of Vineyard Mid-Atlantic

1.2 Purpose of the Navigation Safety Risk Assessment

The United States Coast Guard (USCG) provides guidance on the information and factors that will be considered when reviewing an application for a permit to build and operate an Offshore Renewable Energy Installation (OREI), such as Vineyard Mid-Atlantic. This information, which is outlined in USCG Navigation and

Vessel Inspection Circular No. 02-23 Change 1 (NVIC 02-23 CH 1, USCG 2024), is to be summarized through conducting a Navigation Safety Risk Assessment (NSRA). The NSRA is intended to identify hazards to navigation and associated consequences that might be created by the potential project during the construction and installation, operations and maintenance, and decommissioning phases. Key considerations include: (1) safety of navigation; (2) the effect on existing uses of the waterway; and (3) the impact on maritime search and rescue activities by the USCG and others.

The NSRA process is to be conducted in cooperation and consultation with a wide range of stakeholders, including federal, state, and local agencies, Native American tribes, local maritime representatives, and the general public.

1.3 Report Organization

This report is organized to generally follow the outline of NVIC 02-23 CH 1 (USCG 2024). The following sections include Site Information, Proposed Structures, Metocean Characteristics, Navigation Impact Assessment, Risk of Collision, Allision, or Grounding, Emergency Response Considerations, and Facility Operations. The NVIC 02-23 CH 1 Checklist is provided as Appendix A. The Automatic Identification System (AIS) Data Analysis, Vessel Monitoring System (VMS) Data Maps, NORM Model Summary, and WTG/ESP Coordinates are also provided as appendices.

2. Site Information

2.1 Development of the Layout

The proposed Lease Area's WTG/ESP layout includes 118 WTG and ESP positions that will be arranged in a uniform grid pattern (Figure 2.1) with west-northwest to east-southeast rows, north to south columns (Table 2.1), and 0.68 nautical mile (NM) (1.3 km) spacing between positions (see Figure 2.2).[4] This 0.68 x 0.68 NM WTG/ESP layout provides two common lines of orientation with the layout proposed for neighboring Lease Area OCS-A 0512 (where the Empire Wind projects will be installed), in accordance with the stipulations in Lease OCS-A 0544.

In general, the most optimal WTG layout for wind energy production is a non-grid layout with closer turbine spacing and a higher density of WTGs around the edges of the wind farm; this edge-weighted design maximizes the number of WTGs per area while minimizing wake effects that impact the efficiency of downwind WTGs. However, as permitting of the first offshore wind projects within the Northeast progressed, agencies and stakeholders expressed the need for more uniform turbine layouts across adjacent projects to accommodate vessel transits, fishing, and other uses of the OCS (e.g., search and rescue). This need is reflected in the stipulations of Lease OCS-A 0544, which requires the Proponent to "endeavor to design a surface structure layout that contains two common lines of orientation between OCS-A 0512 and OCS-A 0544."

As described in Empire Offshore Wind LLC's (Empire's) Construction and Operations Plan (COP), the layout of Lease Area OCS-A 0512 was designed through engagement with regulatory agencies and maritime stakeholders to incorporate:

- straight and easily understandable patterns with a minimum WTG spacing of 0.65 NM (1.2 km), although the layout proposed in Empire's COP has a typical spacing of 0.68 NM (1.3 km)[5];
- west-northwest to east-southeast rows (aligned with bathymetry) that are sympathetic to the dominant trawl directions of most active and potentially impacted fisheries;
- north to south columns to facilitate SAR and to provide access for recreational fishing vessels traveling between Long Island and fishing grounds in Lease Area OCS-A 0512 and in the canyons to the south;
- 1 NM (1.9 km) separation between WTG positions and the edge of the traffic separation scheme (TSS) lanes; and
- straight line edges parallel to TSS lanes (no isolated or protruding turbines) (BOEM, 2023a).

While Empire's COP proposed a layout with 176 positions with minimum spacing of 0.65 NM due to off grid siting of some positions, only a maximum of 149 foundations will be installed (up to two ESPs and up to 147 WTGs) (BOEM, 2023a).[6] In the Final Environmental Impact Statement for the Empire Wind projects, BOEM did not propose alternatives that change the spacing and orientation of the WTG layout; rather, BOEM dismissed several layout alternatives, including a 2 NM x 2 NM (3.7 km x 3.7 km) layout (BOEM 2023a).

[4] Where necessary, WTGs and ESP(s) may be micro-sited by a maximum of 152 m (500 ft) to avoid unfavorable seabed conditions, maintain facilities within the Lease Area boundaries, and/or for other unexpected circumstances.

[5] The layout proposed in the Empire Wind Lease Area along the two common lines of orientation has a typical spacing of 0.68 x 0.68 NM (this distance was measured by the Proponent based on shapefiles provided by Empire Wind); however, due to deviations from the typical pattern the minimum spacing for the Empire Wind Lease Area is 0.65 NM as stated in their COP.

[6] The NSRA was developed using 149 foundations based on Final Environmental Impact Statement document (BOEM 2023a). The maximum number of foundations that will be installed for Empire Wind has subsequently been updated to 140 foundations (BOEM 2023b).

Accordingly, the Proponent has designed a surface structure layout for Vineyard Mid-Atlantic that shares two common lines of orientation with Lease Area OCS-A 0512. Since Vineyard Mid-Atlantic's 0.68 x 0.68 NM WTG/ESP layout aligns with the layout of Lease Area OCS-A 0512, in accordance with Section 8 of the Lease, a 3.7 km (2 NM) setback between Lease Areas OCS-A 0512 and OCS-A 0544 is not required. In accordance with the Lease stipulations, the Proponent developed the Lease Area with two lines of common orientation with Empire Wind's Lease Area. The layout proposed in the Empire Wind Lease Area along the two common lines of orientation has a typical spacing of 0.68 x 0.68 NM; therefore, the Lease Area will be arranged in a uniform grid pattern with west-northwest to east-southeast rows, north to south columns, and 0.68 NM (1.3 km) spacing between positions. (Note that Empire Wind WTGs are primarily arranged in a 0.68 x 0.68 NM grid pattern, with a minimum spacing of 0.65 NM due to off grid siting of some positions.) Likewise, Vineyard Mid-Atlantic has maintained a minimum 1.45 NM (2.7 km) distance from the parallel edge of the IMO routing measures on either side of the Lease Area consistent with the minimum spacing cited in the Marine Planning Guidelines (Enclosure 4 of NVIC 02-23 CH 1). The Marine Planning Guidelines also suggest a minimum separation distance of 5 NM (9.3 km) from a TSS entry/exit; however, the Guidelines are not prescriptive requirements and the Lease Area boundaries have been previously coordinated between USCG and BOEM prior to the lease sale. The layout incorporates a minimum 1.45 NM (2.6 km) separation between WTG positions and the edge of the traffic separation scheme (TSS) lanes consistent with the Marine Planning Guidelines (Enclosure 4 of NVIC 02-23 CH 1) which state a minimum distance of 1 NM from parallel boundary of an IMO routing measure; and straight line edges parallel to TSS lanes (no isolated or protruding turbines) (BOEM, 2023a).

Vineyard Mid-Atlantic's WTG/ESP layout includes six positions that are contingent upon the final layout of Empire Wind 2 (Figure ES.1). Empire Wind's proposed layout includes six "off-grid" positions along its boundary with Lease Area OCS-A 0544 that do not follow the west-northwest to east-southeast common line of orientation. Given that Empire will only install up to 149 WTGs and ESPs, but has proposed 176 positions, there is a possibility that the Empire Wind 2 project will not use one or more of these six off-grid positions; however, if the final Empire Wind 2 layout includes WTGs at those positions, Vineyard Mid-Atlantic would not use the immediately adjacent contingent WTG/ESP positions shown in Figure 2.1. These six Vineyard Mid-Atlantic positions are denoted throughout this NSRA as "contingent WTG/ESP positions." The width of the navigation paths between WTGs is presented in Table 2.1; however, the spacing between adjacent WTGs is slightly greater at 0.68 NM (1.25 km) as shown in Figure 2.2. (The term navigation path is used to avoid confusion with a USCG and/or IMO designated navigation corridor or routing measure. A navigation path is a lane clear of physical structures which may be an allision hazard.)

Table 2.1: Vineyard Mid-Atlantic WTG/ESP Layout Spacing

	NE-SW Path Spacing	N-S Path Spacing	NW-SE Path Spacing
Proposed Layout – Max Spacing	0.531 NM (983 m)	0.658 NM (1,219 m)	0.662 NM (1,226 m)

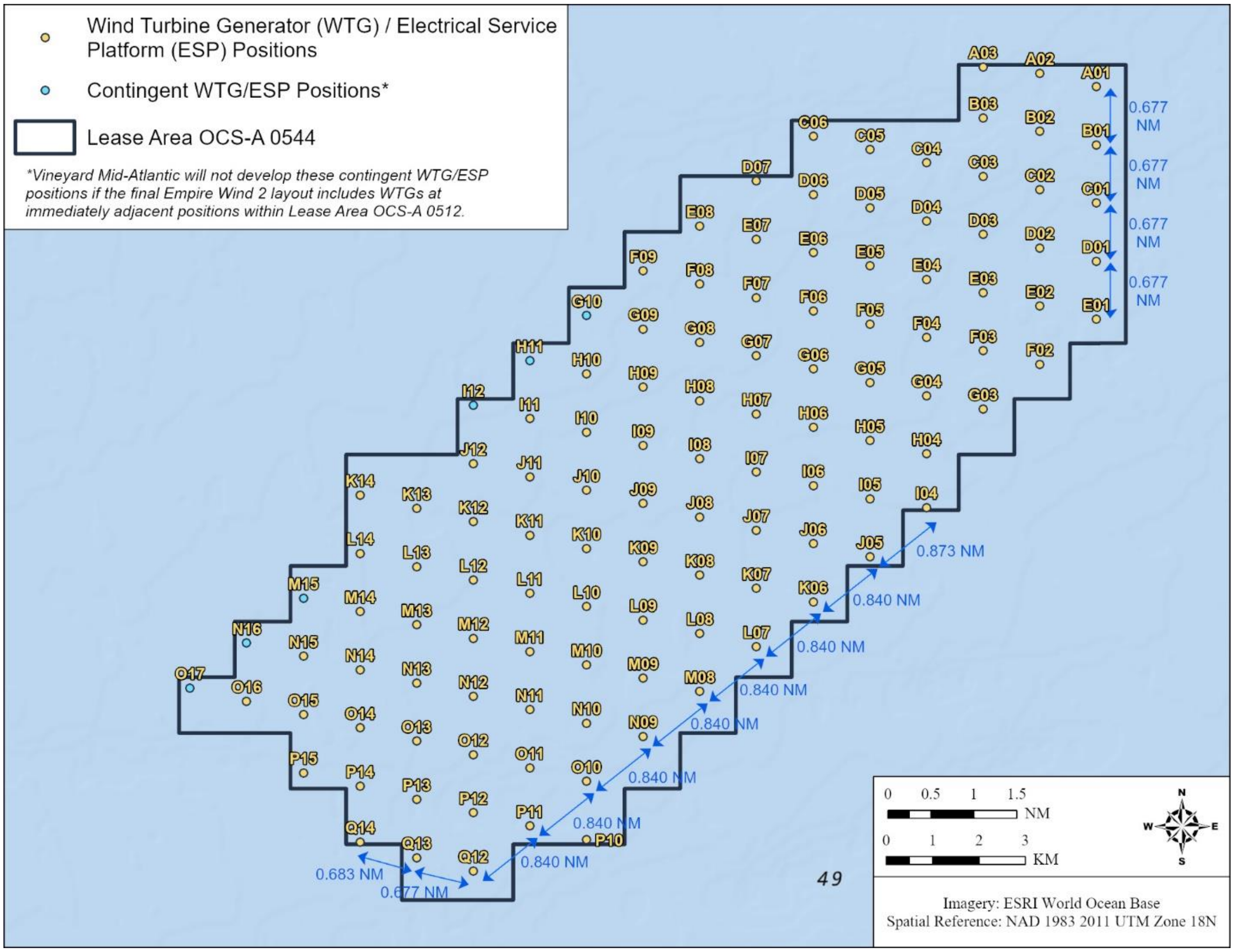


Figure 2.1: WTG/ESP Layout

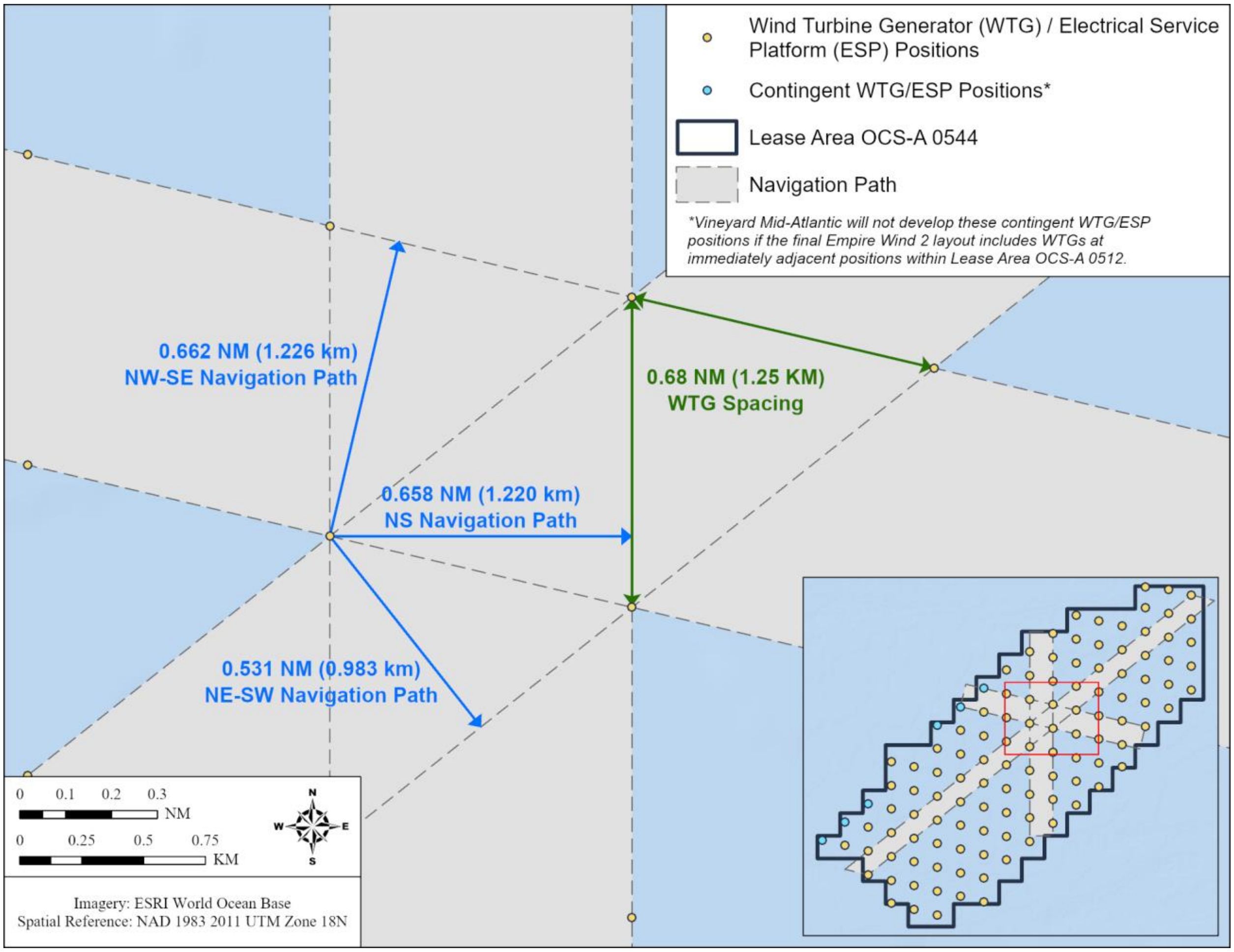


Figure 2.2: WTG/ESP Navigation Path Spacing

2.2 Wind Turbine Generators and Foundations

The Lease Area will contain up to 117 WTGs. With respect to vessel navigation, an important consideration is the WTG's minimum tip clearance, which is identified as being a minimum of 89 ft (27 m) relative to Mean Lower Low Water (MLLW). The PDE for the WTGs is provided in the table below.

Table 2.2: WTG Dimensions

Parameter	Dimensions
Maximum Tip Height	1,165 ft (355 m) MLLW[1]
Maximum Hub Height	640 ft (195 m) MLLW
Maximum Rotor Diameter	1,050 ft (320 m)
Minimum Tip Clearance	89 ft (27 m) MLLW
Maximum Blade Chord	33 ft (10 m)
Maximum Tower Diameter	36 ft (11 m)

1. *MLLW refers to Mean Lower Low Water, which is the average height of the lowest daily tide. Navigational charts in the US normally refer to this as the elevation datum.*

The WTGs will be supported on monopile foundations that are driven into the seabed. A monopile is a single, hollow steel cylinder that is driven into the seabed.

The dimensions for the WTG foundations are provided in Table 2.3. Dimensions include the transition piece (TP). This NSRA has considered the maximum foundation dimensions.

Scour protection may be placed on the seabed around the base of the foundations to minimize sediment transport and erosion (i.e., scour development) caused by water currents. If used, scour protection would likely consist of loose rock material placed around the foundation in one or more layers. Although freely laid rock is the most widely used scour protection material in the offshore wind industry, scour protection may alternatively consist of rock bags or scour mats. The horizontal extent of the scour protection depends on the foundation type.

Table 2.3: WTG Foundation Maximum Dimensions

Concept	Monopile
	With transition piece
Maximum Total Length (from interface with WTG to deepest point beneath the seafloor)	413 ft (126 m)
Maximum Pile Diameter at Base	43 ft (13 m)
Maximum Height of Foundation (including transition piece) above MLLW	115 ft (35 m)
Maximum Diameter/Dimensions of Foundation at the Waterline	38 ft (11.5 m)[1]
Maximum Diameter/Dimensions of Foundation at the Seabed	43 ft (13 m)
Maximum Area of Scour Protection per Foundation	1.8-2.9 acres (7,238-11,660 m^2)[2]

1. *The transition piece/extended monopile diameter at the waterline does not include any ancillary structures such as boat landing(s) and work platforms. Ancillary structures may extend up to 5 m (16 ft) from the outer edge of the transition piece/extended monopile in any direction.*
2. *A range of the maximum area of scour protection is provided as detailed engineering of the foundations is ongoing. Feedback from New York Bight recreational fisherman indicated they are supportive of extending scour protection around the foundations because it provides additional structured habitat for fish.*

The WTG and its foundations will be marked and lighted in accordance with USCG, Federal Aviation Administration (FAA), and BOEM requirements. AIS will be used to mark the WTGs (virtually or using physical transponders) so that the structure will display on AIS receivers. Mariner Radio Activated Sound Signals (MRASS) will be located on significant peripheral structures to aid mariners during low visibility conditions. See Section 5.1.1 for additional description of lighting, marking, and signaling for the WTGs.

2.3 Electrical Service Platforms and Foundations

The ESP(s) are offshore electrical substations that serve as common interconnection points for the WTGs and include step-up transformers and other electrical gear to increase the voltage of power generated by the WTGs.

The maximum width and length of the ESP topside is 279 x 558 ft (85 x 170 m). The ESP topsides will be supported by monopiles or piled jackets. A jacket foundation is a steel structure comprised of several legs that are interconnected by steel tubular cross-bracing. The structure is secured to the seabed using pin piles. Table 2.4 provides the maximum dimensions for the foundations.

Vineyard Mid-Atlantic will include a maximum of two ESP(s) in the Lease Area. The ESP(s) may be located at any WTG/ESP position (see Figure 2.1).

Table 2.4: ESP Maximum Foundation Dimensions

Concept	Monopile	Piled Jacket
Maximum No. of legs	N/A	6
Maximum No. of piles	1	12
Maximum Total Length (from interface with topside to deepest point beneath the seafloor)	413 ft (126 m)	528 ft (161m)
Maximum Pile Diameter	43 ft (13 m)	14 ft (4.25 m)
Maximum Height of Foundation above MLLW	115 ft (35 m)	115 ft (35 m)
Maximum Diameter/Dimensions of Foundation at the Waterline	38 ft (11.5 m)[1]	558 ft x 279 ft (170 m x 85 m) On diagonal: 624 ft (190 m)
Maximum Diameter/Dimensions of Foundation at the Seabed	43 ft (13 m)	558 ft x 279 ft (170 m x 85 m) On diagonal: 624 ft (190 m)
Maximum Area of Scour Protection (includes footprint, mudmats [if used], and seafloor preparation)	1.8-2.9 acres (7,238-11,660 m^2)[2]	8.1 acres (32,577 m^2)

1. *The transition piece/extended monopile diameter at the waterline does not include any ancillary structures such as boat landing(s) and work platforms. Ancillary structures may extend up to 5 m (16 ft) from the outer edge of the transition piece/extended monopile in any direction.*
2. *A range of the maximum area of scour protection is provided as detailed engineering of the foundations is ongoing. Feedback from New York Bight recreational fisherman indicated they are supportive of extending scour protection around the foundations because it provides additional structured habitat for fish.*

2.4 Offshore Export Cable Corridor

Between the Lease Area and shore the offshore export cables will be installed within an Offshore Export Cable Corridor. Up to six HVAC cables, two HVDC cable bundles, or a combination of up to six HVAC cables/HVDC cable bundles will be installed within the OECC. The OECC extends from the northern end of the Lease Area, travels west along the boundary of neighboring Lease Area OCS-A 0512, and then proceeds northwest across the Ambrose to Nantucket and Nantucket to Ambrose Traffic Lanes towards the southern shore of Long Island, New York. As the OECC approaches shore, it splits into three variations to connect to three potential landfall sites: the Rockaway Beach Landfall Site, the Atlantic Beach Landfall Site, and the Jones Beach Landfall Site. The Proponent has also identified a “Western Landfall Sites OECC Variant” that may be used for routing offshore export cables to the Rockaway Beach and Atlantic Beach Landfall Sites.

2.5 Traffic Survey

A comprehensive traffic survey was carried out by means of the following data sources: (1) stakeholder and agency input; (2) AIS data analyses; and (3) National Oceanic Atmospheric Administration (NOAA) VMS data mapping. The results of the traffic survey are presented in the following report subsections, and more detailed summaries and mapping may also be found in Appendix B and Appendix C.

Key observations with regards to the AIS data are that fishing vessels are responsible for 52% of the traffic in the Lease Area, and the largest vessel passing through the Lease Area is a cargo vessel with a length overall (LOA) of 1,204 ft (366.9 m). Of the known vessel types, recreational vessels are responsible for the next greatest number of unique tracks, or 26% of the traffic in the Lease Area. For the OECC, the average crossing rate for all vessels is 10.7 crossings per day, varying between 0.4 and 3.7 crossings per day for different vessel types based on AIS data from July 2017 to June 2022 (see Table B.14 and Table B.15).

2.5.1 Stakeholder Consultations

Vineyard Mid-Atlantic is being developed by the same team that developed Vineyard Wind 1, the nation’s first and most advanced commercial-scale offshore wind project, and Vineyard Northeast. The Proponent has presented its planned configuration to USCG, other agencies, and maritime stakeholders. Vineyard Mid-Atlantic held a meeting in January 2024 with maritime stakeholders to present the NSRA approach and traffic survey data for the Offshore Development Area and receive feedback. Seven organizations (8 participants) including the Port Authority of NY/NJ and maritime industry associations and companies attended. Vineyard Mid-Atlantic modified and refined the OECC through numerous consultations with agencies, including USCG, fishermen and other stakeholders, and based on their feedback, consolidated the offshore export cables with other developers’ proposed cables to the extent feasible. Vineyard Mid-Atlantic plans to continue outreach activities through participation in future NY Harbor Safety Committee meetings and other venues.

The Proponent employs a Marine Liaison Officer who is responsible for safe marine operations and ensuring that the Proponent is a good neighbor while on the water. The Marine Liaison Officer currently serves as the Proponent’s point of contact for all external maritime agencies, partners, and stakeholders, including USCG, US Navy, port authorities, state and local law enforcement, and commercial operators (e.g., ferry, tourist vessels, and other offshore wind developers). The Marine Liaison Officer is also a member of NYSERDA’s Maritime Technical Working Group (M-TWG). There is frequent interaction, information exchange, and coordination between the Marine Liaison Officer and the fisheries team regarding fisheries outreach (see Section 2.5.1.1 for further discussion of fisheries outreach).

The Marine Liaison Officer is responsible for coordinating and issuing Offshore Wind Mariner Updates to notify maritime stakeholders of the Proponent’s offshore activities. The Offshore Wind Mariner Updates include a description of the planned activity, pictures of the vessel(s) and equipment to be deployed, a chart showing the location of the activity, vessel contact information, and the Proponent’s OFL’s contact information (if applicable). Depending on the activity, the Offshore Wind Mariner Update may request that mariners give a wide berth to the work site or construction and maintenance vessel(s). These updates are published on the Proponent’s website, social media channels, and sent via email and SMS text alert to those who have opted-in to receive notifications from the Proponent. To help mariners and fishermen keep track of the various notifications that they receive, the Proponent distributes a weekly email to consolidate and recirculate active

Offshore Wind Mariner Updates. The Proponent will also coordinate with the USCG to issue Notices to Mariners (NTMs) to notify recreational and commercial vessels of their planned offshore activities. To sign-up to receive Offshore Wind Mariner Updates and other Vineyard Mid-Atlantic-related information, visit:

https://www.vineyardoffshore.com/fisheries-544

During construction, the Proponent expects to employ a dedicated Marine Coordinator to manage construction vessel logistics and implement communication protocols with external vessels at ports and offshore. During construction, the Marine Coordinator will be the primary point of contact with external maritime agencies, partners, and stakeholders for day-to-day offshore operations. The Marine Coordinator will operate from a marine coordination center that will be established to control vessel movements throughout the Offshore Development Area. The Marine Coordinator will use tools such as radio communications and safety vessels to address vessels entering active work sites. The safety vessels would provide guidance to mariners and fishing vessels, explain the ongoing activities, and request that they give a wide berth to the work site or construction vessel(s), if necessary. These safety vessels would have no enforcement authority; the safety vessels would only assist mariners in navigating in the vicinity of the activity. The Proponent is also exploring options for conducting outreach with cargo vessel and tanker companies/operators, such as including project information in trade magazines and working with maritime pilot groups to obtain information about incoming vessels.

2.5.1.1 Outreach to Fisheries Stakeholders

The Proponent's team has over a decade of experience engaging with commercial and recreational fishermen, vessel owners, fishing advocacy organizations, shore support services, and fisheries research institutions. The Proponent has translated that experience to develop a robust fisheries communication strategy for Vineyard Mid-Atlantic. During the early planning stages of Vineyard Mid-Atlantic, particularly in relation to siting the OECC, the Proponent consulted with numerous fishermen. The Proponent will continue to engage with fisheries stakeholders throughout the development, construction, operations, and decommissioning of Vineyard Mid-Atlantic.

The Proponent has developed a Fisheries Communication Plan (FCP) to facilitate effective and regular engagement with fisheries stakeholders throughout the life of Vineyard Mid-Atlantic (see Appendix I-H of COP Volume I). The communication protocols outlined in the FCP are designed to help avoid interactions with fishing vessels and fishing gear. The FCP aligns with the Vineyard Wind 1 FCP, which was first drafted in 2011 to improve communication with fishermen during that offshore wind project and was subsequently refined with over 10 years of input from fisheries stakeholders. The Vineyard Mid-Atlantic FCP is periodically updated, in response to stakeholder feedback and to incorporate lessons learned, to ensure that the communication protocols and tools remain relevant and effective.

As described in the FCP, the Proponent's fisheries communication efforts are led by Fisheries Manager (FM) Crista Bank, a fisheries biologist with deep knowledge of fishing practices as well as an extensive network of personal relationships with fishermen and fishery organizations in the region. The fisheries team also includes a Fisheries Liaison (FL), Fisheries Representatives (FRs), Onboard Fisheries Liaisons (OFLs), and scout vessels. The FL is responsible for implementing the FCP and serves as a communication conduit between the Proponent and the fishing industry. FRs are individuals or organizations that represent a particular fishing community, organization, gear type, port, region, state, or sector(s). While FRs are compensated for their time and expenses by the Proponent, their duty is to the fishing region, industry, organization, gear type, or sector they represent. The Proponent engages with a network of FRs who represent a variety of gear types and homeports in Connecticut, Massachusetts, New York, and Rhode Island. The Proponent is also working closely with New Jersey-based fishermen. OFLs are experienced fishermen employed by the Proponent to assist geophysical and geotechnical survey vessel captains with communication and to document fishing gear in the area to help avoid interactions. Among other things, the OFL records observed fisheries activities, ensures survey vessel operations are compliant with the FCP and other fisheries-related policies, and seeks to avoid negative fisheries interactions by looking out for fixed gear and establishing communications with fishing vessels when appropriate. The Proponent also employs local fishing vessels to serve as scout vessels. The scout vessels work ahead of the geophysical and geotechnical survey vessels and report fixed gear locations back to the OFL to avoid any gear interaction. The scout vessel identifies fishermen actively working in the area so the FL can reach out to them with detailed survey vessel in formation throughout the remainder of the survey activity. Additional information about the roles of the FM, FL, FRs, OFLs, and scout vessels is provided in the FCP (see Appendix I-H of COP Volume I).

The Proponent maintains a webpage with information specifically for fishermen, including fisheries science information, charts, Offshore Wind Mariner Updates, and periodic information requests, which can be found at:

https://www.vineyardoffshore.com/fisheries-544

Fisheries communication is conducted through numerous other methods including email, SMS text message alerts, letter mailings, webinars, phone calls, meetings, and social media channels. When appropriate and weather permitting, the Proponent's FM and FL hold "port hours" at ports in Montauk, New York; New Bedford, Massachusetts; Narragansett, Rhode Island; and Stonington, Connecticut to provide information to fishermen who fish in or transit through the Offshore Development Area. These events are typically held jointly with FLs from other offshore wind developers to provide information to fishing vessel crews who fish in or transit through multiple lease areas. The Proponent also hosts information tables and attends regional trade shows and conferences for fishermen and mariners.

The Proponent is in regular contact with relevant federal and state agencies on fisheries-related matters. The Proponent also uses its membership and participation in fisheries-related technical working groups, advisory boards, councils, and commissions to provide project updates, better understand fisheries stakeholders' concerns, build relationships, and collaborate on research and education. The Proponent is a member of and/or actively participates in the following groups:

- Regional Wildlife Science Collaborative for Offshore Wind
- Responsible Offshore Science Alliance
- New York State Energy Research and Development Authority's (NYSERDA's) Environmental Technical Working Group (E-TWG)
- NYSERDA's Fisheries Technical Working Group (F-TWG)
- American Clean Power New York Bight Fisheries Working Group
- International Council for the Exploration of the Sea (member of Working Group on Offshore Wind Development and Fisheries)
- Massachusetts Fisheries Working Group on Offshore Wind Energy
- Massachusetts Habitat Working Group on Offshore Wind Energy
- Mid-Atlantic Fishery Management Council
- New England Fishery Management Council

2.5.2 AIS Based Traffic Survey

AIS data was downloaded and processed for the time period of July 1, 2017, to June 30, 2022, from NOAA's Marine Cadastre dataset. A regional subset of the data was extracted for longitudes between 71.85° W to 75.24° W and latitudes between 38.79° N to 40.69° N. In total, there are 1,230,997 track records within the regional subset and a total of 18,226 unique vessels in the data set. Table 2.5 provides a summary of all unique vessels and unique fishing vessels by year over the AIS data period crossing the Lease Area.

Table 2.5: Summary of AIS Dataset Analyzed (Data Source: Marine Cadastre)

Parameter	2017	2018	2019	2020	2021	2022	July 2017-June 2022
Number of Unique Vessels	191	247	298	320	315	150	1,195
Number of Unique Fishing Vessels	63	65	80	137	73	24	251
Number of Unique Recreational Vessels	74	100	117	103	156	63	530

***Note that the number of unique vessels for a given year as compared to the total number of unique vessels per 2017-2022 will not add up to the same number since the same vessel may frequent the area in different years.*

Figure 2.3 presents a colored contour map of the annual average traffic density within the regional subset area for all vessel types. Table 2.6 provides a breakdown of the vessel traffic types passing through the Lease Area. Over half of the tracks in the Lease Area are from commercial fishing vessels, which also contributes to just under a fourth of the unique vessels. A distinction is made between fishing vessels that are transiting and actively fishing based on vessel speed inside the Lease Area. Any fishing vessel track that intersects with the Lease Area and has pings inside the Lease Area that are more than 4 kts (2.1 m/s) is assumed to be transiting and not actively fishing.

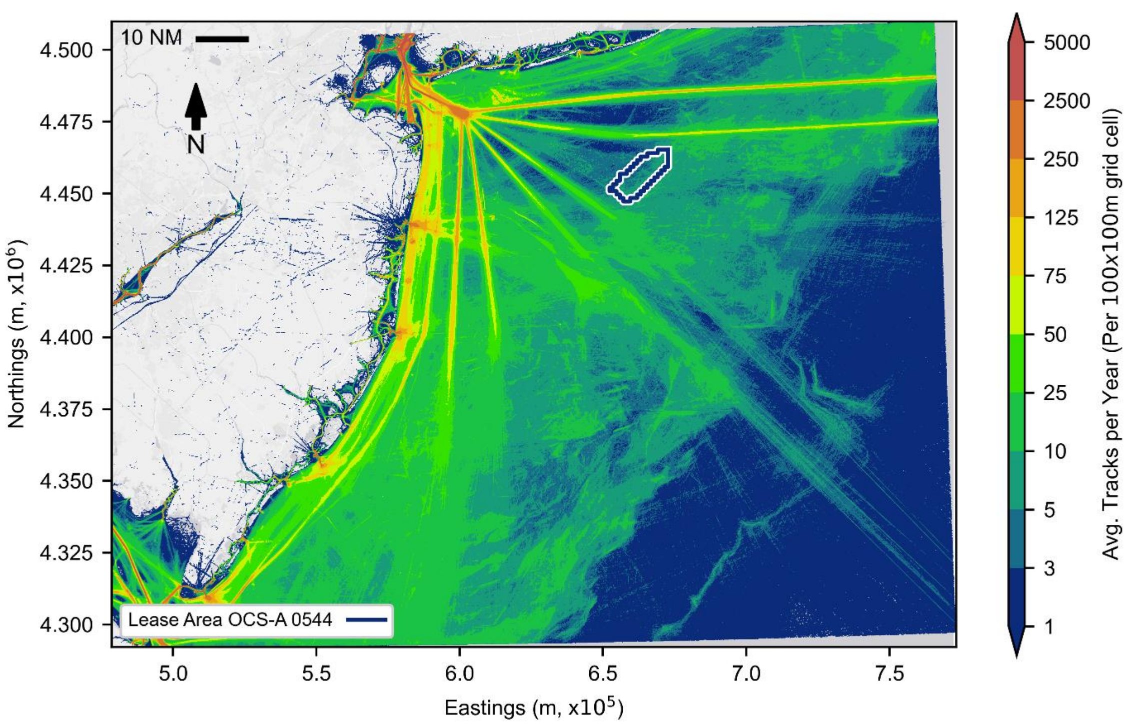


Figure 2.3: Annual Average Vessel Traffic Density for AIS-equipped Vessels

Table 2.6: Numbers of Vessels Entering the Lease Area (July 2017 to June 2022)

	Unique Vessels		Unique Tracks	
	Number	Percentage	Number	Percentage
Cargo Vessels	163	14%	208	7%
Tankers	127	11%	148	5%
Passenger Vessels	19	2%	42	1%
Tug Tow Vessels	43	4%	74	3%
Military Vessels	0	0%	0	0%
Recreational Vessels	530	44%	733	26%
Fishing Vessels, All[1]	251	21%	1,480	52%
Fishing Vessels, In Transit [1]	209	17%	961	34%
Fishing Vessels, Fishing [1]	125	10%	519	18%
Other Vessels	62	5%	155	5%
Total (July 2017–June 2022)	1,195	100%	2,840	100%
Annual Average	304[2]	-	568	-

1. *Any track that intersects with the Lease Area and has pings inside the Lease Area that are less than 4 knots (2.1 m/s) is considered actively fishing.*
2. *The number of unique vessels in each year is determined, summed, and divided by the total number of years used in the analysis (five years).*

It is important to recognize that AIS is only required on commercial vessels 65 ft (20 m) and longer, and as a result, not all vessels, particularly recreational and smaller fishing vessels, are equipped with AIS equipment. If there are any other smaller non-fishing commercial vessels that are not AIS-equipped, the number of these vessels is likely very small and would not impact on the vessel traffic analyses presented in this report. Additionally, many recreational vessels do not carry AIS equipment.

Although AIS data may not include the total number of vessels that could potentially transit the AIS analysis area, it is believed to provide a suitable representation of the overall fleet distribution and traffic patterns in terms of track density and orientation.

The following subsections provide a more detailed review of the different types of vessel traffic encountered at the Lease Area and OECC. Additional details are presented in Appendix B.

2.5.2.1 Commercial (Non-Fishing) Traffic

On average, approximately 77 unique commercial vessels transit through the Lease Area annually. These include passenger vessels, cargo vessels, tankers, and tug--tow vessels. Cumulatively, these vessels represent about 17% of the vessel traffic tracks transiting through the Lease Area. Figure 2.4 presents the track density plots for these vessels in the region. It is noted that much of the traffic is in fairways to the south and north of the Lease Area. Table 2.7 summarizes the largest vessels that have transited through the Lease Area over the 2017 to 2022 period.

Table 2.7: Size of Largest Vessels Through the Lease Area for Each Vessel Class

Vessel Type	Name	LOA (ft)	LOA (m)
Passenger	NORWEGIAN DAWN	964.7	294.0
Dry Cargo	GRETE MAERSK	1203.8	366.9
Tanker	SK SUMMIT	908.8	277.0
Other	CHARLTON	289.6	105.9
Tug Tows	VOS STAR	201.7	61.5

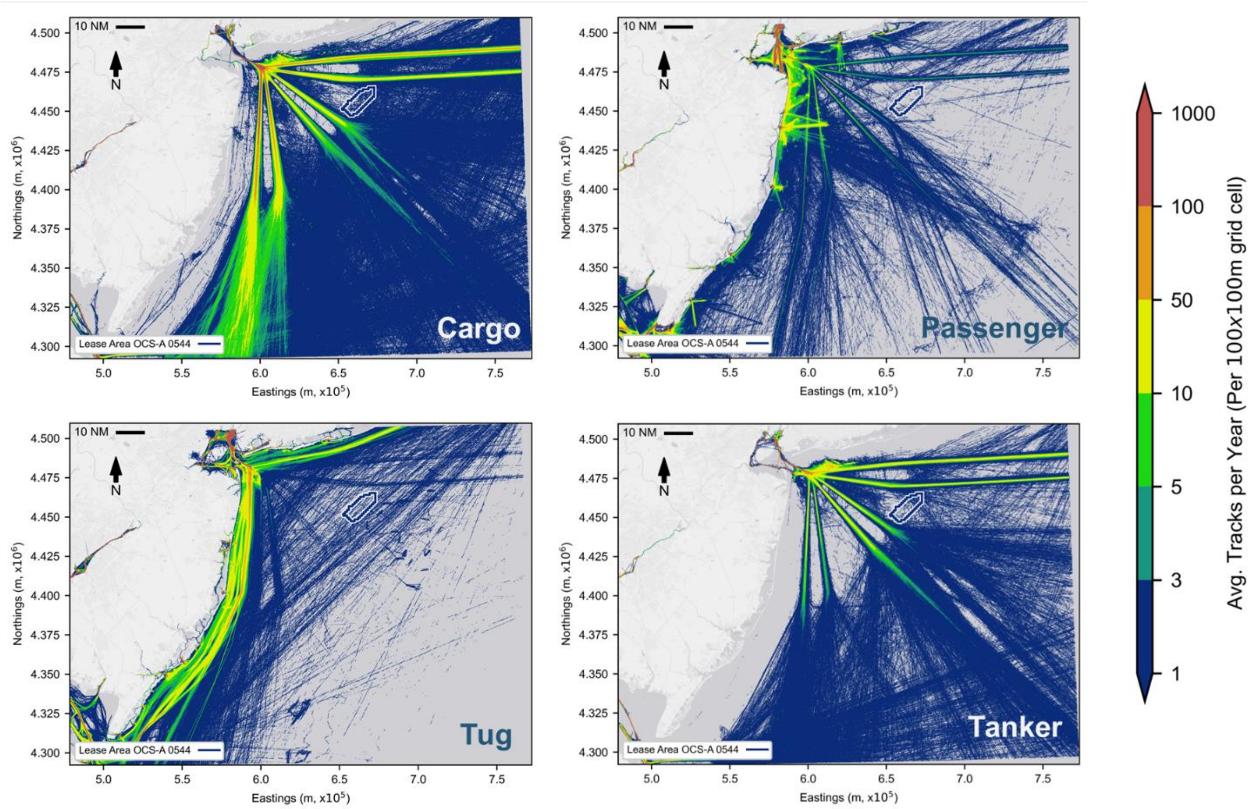


Figure 2.4: Commercial (Non-Fishing) Vessel Average Annual Traffic Densities

2.5.2.2 Commercial Fishing Traffic

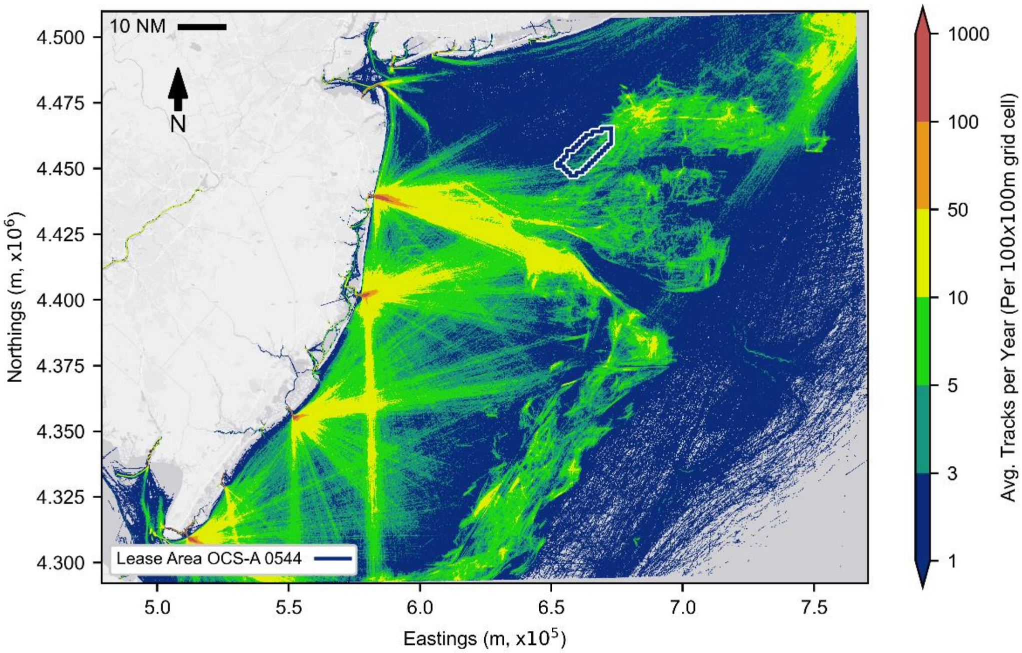
Commercial fishing vessels make up just under a fourth of unique vessels (21%) and over half (52%) of the tracks passing through the Lease Area. Vessels transit through the AIS analysis area on a variety of courses but the dominant track orientation historically has been a west to east course, and the reciprocal course for return trips. Figure 2.5 provides track plots for fishing vessels when transiting and actively fishing.

Fishing activity does vary seasonally with a greater number of vessel tracks during the summer months as summarized in Table 2.8. Overall, vessel activity is relatively low with only one fishing vessel entering the Lease Area per day (on average) during the peak summer months.

Table 2.8: Average Number of AIS Fishing Tracks Per Day in the Lease Area Based on Season (July 2017 to June 2022)

Vessel Activity	Meteorological Season			
	Winter	Spring	Summer	Autumn
Active Fishing	0.1	0.2	0.3	0.5
Transiting	0.4	0.5	0.8	0.5
All Vessels	0.5	0.6	1.0	1.0

Figure 2.5 provides average annual track density plots for fishing vessels in the regional subset when transiting and actively fishing.



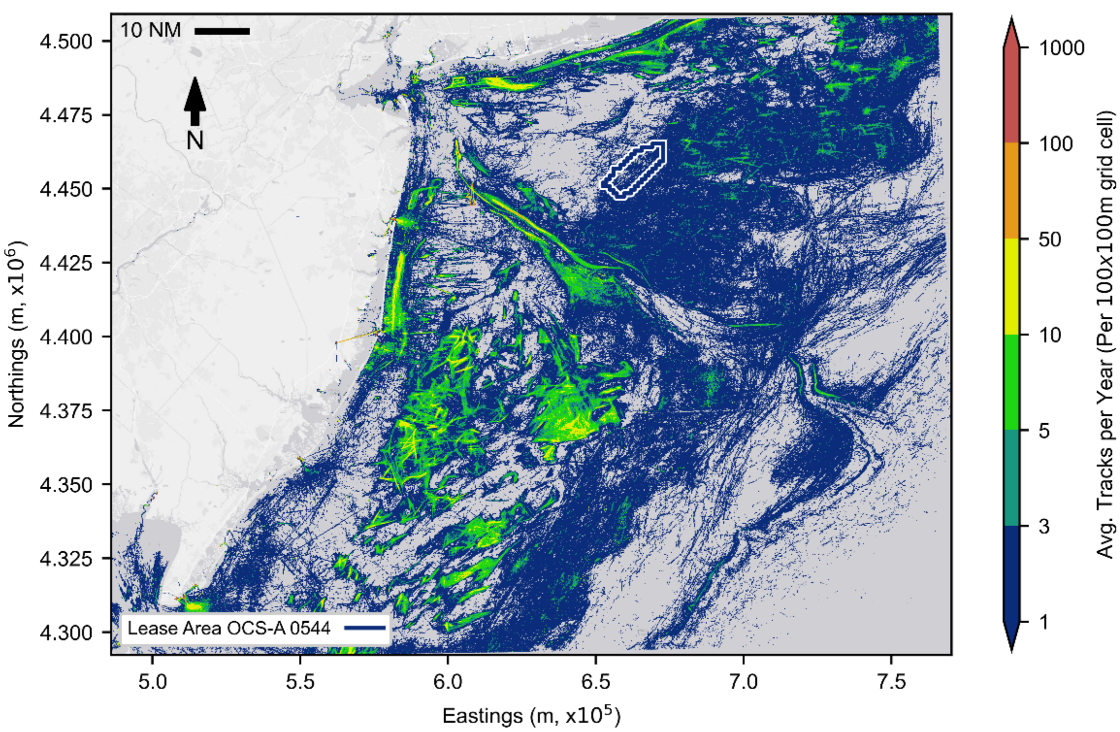


Figure 2.5: Transiting (top) and Actively Fishing (bottom) Vessel Average Annual Traffic Densities

2.5.2.3 Recreational Traffic

Approximately 26% of the AIS-equipped vessel traffic in the Lease Area is associated with recreational traffic. As noted previously, it is likely that this traffic volume is under-represented in the AIS dataset as vessels smaller than 65 ft in length are not required to utilize AIS equipment. Figure 2.6 shows the recreational annual average track density of the AIS regional dataset. These vessels have a range of track directions, with the dominant courses within the Lease Area being northeast and southwest.

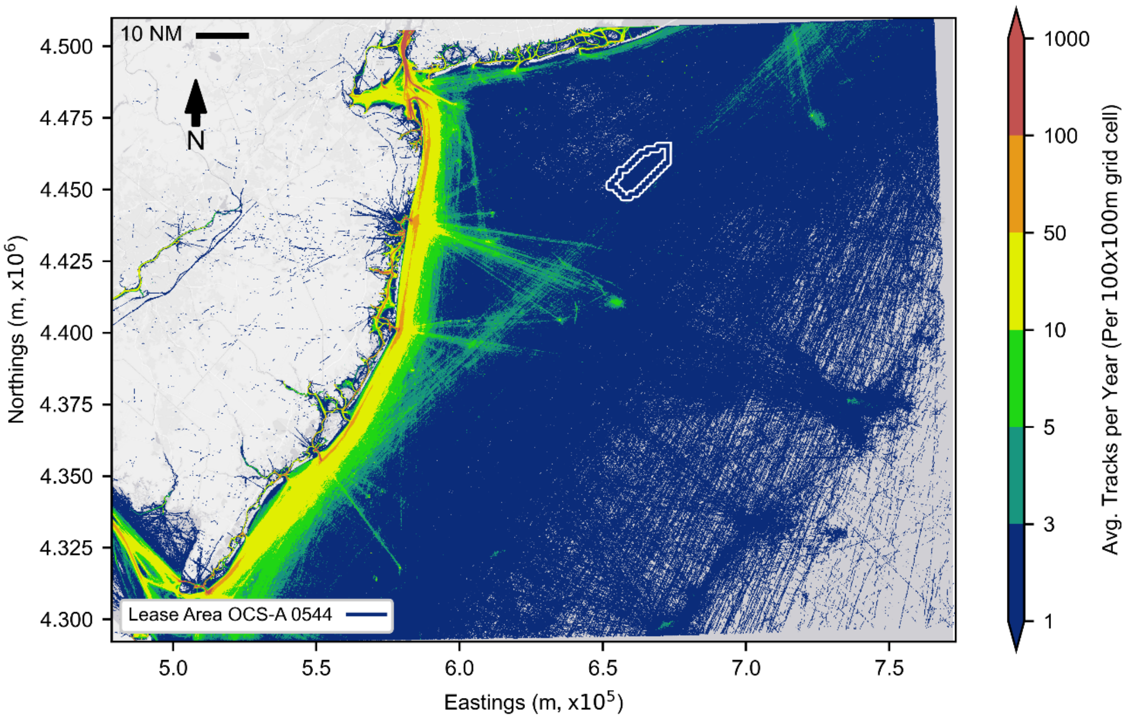


Figure 2.6: Recreational Vessel Average Annual Traffic Densities

2.5.2.4 Offshore Export Cable Corridor (OECC)

An AIS analysis was carried out to assess the number of vessels crossing the OECC. The annual average track density for the OECC is shown in Figure 2.7. For the OECC, the average crossing rate for all vessels is 10.7 crossings per day, varying between 0.4 and 3.7 crossings per day for different vessel types. Cargo vessels are responsible for the most crossings across the OECC, making up 34% of all crossings in the five-year period. Fishing, passenger, and recreational vessel classes experience clear seasonality in vessel traffic volumes and increase in summer; however, cargo vessels remain responsible for the most crossings across the OECC in the summer months, making up 28% of all summer crossings.

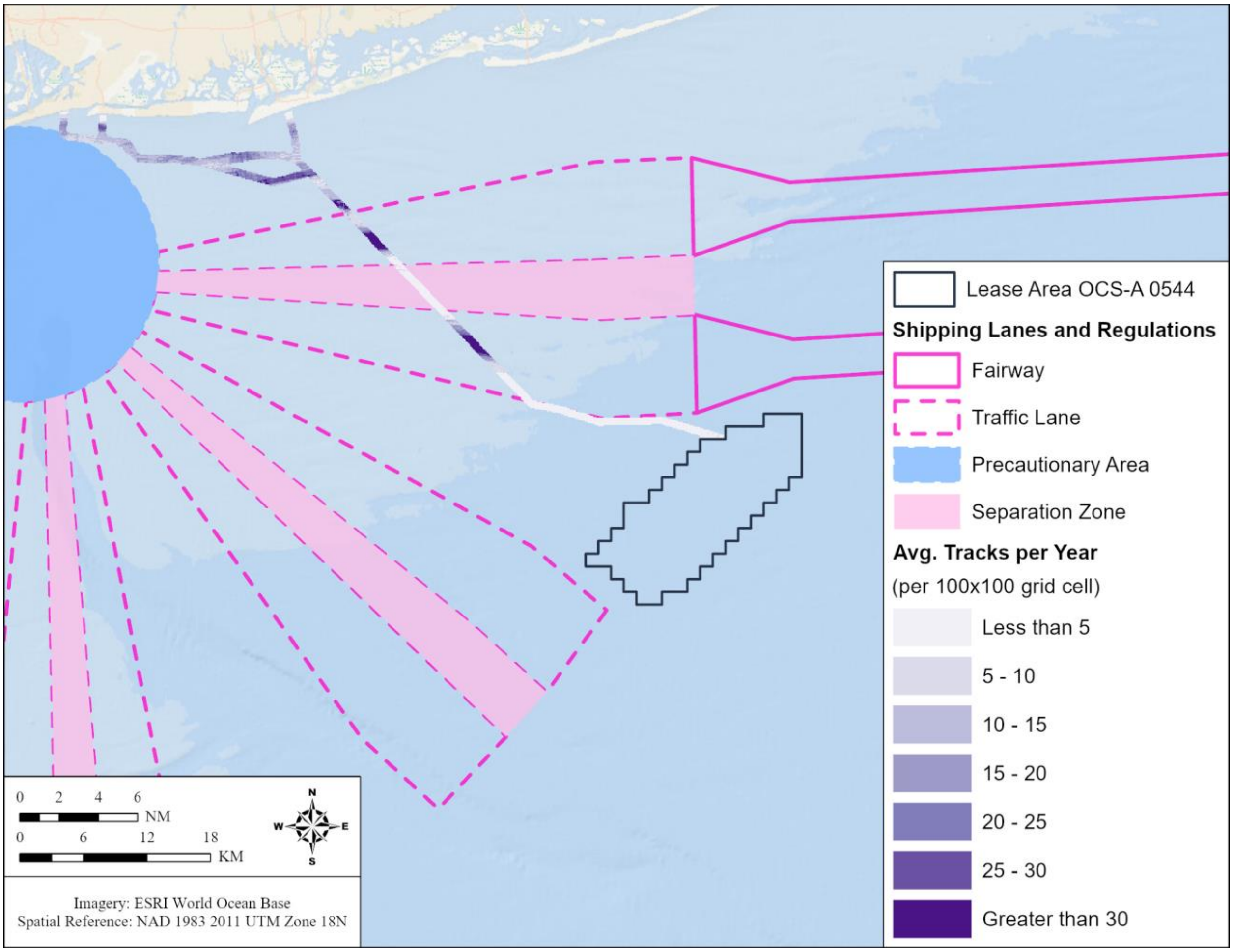


Figure 2.7: Annual Average Track Densities for Vessels Crossing the Offshore Export Cable Corridor

2.5.3 VMS Traffic Analysis

The AIS data for fishing vessels is supplemented with a review of NOAA Fisheries' VMS data. VMS is a satellite surveillance system primarily used to monitor the location and movement of certain commercial fishing vessels fishing for certain species (i.e., not all fishing vessels are included) within the US. Unlike the AIS dataset, it provides a description of fishing activities for regulated commercial fisheries. The system uses satellite-based communications from onboard transceiver units, which certain vessels are required to carry. The transceiver units send position reports that include vessel identification, time, date, and location, and are mapped and displayed at NOAA Fisheries. The system is used to support fisheries law enforcement initiatives and to prevent violations of laws and regulations.

The raw VMS data were not available due to privacy constraints, but GIS mapping of the resultant analyses of fishing traffic density are provided. Appendix C provides density maps for several fish species for the 2015 to 2016 time period (which breaks down density by active fishing versus transiting based on speed) as well as 2015 to 2019 time period (which does not break down active fishing versus transiting), including:

- Herring
- Monkfish

- Multispecies (Northeast)
- Pelagics (Mackerel, Squid, Butterfish)
- Atlantic Sea Scallop
- Surfclam/Ocean Quahog
- Squid (VMS plots only)

In addition, BOEM has extracted and processed raw VMS data for the Lease Area. In the VMS dataset, vessel speed is used to distinguish vessels that are actively fishing as opposed to transiting. For most species, vessels sailing at less than 4 kts (2.1 m/s) are considered fishing, but for scallop fishing, the vessel speed is assumed less than 5 kts (2.6 m/s). Thus, density maps for both actively fishing and all vessel speeds are present for the various species in Appendix C.

Additionally, NOAA Fisheries collects fishery data by means of Vessel Trip Reports (VTRs) in which commercial fishing vessels report the details of each individual trip including vessel details, type of gear used, location, and type of catch. These data have been analyzed and mapped by NOAA Fisheries and are available online as GIS map files broken out by type of fishing activity and time period. VTR maps for the Lease Area are also provided in Appendix C. Figure 2.8 provides an example density plot for Monkfish fishing while actively fishing and Figure 2.9 shows a density plot for movement of scallop vessels at all speeds. These plots are generally consistent with what was observed for fishing activity in the AIS dataset.

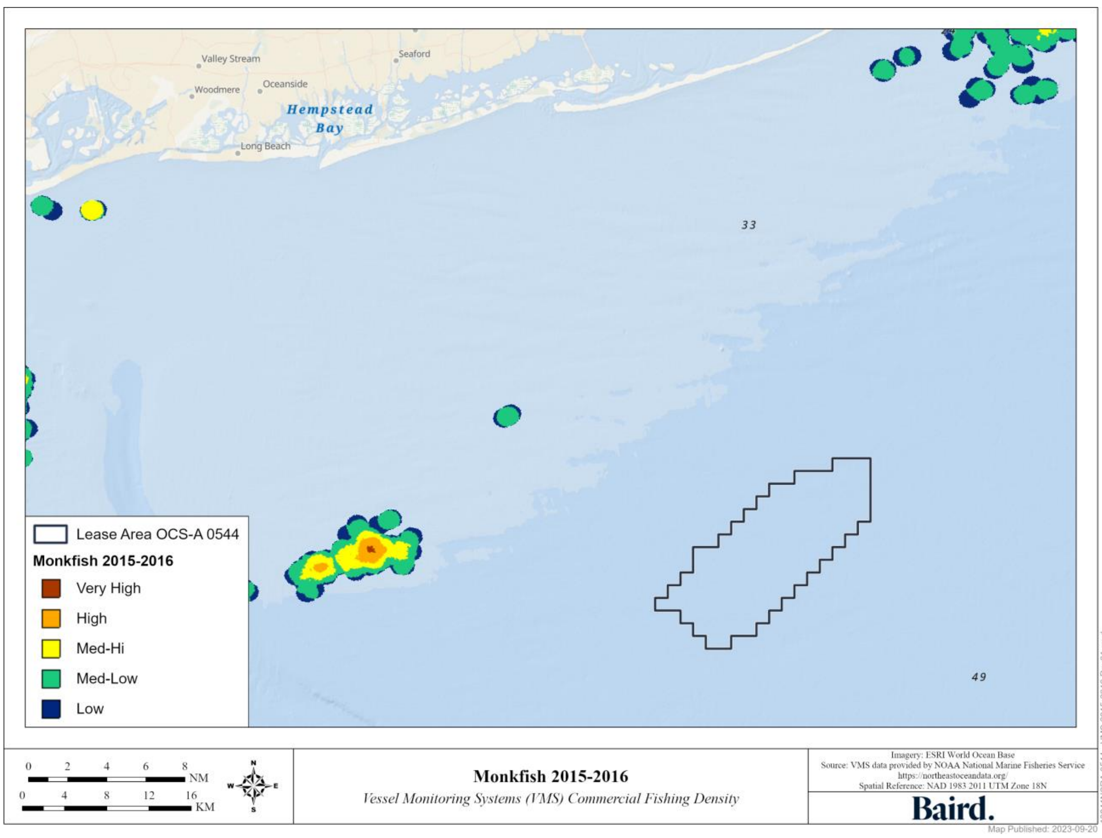


Figure 2.8: VMS Map of Active Monkfish Fishing for the 2015-2016 Time Period

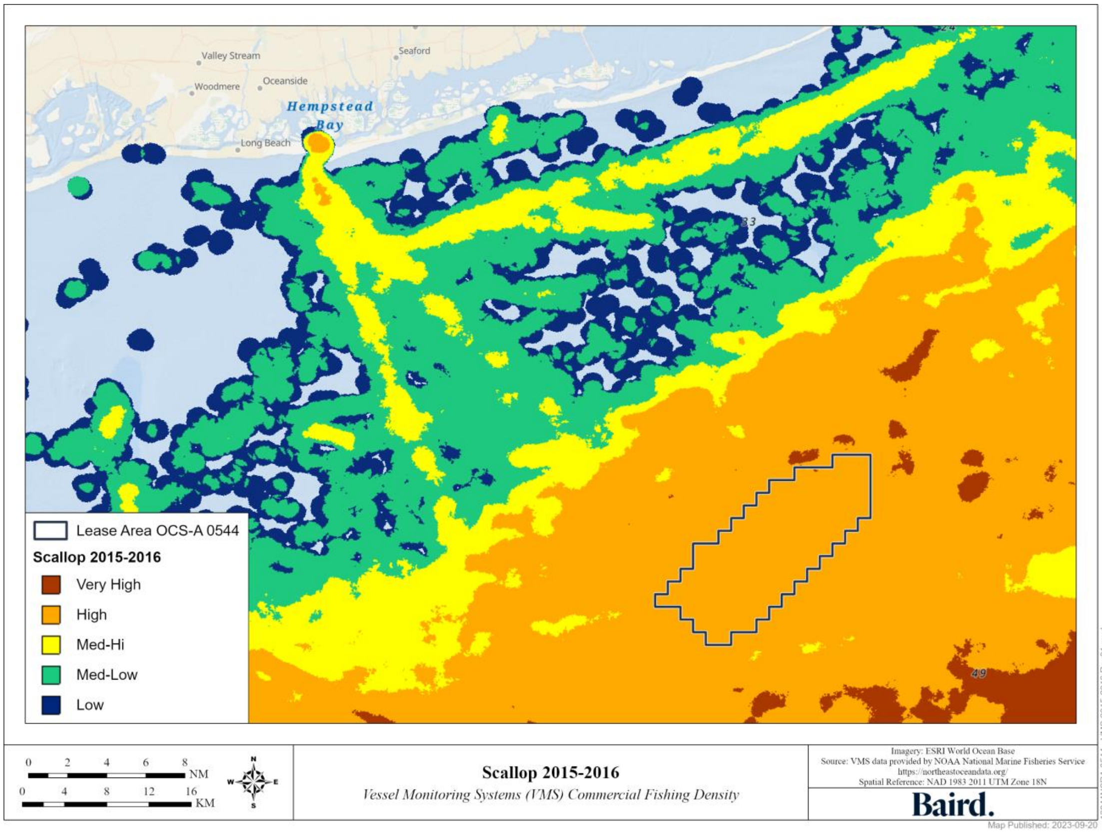


Figure 2.9: VMS Map of Atlantic Sea Scallop Fishing at All Speeds for the 2015-2016 Time Period

2.5.4 Existing and Proposed Navigation Features

At its closest point, the Lease Area is just over 37 NM (69 km) east from the coast of New Jersey near Neptune City, and approximately 20.5 NM (38 km) south of Fire Island, New York. The waterway characteristics for this area are described in USCG Coast Pilot Vol. 2 Cape Cod to Sandy Hook and Vol 3. Sandy Hook to Cape Henry. The location of the Lease Area in relation to the NOAA nautical charts is shown in Figure 2.10 and Figure 2.11.

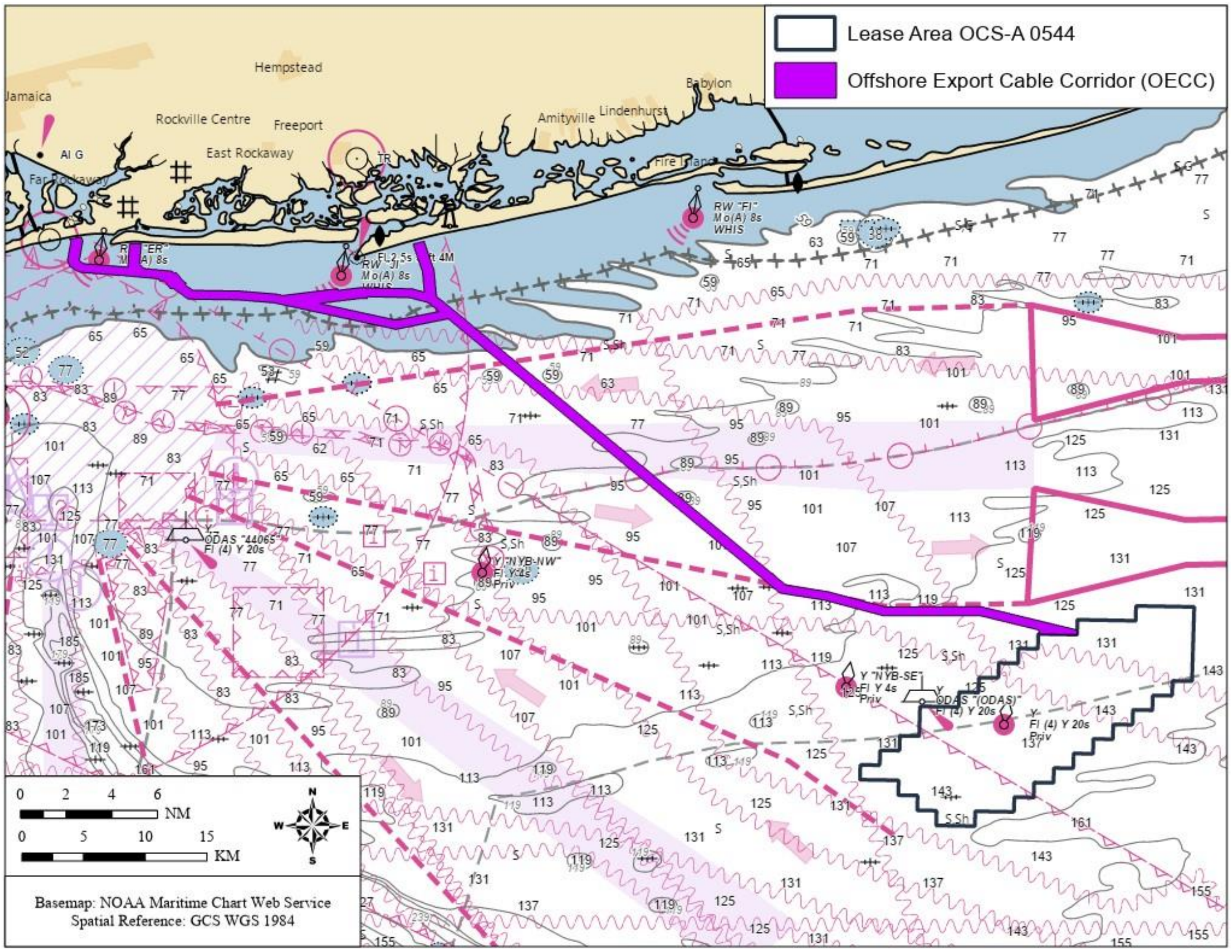


Figure 2.10: Location of Vineyard Mid-Atlantic Shown in NOAA Maritime Chart Web Service Map

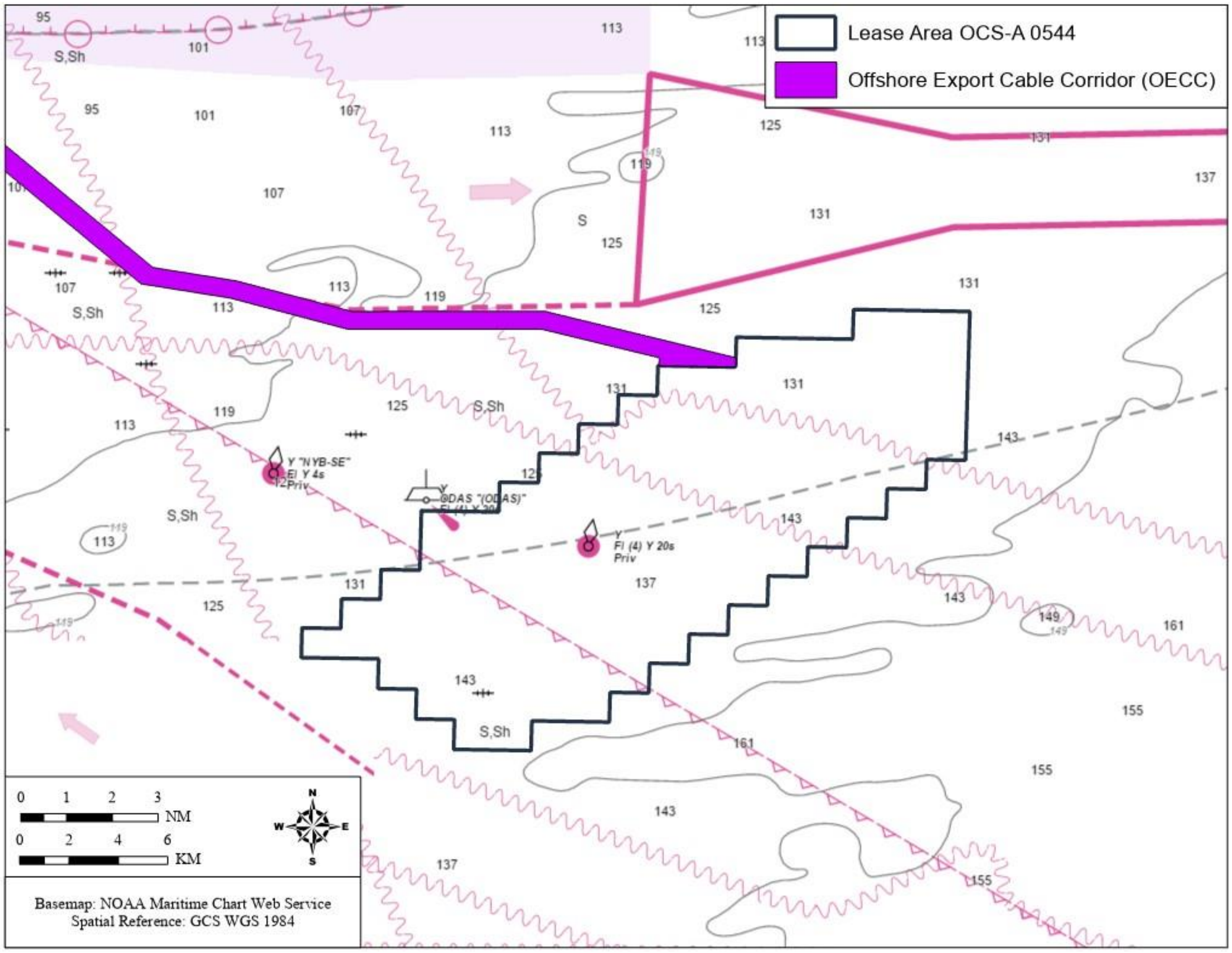


Figure 2.11: Closer View of the Lease Area Location

2.5.4.1 Existing Aids to Navigation

Aids to navigation including Federal ATONs are located throughout the Offshore Development Area. These aids to navigation serve as visual and audible references to support safe maritime navigation and consist of buoys, lights, sound horns, and onshore lighthouses. Federal ATONs are developed, operated, and maintained or regulated by the USCG to assist mariners in determining their position, identify safe courses, and warn of dangers and obstructions. ATONs are marked on the NOAA nautical charts.

Federal ATONs are located in the vicinity of the Lease Area and OECC, and there is one PATON showing within the vicinity of the Lease Area and OECC (Figure 2.12). This is the Vineyard Mid-Atlantic met buoy. The closest Federal ATON to the Lease Area is the NOAA Data Lighted Buoy 44025 located right along the northwest boundary of the Lease Area. The closest lighthouse to the Lease Area is the Fire Island Lighthouse. The lighthouse is 21 NM (38.9 km) northwest from the Lease Area. The lighthouse has a height of 167 ft and a nominal 24 NM visibility. The lighthouse would be nominally visible from the northernmost approximately 3 NM (5.6 km) of the Lease Area.

USCG recommends a 500m Minimum Safe Distance (MSD) between an OECC and federal ATONs. There are no federal ATONs or PATONs within the OECC; there is only one ATON within 1,640 ft (500 m) from the edge of the OECC. As the OECC approaches shore, it splits into three variations to connect to three potential landfall sites (of which, up to two will be used): the “Jones Beach Approach” of the OECC connects to the Jones Beach Landfall Site, the “Atlantic Beach Approach” connects to the Atlantic Beach Landfall Site, and the “Rockaway Beach Approach” connects to the Rockaway Beach Landfall Site. For the “Rockaway Beach Approach” of the OECC, one ATON is located within 1,640 ft (500 m) of the OECC. Using any of the other approaches, no ATONs are within the 1,640 ft (500 m) buffer. Aids to navigation in proximity to the OECC (distance relative to the edge of the OECC) are summarized in Table 2.9 and shown in Figure 2.12.

The Proponent will engage with the USCG early in the permitting process and coordinate closely to address ATONs in proximity to or within the OECC. These ATONs will be avoided through micro-siting the offshore export cables (within the OECC) around the ATONs in accordance with the following MSD equation provided through consultation with USCG[7] (the specific inputs for each ATON would be obtained from USCG):

> MSD ≥ Position Tolerance (PT) + Chain Length (CL) + Length of Servicing Vessel (LSV) (+ shoaling consideration)

ATONs within approximately 4,920 ft (1,500 m) from the landfall sites may be avoided through the use of horizontal directional drilling (HDD), subject to further detailed engineering; however, at present there are no ATONs which are within 4,920 ft (1,500 m) from a landfall site.

[7] The MSD equation was provided to the Proponent by the USCG during a call with USCG and BOEM on February 10, 2023.

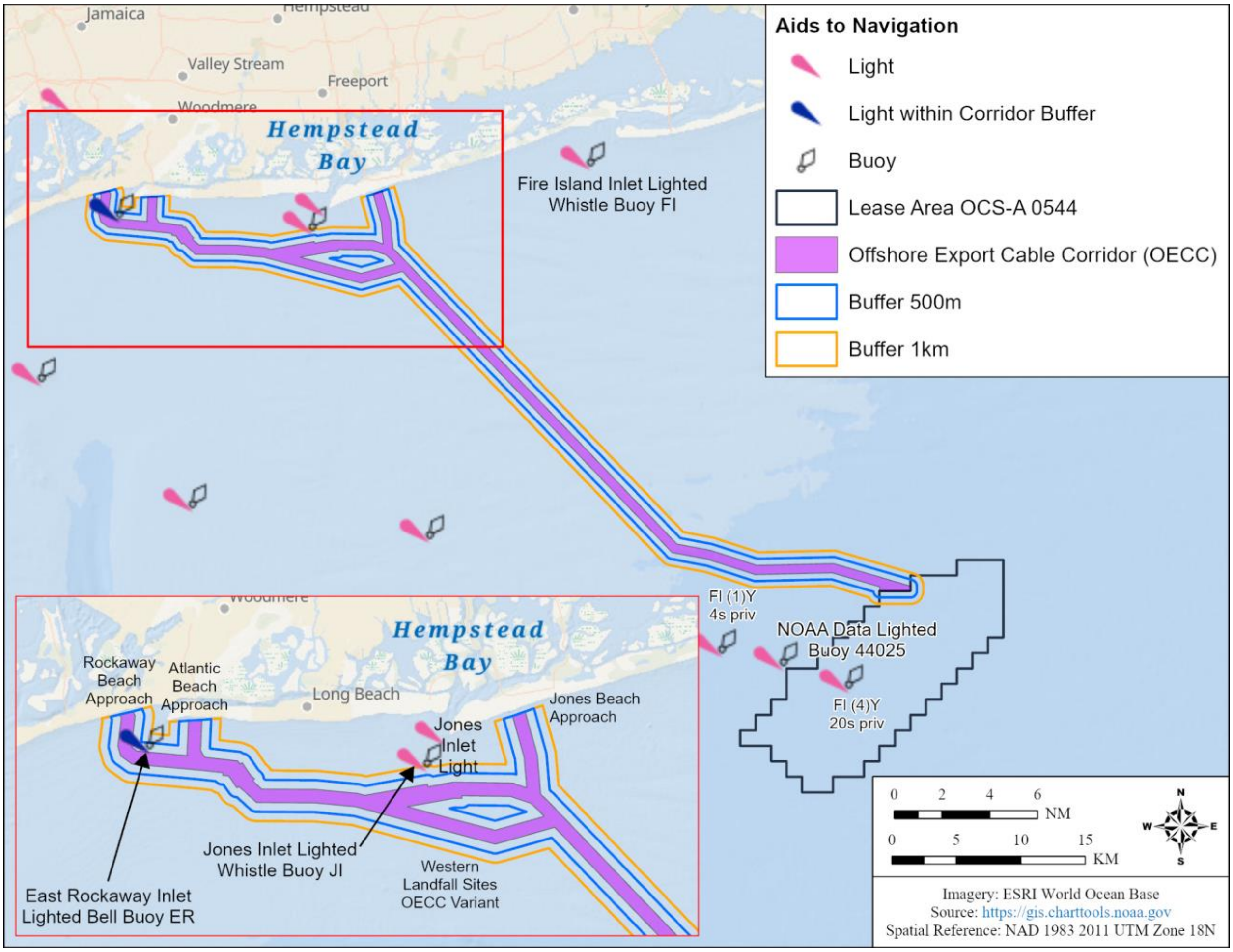


Figure 2.12: ATONs and PATONs in Proximity to the Lease Area and OECC

Table 2.9: ATONs and PATONs Within 1,640 ft (500 m) of the OECC (Distance Relative to Edge of OECC)

Aid to Navigation Name	USCG Light List Number	Description	Distance from OECC Edge
Rockaway Beach Approach of the OECC			
1 East Rockaway Inlet Lighted Bell Buoy ER	31495	Red and white stripes with red spherical topmark	1,125 ft (343 m)

2.5.4.2 Proximity to Transit Routes

Precautionary areas are defined areas where vessels must exercise particular caution and should follow the recommended direction of traffic flow. Implementing a TSS is one of several routing measures adopted by the International Maritime Organization (IMO) to facilitate safe navigation in areas where dense, congested, and/or converging vessel traffic may occur, or where navigation (particularly for deep-draft vessels) is constrained. A TSS separates opposing streams of vessel traffic by creating separate unidirectional traffic lanes and is typically designed to safely guide commercial vessels transiting to and from major ports. A TSS is not necessarily marked by an ATON, but it is marked on NOAA nautical charts. Fairways are corridors in which no artificial islands or fixed structures (temporary or permanent) are permitted. These are used so vessels will have unobstructed approaches to major US ports. While there are vessel routing measures in the vicinity of the Lease Area, there are no vessel routing measures within the Lease Area.

The Lease Area is in deep water with depths of approximately 130 to 155 ft (39.5 to 47.1 m). The navigation features near the Lease Area are depicted in Figure 2.13. Near the Lease Area, there are three TSS which lead to the Port of New York/New Jersey, all of which converge at a central precautionary area. The three TSS are:

- Nantucket/Ambrose TSS;
- Hudson Canyon/Ambrose TSS;
- Barnegat/Ambrose TSS.

The Lease Area is approximately 1.2 NM (2.2 km) south of the Ambrose to Nantucket Traffic Lane (eastbound TSS lane) with the nearest WTG position being 1.35 NM from the fairway and 1.45 NM from the end of the TSS, 1 NM (1.8 km) north of the Hudson Canyon to Ambrose Traffic Lane (northwest bound) with the nearest WTG position being 1.45 NM from the lateral boundary of the TSS, and 23.4 NM (43.4 km) east of the Barnegat to Ambrose Traffic Lane (northbound). The positions of WTGs and/or ESPs are consistent with the minimum spacing of 1 NM between a structure and a parallel boundary of an IMO routing measure as cited in the Marine Planning Guidelines (Enclosure 4 of NVIC 02-23 CH 1). The Marine Planning Guidelines also suggest a minimum separation distance of 5 NM (9.3 km) from a TSS entry/exit; however, the Guidelines are not prescriptive requirements, and the lease boundaries have been previously coordinated between USCG and BOEM prior to the lease sale.

Most of the vessels which transit in the Offshore Development Area but not through the Lease Area do so along the marked fairways and TSS. The Ambrose to Nantucket Traffic Lane (eastbound) lies approximately 1.2 NM (2.2 km) north of the northern boundary of the Lease Area. The Nantucket to Ambrose Traffic Lane (westbound) lies approximately 8.9 NM (16.5 km) north of the northern boundary of the Lease Area. Each traffic lane has a variable width with a minimum of 1 NM (1.8 km) and maximum of about 5 NM (9.3 km). The separation between eastbound and westbound lanes also varies from 6 NM (11 km) at the offshore end to 1 NM (1.8 km) at the entrance to the Port of New York/New Jersey.

The Hudson Canyon to Ambrose Traffic Lane (northwest bound) lies approximately 1 NM (1.8 km) south of the southern boundary of the Lease Area. The Ambrose to Hudson Canyon Traffic Lane (southeast bound) lies approximately 9.1 NM (16.9 km) south of the southern boundary of the Lease Area. Each traffic lane has a variable width with a minimum of 1 NM (1.8 km) and maximum of about 5 NM (9.3 km). The separation between northwest bound and southeast bound lanes also varies from 3 NM (5.6 km) at the offshore end to 1 NM (1.8 km) at the entrance to the Port of New York/New Jersey.

The Barnegat to Ambrose Traffic Lane (north bound) lies approximately 23.4 NM (43.4 km) west of the western boundary of the Lease Area. The Ambrose to Barnegat Traffic Lane (south bound) lies approximately 27.3 NM (50.6 km) west of the western boundary of the Lease Area. Each has a variable width with a minimum of 1 NM (1.8 km) and maximum of about 4.8 NM (9.0 km). The separation between northwest bound and southeast bound lanes also varies from 3 NM (5.6 km) at the offshore end to 1 NM (1.8 km) at the entrance to the Port of New York/New Jersey.

Commercial vessel traffic is described in Section 2.5.2.1. In general, large non-fishing commercial vessels do not frequently transit through the Lease Area and comprise approximately 22% of the traffic. The large non-fishing commercial vessels tend to transit outside of the Lease Area, either in the Nantucket/Ambrose TSS or in the Hudson Canyon/Ambrose TSS. Those that do travel through the Lease Area tend to do so after they exit the Ambrose to Nantucket Traffic Lane and head southeast.

Lastly, a pilot boarding area is located in the precautionary zone (Figure 2.13), which is required for registered US vessels and all foreign vessels.

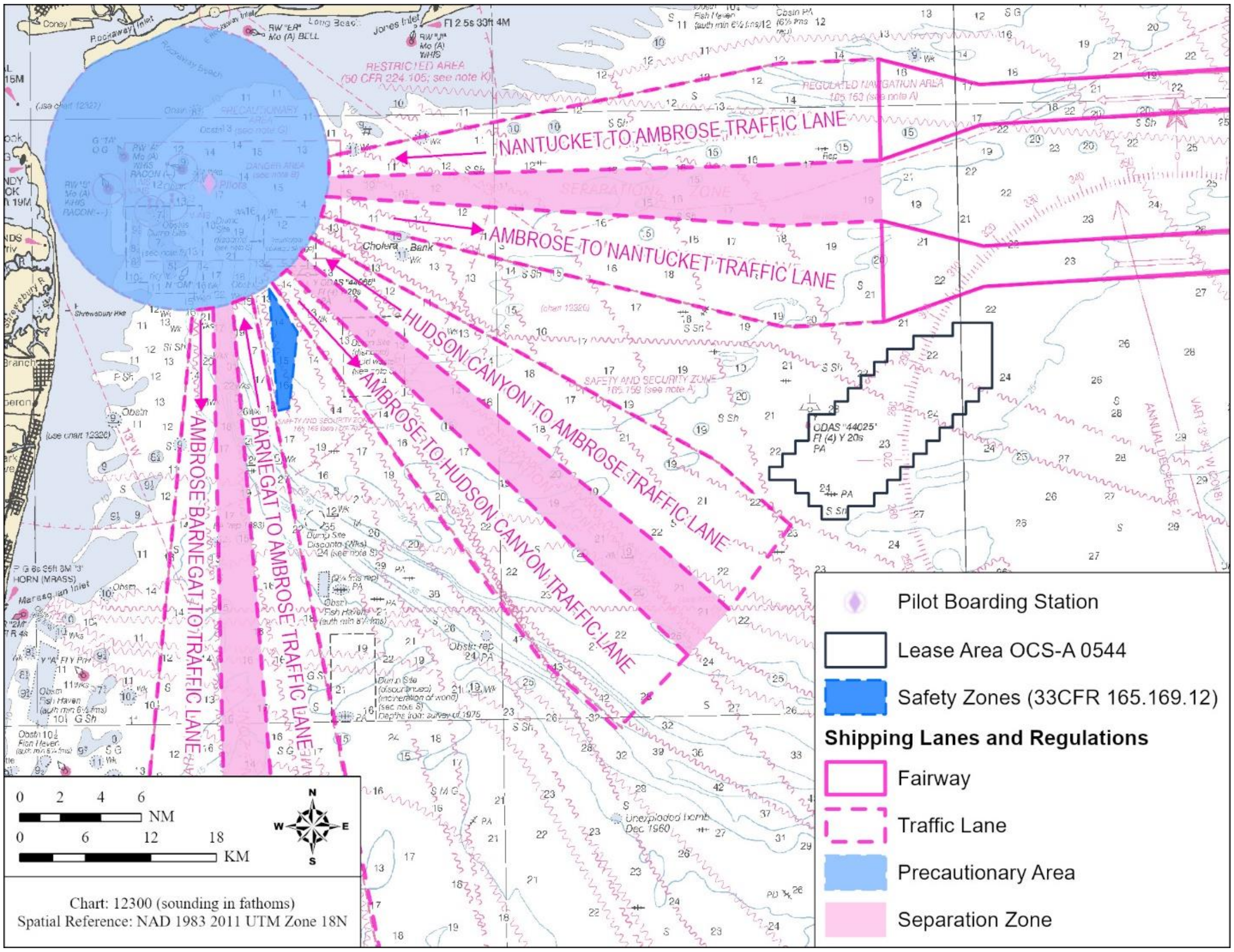


Figure 2.13: IMO Designated Routing Measures

The Northern New York Bight Port Access Route Study (NNYBPARS) (USCG, 2021c) included a recommended measure to combine the Nantucket to Ambrose Safety Fairway and Ambrose to Nantucket Safety Fairway into a single Nantucket to Ambrose Fairway with a total width of 13 NM (24 km) matching the width of the existing TSS (including the separation zone). The subsequent Consolidated Port Approaches and International Entry and Departure Transit Areas PARS (CPAPARS) (USCG, 2023a) modified this recommendation to keep the boundaries of the proposed combined fairway to the existing width of the two existing fairways and the space between them, for a total width of 10 NM (18.5 km). This modification of the NNYBPARS was recommended to ensure there is sufficient room for safe navigation (USCG, 2023a). As a result, the Lease Area maintains a distance of approximately 1.2 NM (2.2km) from the boundary of the Nantucket to Ambrose Fairway. In addition, the NNYBPARS (USCG, 2021b) included a recommendation to modify the Barnegat to Narragansett Fairway to reconcile conflicts with Lease Areas OCS-A 0544 and OCS-A 0549. The northern boundary of the proposed Barnegat to Narragansett Fairway is directly south of the southern boundary of the Lease Area. Figure 2.14 shows the proposed changes associated with the CPAPARS.

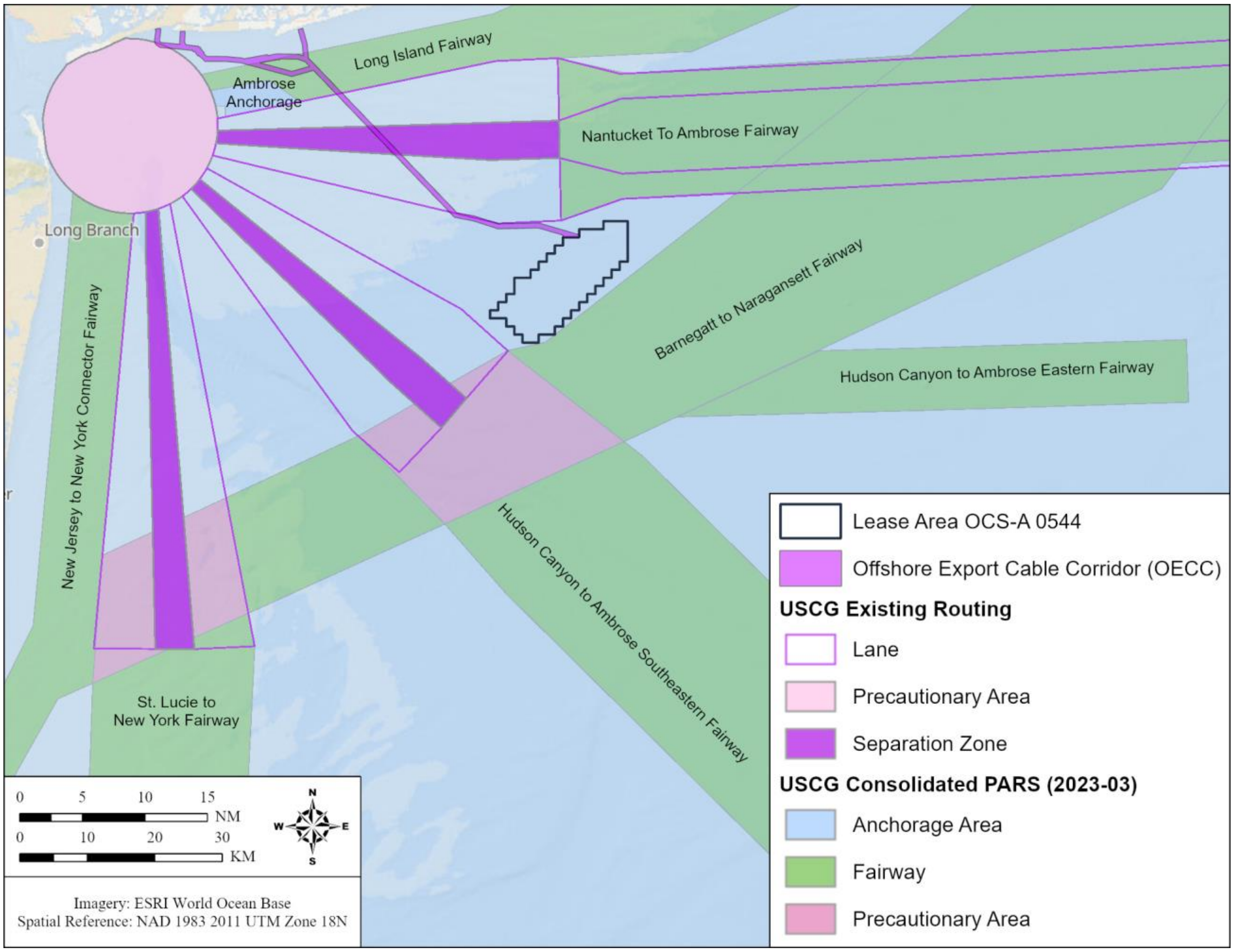
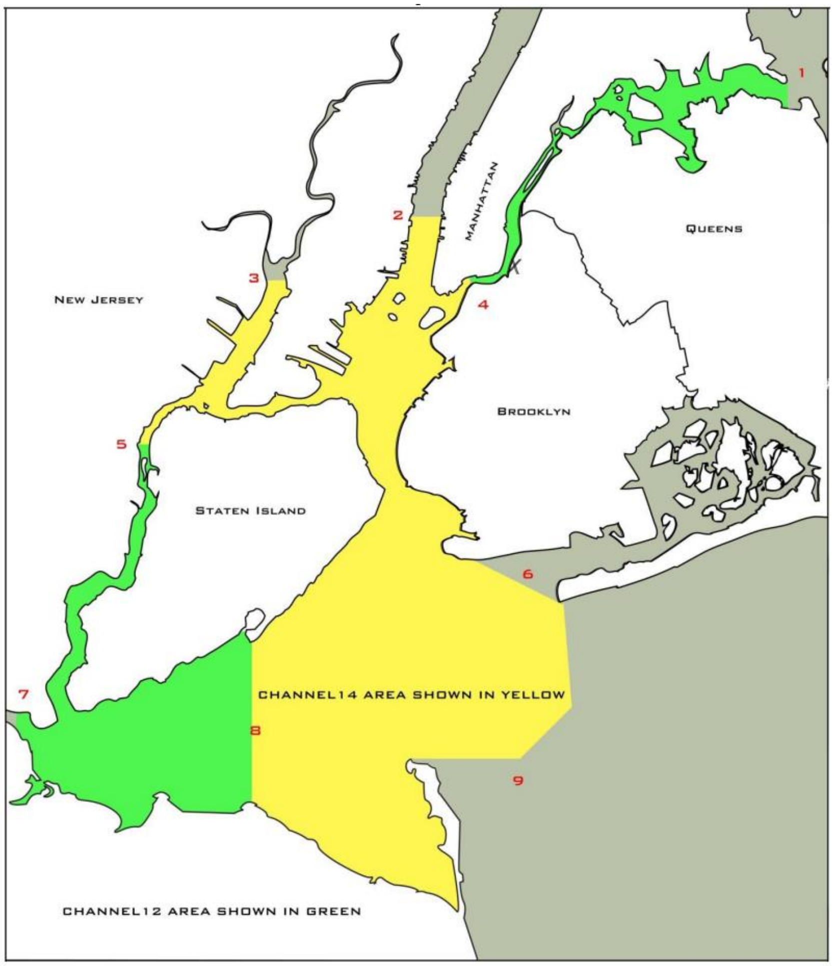


Figure 2.14: Proposed Routing Measures from CPAPARS (USCG 2023)

2.5.4.3 Lease Area Proximity to Other Waterway Uses

<u>Vessel Traffic Services</u>

A Vessel Traffic Services (VTS) is used to manage vessels requiring access to New York or New Jersey, as defined in 33 CFR Part 161.25. The area of VTS coverage is shown in Figure 2.15, which partly extends into the precautionary area at the entrance to the Port of New York/New Jersey and at its closest point is about 34 NM (64 km) northwest of from the Lease Area.



1	Throgs Neck Bridge	4	Brooklyn Bridge	7	Raritan River Railroad Bridge
2	Holland Tunnel Ventilators	5	Arthur Kill Railroad Bridge	8	Line drawn from Great Kills Light to Pt. Comfort (thru Raritan Chnl LB #14)
3	Lehigh Valley Lift Bridge	6	Line drawn from Norton Point to Breezy Point	9	Line drawn from Breezy Pt. to entrance buoys of Ambrose, Swash and Sandy Hook Channels then to tip of Sandy Hook

Figure 2.15: Vessel Traffic Services Area (US Coast Guard, 2023b)

Military Areas and Transit Routes

An Operating Area (OPAREA) is an area where national defense training exercises and system qualification tests are routinely conducted. The Lease Area is within the Narraganset Bay OPAREA, as shown in Figure 2.16. This OPAREA is also used for military transit lanes for US Navy submarines underwater navigation, however the submarine transit lanes are approximately 55 NM (102 km) from the Lease Area. The Atlantic City OPAREA is located approximately 22 NM (40.7 km) to the southwest of the Lease Area. Other areas near the Lease Area may be used for military exercises but are not formally designated as marine cautionary zones.

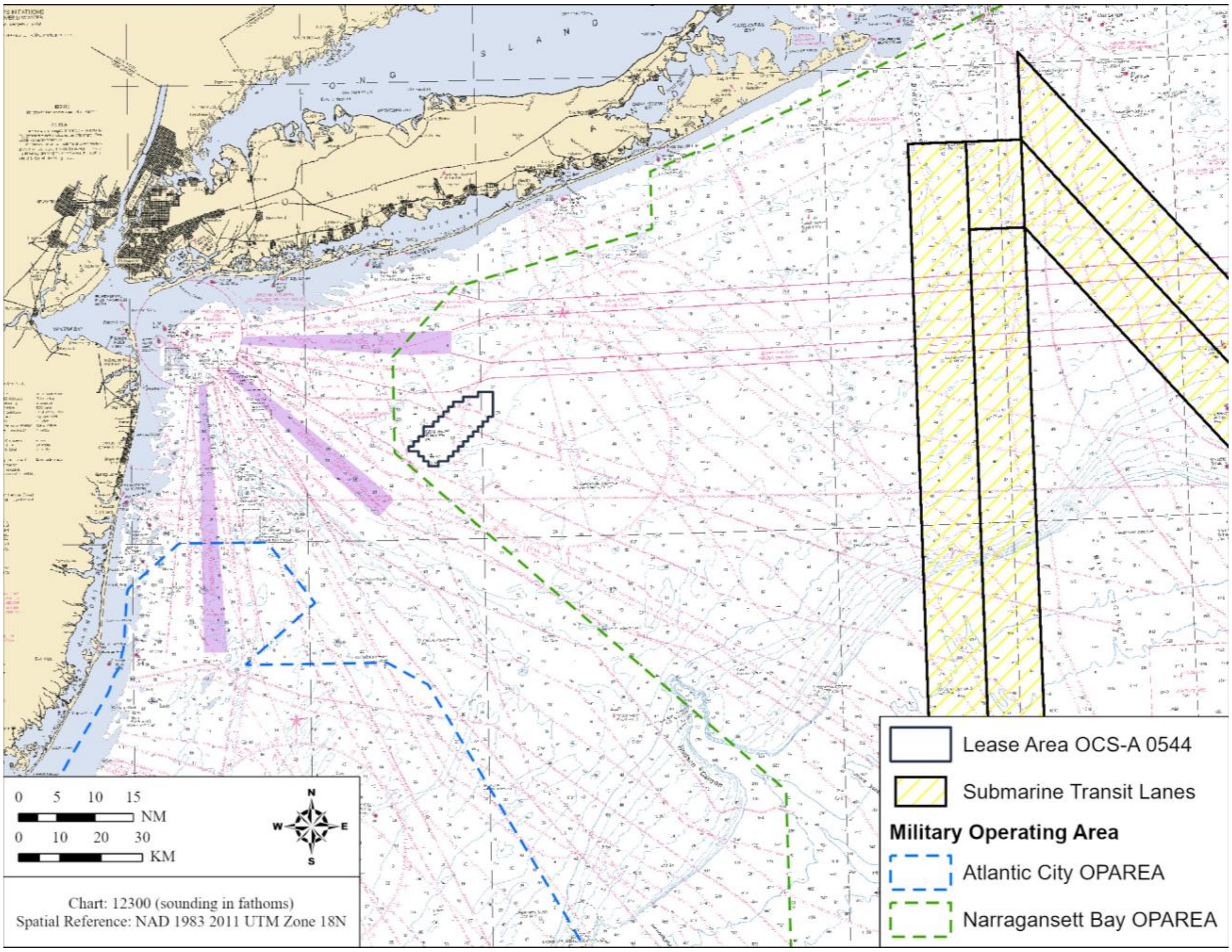


Figure 2.16: PAREAs and Military Transit Routes

Disposal Sites

There are no known designated beach nourishment borrow areas, mineral, aggregate, or sand/gravel mining operations in the nearby area. Figure 2.17 shows the closest placement areas and disposal sites to the Lease Area. See Section 5.8 of COP Volume II for additional information about other marine uses in the vicinity of the Lease Area and the OECC. The two nearest active US Army Corps of Engineers (USACE) placement areas are 22 NM (40.7 km) and 23 NM (42.5 km), towards the entrance to the Port of New York/New Jersey. The Lease Area is not within or adjacent to the jurisdiction of any port authority or navigation district.

Approximately 18.4 NM (34 km) to the northwest of the Lease Area there is a discontinued dump site containing acid waste. This area has an east-west dimension of 3 NM (5.6 km) and north-south dimension of 3.9 NM (7.2 km). There is a second discontinued dump site approximately 20.9 NM (38.8 km) to the southwest of the Lease Area containing the incineration of wood. This area has an east-west dimension of 2.2 NM (4.1 km) and north-south dimension of 4.4 NM (8 km).

There are no existing or proposed offshore OREI/gas platform, marine aggregate mining or known proposed structure developments near the Lease Area, other than additional WTGs and ESP(s) associated with other offshore wind developments.

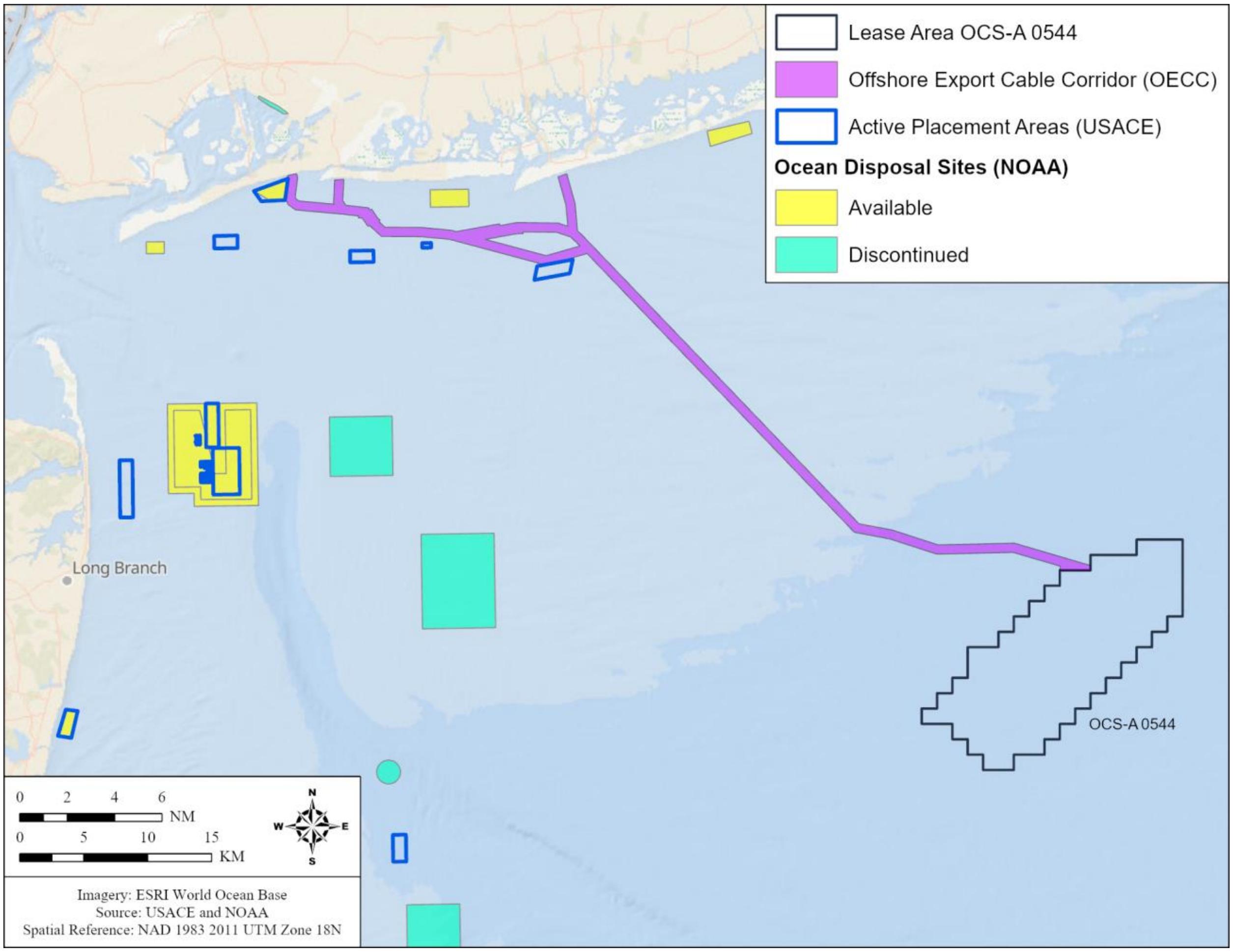


Figure 2.17: Placement Areas and Disposal Sites

Anchorages

There are no safe havens or anchorages in the vicinity of the Lease Area as designated in the Coast Pilot (Vol 2, 2023 and Vol. 3, 2023). Along the New Jersey coast, the only protected anchorage for deep-draft vessels is outside the channel limits in Delaware Bay. Absecon Inlet, Cape May Inlet, and some of the others can accommodate light-draft vessels, such as trawlers and small yachts, but not medium or deep drafts. Small craft often seek shelter inside the shallower inlets, but entrance can be difficult. Along the New York coast, anchorages include Sampawams Creek for small craft, Zachs Bay just east of Jones Beach State Park, Randall Bay, and Reynolds Channel. There are also several anchorage areas near the entrance to the Port of New York/New Jersey. In addition to existing anchorage, a new Ambrose Anchorage is proposed by the CPAPARS as indicated in Figure 2.14.

Ferries

There are no operating ferries near the Lease Area. The nearest ferry on the New Jersey Coast is the Cape May-Lewes Ferry on the north side of Cape May Canal in Delaware Bay. On the New York Coast there are several ferry services within the New York Harbor and Great South Bay; however, all operate within the bays and do not transit in the open water of the Lease Area.

Non-Transit Waterway Uses

There are numerous non-transit waterway features in the Offshore Development Area; however, none are located within or immediately adjacent to the Lease Area (Figure 2.18). Within the 20 NM buffer zone, there are recreational scuba diving areas, a general commercial whale-watching area towards the entrance to the Port of New York/New Jersey, several recreational fishing locations, and the course of a sailboat race (regatta). It is noted that the vessels racing are not necessarily following these idealized straight line courses. The figure also indicates several recreational boating routes with low to moderate traffic density, which are in general agreement with the AIS-based traffic analysis presented in Section 2.5.2.3; however, for purposes of risk analysis, the AIS data are relied upon.

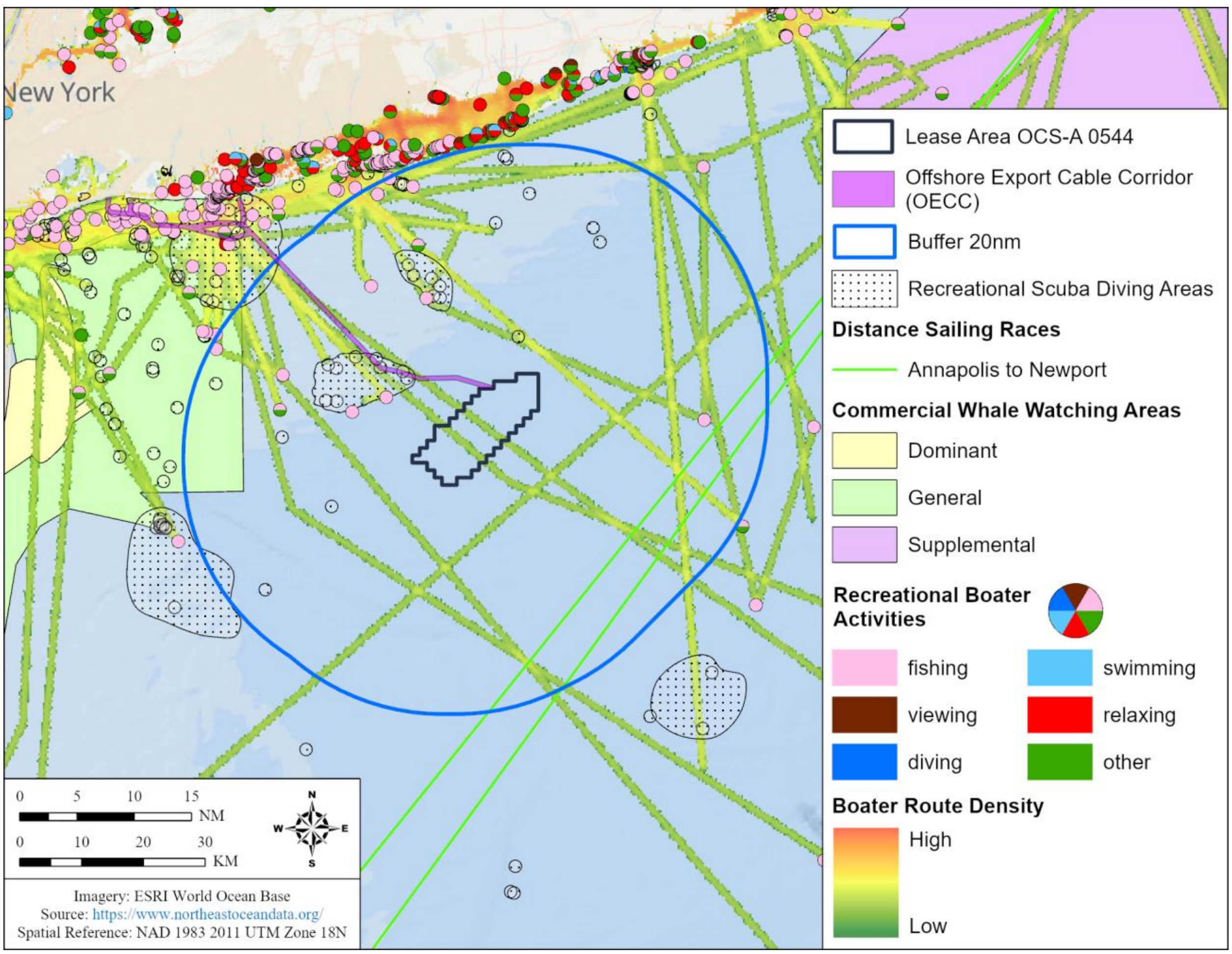


Figure 2.18: Non-Transit Waterway Uses (Northeast Ocean Data, 2023)

2.5.5 Marine Hazards

The primary marine hazard in the vicinity of the Lease Area is a sunken wreck in the south corner of the Lease Area; however, the wreck is marked as one that is not dangerous to surface navigation. There are several wrecks around the Lease Area, including four that are within 8 NM (14.9 km) to the northwest of the Lease Area, and two that are within 8 NM (14.9 km) to the southwest of the Lease Area; however, all are marked as ones that are not dangerous to surface navigation, and one of the depths has been confirmed at 119 ft (36.3 m). There is also a Subsurface Ocean Data Acquisition System (ODAS) along the western edge of the Lease Area. Outside of the Lease Area, there is an unexploded ordnance (reported in 2010), which at its closest point is about 17.5 NM (32.3 km) to the southeast. These hazards are marked on the NOAA chart, as shown in Figure 2.10.

A Right Whale Seasonal Management Area (speed restrictions to protect North Atlantic Right Whales per 50 CFR 224.105) around the Ports of New York/New Jersey between November 1 and April 30. This area is 17.5 NM (32.3 km) northwest of the Lease Area. There are no other safety or security zones in the vicinity of the Lease Area.

2.6 Effects of Vineyard Mid-Atlantic on Vessel Traffic

2.6.1 Navigation Paths Between Grid Positions

Smaller vessels, particularly fishing and recreational vessels, may choose to transit through and to fish within the Lease Area. The navigational safety for these activities has been evaluated based on turbine spacing and size of vessels. Given the relatively deep water at this site, approximately 130 to 155 ft (39.5 to 47.1 m), navigation is not limited by water depth. The spacing between grid positions generate lanes of clear (structure free) navigation which are referred to here as navigation paths for clarity; however, it is noted that these are not formal routing measures which may only be designated by the USCG with acceptance by IMO.

In addition to various international guidelines that address required spacing between commercial shipping lanes and the perimeter of an offshore wind development (e.g., PIANC 2018; United Kingdom (UK) Maritime MGN 543, UK MGN 654), there are various studies provided below regarding the spacing of structures to create safe navigation paths for vessels navigating within a wind turbine field. It is also noted that NVIC 03-23 (USCG 2023c) “Guidance on Navigational Safety In and Around Offshore Renewable Energy Installations (OREI)” provides valuable information to mariners on navigation within a wind turbine field.

The USCG Northern New York Bight Port Access Route Study (NNYBPARS) (USCG, 2021b), New Jersey Port Access Route Study (NJPARS) (USCG, 2021a), and Massachusetts and Rhode Island Port Access Route Study (MARIPARS) (USCG, 2020) assessed turbine navigation path width based on PIANC (2018), which recommended the following provisions:

- Standard turning circles for collision avoidance of vessels that are six times vessel length;
- Requirements for stopping in an emergency; and
- Adequate space for vessels to safely pass and overtake each other, equivalent to a lane width of two to four vessel lengths, depending on traffic density.

The last consideration derives from a Government of Netherlands White Paper on Offshore Wind Energy (2014). If there are less than 4,400 vessels per year transiting the navigation path, a navigation path width of four (4) ship lengths (i.e., lanes of two times the ship length in each direction) of the “standard design vessel” are considered. If there is greater than 4,400 and less than 18,000 vessels per year, a navigation path width of six (6) ship lengths is considered. If greater than 18,000 vessels per year, then a navigation path width of eight

(8) ship lengths is recommended. Note that the standard design vessel is considered to be the 98.5% percentile vessel length (i.e., exceeded by 1.5% of vessels). Under existing conditions, there are less than 4,400 vessels per year that transit through the entire Lease Area.

Figure 2.19 is a graphical representation of the methodology used by the USCG to determine the turbine spacing that would enable safe transits between WTGs in the NNYBPARS. It is made up of the following components:

- Navigational spacing of two (2) ship lengths in two directions. It was recognized that this spacing, which would accommodate up to 4,400 vessel transits in a single navigation path, will satisfy the 568 average vessels transiting through the Lease Area annually.
- A collision avoidance zone on either side of 1.5 vessel lengths.
- A safety margin of six (6) ship lengths on either side of the navigation path.
- An additional buffer[8] that may range in size from 0 to 1,640 ft (500 m) around the WTG. At the time the NNYBPARS (USCG, 2021b) was prepared, the USCG did not have the authority to establish safety zones around structures for offshore wind farms beyond 12 NM from the territorial sea baseline. Subsequently, USCG has been granted regulatory authority under 33 CFR 147 to designate safety zones around OREI structures. NNYBPARS (USCG, 2021b) notes regarding this buffer that, “A 500-meter distance may be excessive or overly conservative for vessels 165 feet in length or less, as these smaller vessels are capable of navigating coastal seaports, and are significantly more maneuverable and responsive than larger ships. In the event the owner/operator of any offshore structure feels it necessary to protect the structures during a maintenance period, an up to 500m safety buffer may be requested.”
- As discussed further in Section 8.1.1, the Proponent may request that USCG establish temporary safety zones around each structure during construction and/or certain maintenance activities under their authority under 33 CFR 147; however, this analysis of allowable navigation path widths is focused on normal operational conditions. The buffers used in this analysis are not considered regulatory safety zones.

[8] Note that the MARIPARS and MGN 543 use the term “safety zone”, but to avoid confusion with a regulatory safety zone under 33 CFR 147, this NSRA uses the term “buffer” instead.

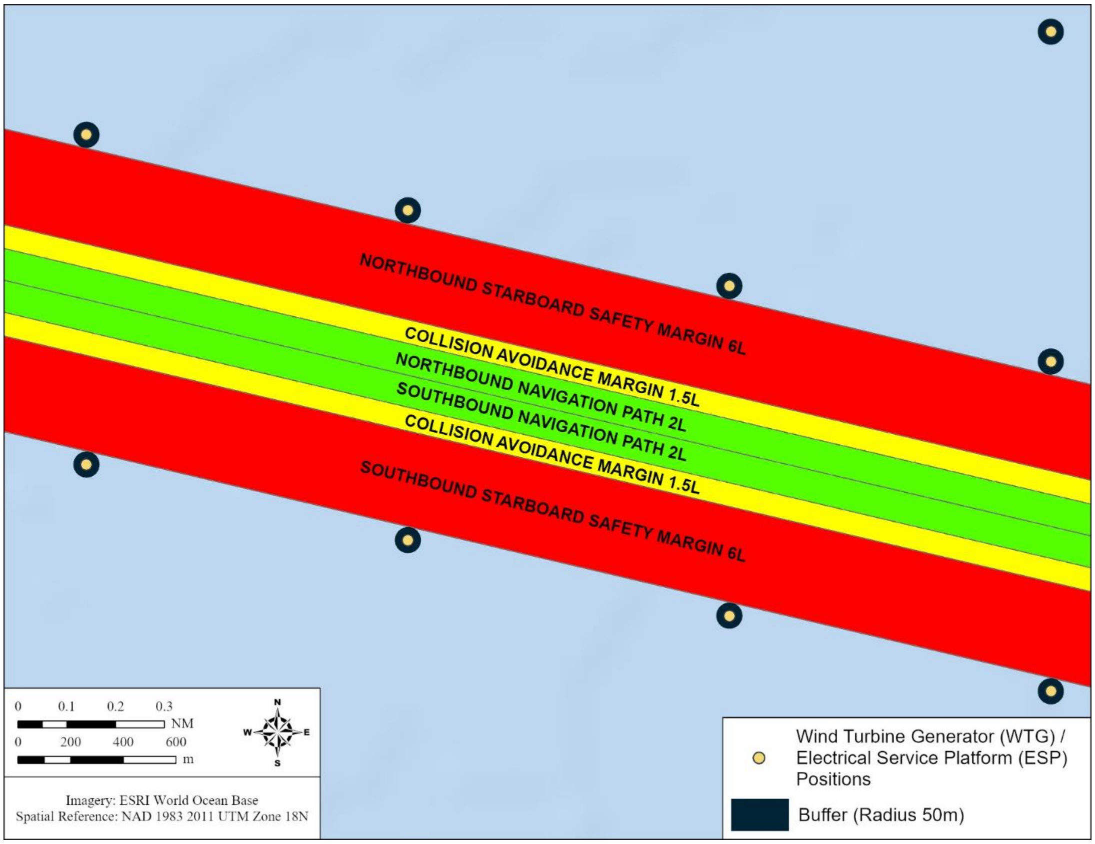


Figure 2.19: Recommended Spacing Based on NNYBPARS Methodology (Buffer of 164 ft [50 m] Radius Shown)

An alternative approach from MGN 543 (UK Maritime & Coastguard Agency 2016), which specifically considers offshore renewable energy installations (OREIs), states “The mention of the IMO/UNCLOS safety zone limited to 500 meters does not imply a direct parallel to be applied to OREIs.” Further, MGN 543 allows for a buffer of 164 ft (50 m) around turbines during operation. This suggests that a 1,640 ft (500 m) buffer during operation, as presented in MARIPARS, is conservative for OREIs. Furthermore, a buffer of 1,640 ft (500 m) in addition to a safety margin of 6 times the vessel length may be overly conservative. Based on present USCG practice it is understood that safety zones of up to 1,640 ft (500 m) may be designated during construction and/or maintenance activities as discussed further in Section 8.1.1, but are not intended to be permanent safety zones.

The NNYBPARS concludes that, “Based on this, the First Coast Guard District concludes an adequate width of a transit lane for vessels 165 feet in length in an area with less than 4,400 vessel transits per year is 0.62 to 0.89 nautical miles.” The NNYBPARS goes on to state, “To be clear, the First Coast Guard District is not setting a minimum spacing requirement between offshore structures with these study calculations. The calculations have been included only to illustrate what would be considered safe navigation parameters if establishing a fairway or traffic separation scheme. Further evaluation for safe navigation within and adjacent to all OREI under development will be reviewed by the Coast Guard as a cooperating agency with BOEM during the leasing and development process.”

In this NSRA, Baird has applied the NNYBPARS approach for defining navigation path widths with and without buffers around the WTGs. The buffer has been considered with a radius of 164 ft (50 m) per side for this analysis. Table 2.10 shows the recommended maximum vessel length that can be accommodated by the largest and smallest navigation path widths present in the Lease Area: (1) 0.66 NM (1,226 m) northwest to southeast navigation paths; and (2) 0.53 NM (983 m) northeast to southwest navigation paths (see Section 2.1 for additional discussion of the spacing between Vineyard Mid-Atlantic's WTG/ESP positions). It is noted that while the navigation path widths are less than 0.68 NM (1.25 km), the spacing between adjacent structures is 0.68 NM (1.25 km).

Table 2.11 and Table 2.12 indicate the percentage of fishing and recreational fleets, respectively, that have lengths less than the values given in Table 2.10. Based on this comparison, all of the AIS fishing vessels (Section 2.5.2) and 99.8% of recreational vessels would be able to transit through the primary 0.66 NM (1,226 m) northwest to southeast navigation paths with or without a buffer around the WTGs. For the minimum 0.53 NM navigation path, depending on the assumed buffers (none or 164 ft [50 m]), between 96.5% and 98.8% of recreational vessels and 100% of the fishing vessels could transit through the navigation paths based on the outlined navigation path width methodology.

Table 2.10: Recommended Maximum Vessel Length by Navigation Path Width

Allowable Vessel Length – ft (m)		
	No Buffer	164 ft (50 m) Buffer
0.66 NM (1.2 km) Navigation Paths	210 (64)	194 (59)
0.53 NM (0.98 km) Navigation Paths	170 (52)	153 (47)

Table 2.11: Percentage of AIS-Equipped Fishing Fleet with Length Less than Maximum

	Percentage of Fleet	
	No Buffer	164 ft (50 m) Buffer
0.66 NM (1.2 km) Navigation Paths	100.0%	100.0%
0.53 NM (0.98 km) Navigation Paths	100.0%	100.0%

Table 2.12: Percentage of AIS-Equipped Recreational Fleet with Length Less than Maximum

	Percentage of Fleet	
	No Buffer	164 ft (50 m) Buffer
0.66 NM (1.2 km) Navigation Paths	99.8%	99.8%
0.53 NM (0.98 km) Navigation Paths	98.8%	96.5%

It is very important to recognize that the navigation path widths are notional and not actual channels with continuous physical limits at the channel edges. Vessels can certainly navigate from one navigation path to the next without restriction in most areas (i.e., except at the actual locations of WTGs and/or ESP(s)).

2.6.2 Future Vessel Traffic Changes

As further discussed in Sections 3.1.2, 3.2.3, and 6.9, it is anticipated that most non-fishing commercial vessels will reroute around the Lease Area following the construction of Vineyard Mid-Atlantic. While the layout is expected to accommodate fishing and recreational vessels, some fishing and recreational vessels may opt to reroute transits around the Lease Area; however, for the purposes of modeling the risks for collision and allision, it has been assumed that these types of vessels will transit through the WTG/ESP field in the Lease Area as discussed in subsequent sections of this report.

3. Proposed Structures

3.1 Above-Water Structure Description

3.1.1 WTG and ESP(s)

Vineyard Mid-Atlantic includes 118 total WTG and ESP positions within the Lease Area. One or two of those positions will be occupied by ESP(s) and the remaining positions will be occupied by WTGs. In accordance with Proponent's lease stipulations, the WTGs and ESP(s) will be oriented in west-northwest to east-southeast rows and north to south columns with 0.68 nautical mile (NM) (1.3 kilometer [km]) spacing between positions. The WTGs will be supported by monopiles, and the ESP(s) will be supported by monopiles or a piled jacket foundation.

The Project Design Envelope (PDE) of dimensions for the WTGs and their foundations is provided in Section 2.2. With respect to vessel navigation, an important consideration is the minimum WTG tip clearance, which is 89 ft (27 m) relative to Mean Lower Low Water (MLLW). The PDE of dimensions for the ESP(s) is provided in Section 2.3. This NSRA has considered the overall envelope of the dimensions.

3.1.2 Above-Water Structure Impacts on Navigation

The foundations of the WTGs and ESP(s) are considered as part of the allision and collision risk modeling described later in this report (Section 6). The potential impacts to air draft are covered in the following subsection.

3.1.2.1 Air Draft

It is important to check the vertical clearance between the top of the largest vessels and the turbine rotor. Figure 3.1 shows that the minimum rotor tip clearance is 89 ft (27 m) relative to MLLW. Highest Astronomical Tide (HAT) is 6.63 ft (2.020 m) above MLLW based on the nearest onshore NOAA Station (#8531690) located at Sandy Hook, New Jersey. Therefore, the minimum possible tip clearance from a high tide level is approximately 77 ft (23.4 m), allowing for a 5 ft (1.5 m) safety margin. This is the maximum allowable vessel "air draft" under calm conditions. Air draft refers to the maximum distance from the water line to the highest point on the vessel.

Waves induce vertical motions of vessels and will reduce the required vertical clearance. PIANC (2014) provides a means to estimate the vertical motion of vessels due to wave action. The largest vertical response tends to occur when the length of the vessel is approximately equal to wavelength. For wave periods of 10 to 12 seconds, the wavelength ranges from 480 ft to 640 ft (146 m to 194 m), which is the approximate size of the larger vessels. The estimated vertical response for such vessels would be approximately 1.5 times the magnitude of the significant wave height. The largest sailing vessel to historically transit the Lease Area is NRP Sagres, which has a length of 295.3 ft (90.0 m). The mast of such a vessel would likely be at risk of allision with the turbines.

Note that both the cargo and sailing vessels are at little risk of interacting with the WTG blades under normal conditions, but the risk increases considerably should the vessel lose power and/or steerage and become adrift, or if there is a breakdown in navigational capability under poor visibility conditions. The vessel must be in very close proximity to the WTG in order for turbine strike to be feasible and would likely be associated with a co-incident allision between the vessel and the turbine base.

Based on the above, it is recommended that the air draft restrictions within the Lease Area be identified by means of Local Notices to Mariners (LNMs) and on the navigational chart, subject to USCG practices and regulations.

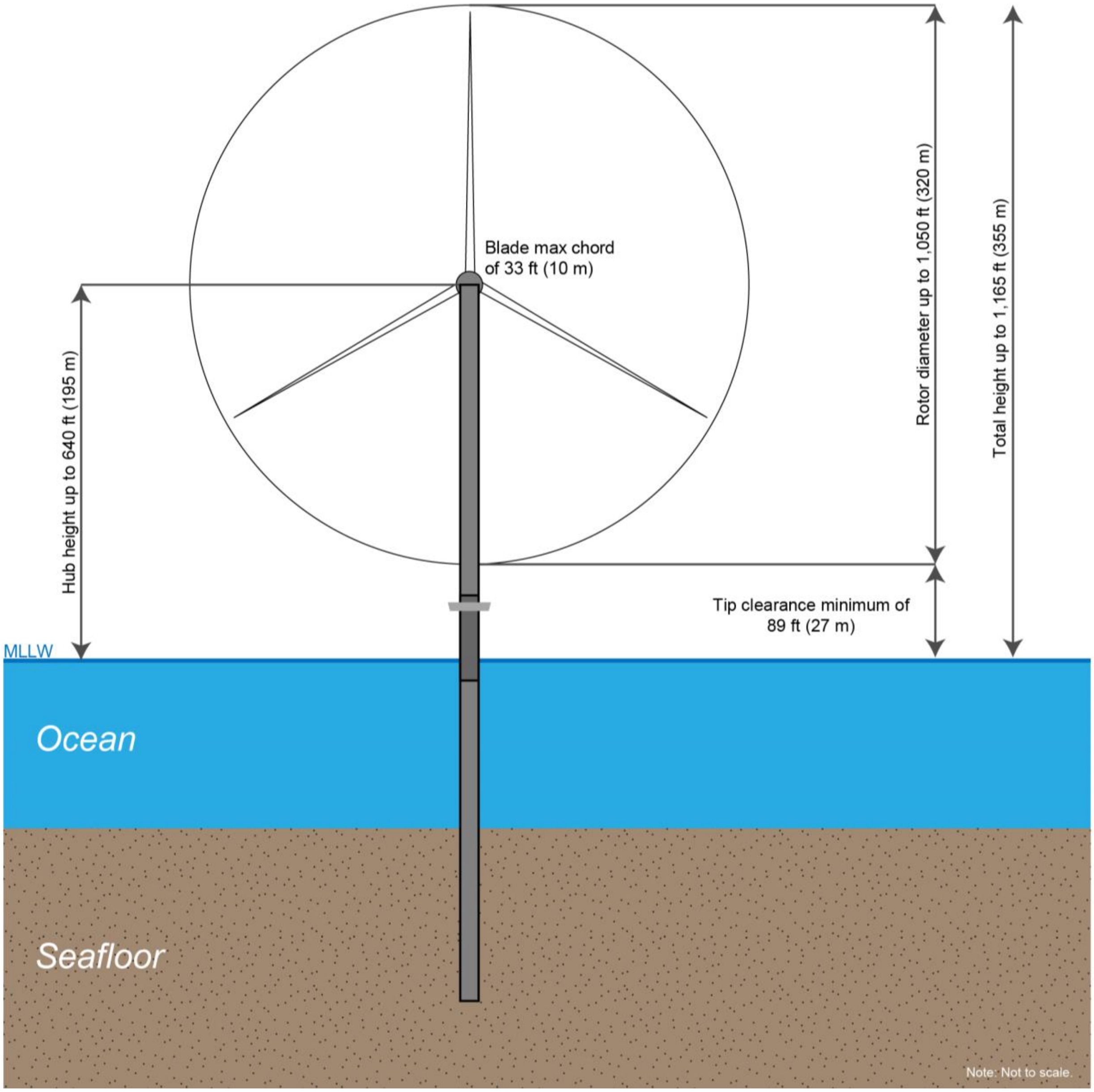


Figure 3.1: WTG Vertical Dimensions

3.2 Below-Water Structure Description

3.2.1 Foundations

As described above, the WTGs will be supported by monopiles and the ESP(s) will be supported by monopiles or a piled jacket foundation.

- Monopiles – A monopile is a single, hollow cylindrical steel pile that is driven into the seabed. Monopiles usually consist of several rolled steel plates that are joined together by circumferential welds. Typically, a separate steel transition piece is installed on top of the monopile. Alternatively, the monopile length can be extended to the interface with the WTG tower, which is referred to as an "extended monopile." The transition piece or top of the extended monopile contains a flange for connection to the WTG tower. Ancillary structures, such as boat landing(s), ladders, work platforms, electrical equipment, and various ancillary equipment (e.g., cranes), will be located inside or outside of the transition piece or extended monopile. The base of the monopile will have j-shaped steel tubes (i.e., J-tubes) or an opening to allow the inter-array cables to enter and exit the foundation safely. The foundation is expected to include an anode cage to provide corrosion protection.
- Piled Jacket – A piled jacket foundation is a steel structure comprised of several legs connected by welded tubular cross-bracing, which is secured to the seafloor using pin piles. Pin piles are similar to monopiles (they are hollow steel cylinders that are driven into the seabed) but are much smaller in diameter. The jacket foundation will ancillary structures, such as cable tubes, boat landing(s), ladders, work platforms, electrical equipment, and various ancillary equipment (e.g., cranes).
- Scour Protection – Scour protection may be placed around the bases of the foundations on the seabed; the horizontal extent of the scour protection depends on the foundation type.

See Sections 2.2 and 2.3 for additional details and dimensions for WTG and ESP foundations.

3.2.2 Offshore Cables

Two to six offshore export cables will transmit electricity from the ESP(s) to landfall sites on the southern shore of Long Island, New York. Up to six high-voltage alternating current (HVAC) cables, two high-voltage direct current (HVDC) cable bundles, or a combination of up to four HVAC cables/HVDC cable bundles will be installed within the OECC.

Inter-array cables will connect strings of multiple WTGs to the ESP(s). If two ESPs are used, up to three inter-link cables may connect the ESPs together.

The offshore export cables will have a target burial depth beneath the stable seafloor of 1.2 m (4 ft) in federal waters and 1.8 m (6 ft) in state waters,[9] unless the final Cable Burial Risk Assessment (CBRA) indicates that a greater depth is necessary and taking into consideration technical feasibility factors, including thermal conductivity. The target burial depth is at least twice the burial depth required to protect the cables from fishing activities and also generally provides a maximum of 1 in 100,000-year probability of anchor strike, which is considered a negligible risk.

While every effort will be made to achieve sufficient burial, a limited portion of the offshore export cables may require remedial cable protection (rocks, rock bags, concrete mattresses, half-shell pipes, or similar) if a

[9] Based on a preliminary CBRA (see Appendix II-T of COP Volume II), in a limited portion of the OECC within the Nantucket to Ambrose Traffic Lane, the offshore export cables will have a greater target burial depth of 2.9 m (9.5 ft) beneath the stable seafloor to achieve a 1 in 100,000 year probability of anchor strike, subject to the results of the final CBRA.

sufficient burial depth cannot be achieved. Cable protection may also be used if the cables need to cross other infrastructure (e.g., existing cables, pipelines, etc.) to secure the cable entry protection system in place, or where a cable splice requires protection.

3.2.3 Below Water Structure Impacts on Navigation

The foundations of the WTGs and ESP(s) are considered as part of the allision and collision risk modeling described later in this report (Section 6). The draft of vessels operating in proximity to the structures is significantly less than the water depths in the area and the structures are generally near vertical near the waterline; thus, vessel navigation would only be impacted if they allide with a structure.

The potential for navigation impacts within the OECC is primarily during construction as discussed in Sections 3.2.2 and 8.1.1. Once in place, the primary impact to navigation will be limited to those portions of the OECC where cable protection is installed, which may cause localized restrictions on dredging and anchoring. As described above, while every effort will be made to achieve sufficient burial, a limited portion of the offshore cables may require cable protection if a sufficient burial depth cannot be achieved. Cable protection may also be used if the cables need to cross other infrastructure (e.g., existing cables, pipelines, etc.), to secure the cable entry protection system in place, or where a cable splice requires protection. Cable protection will be designed and installed to minimize interfering with bottom fishing gear, dredging, and anchoring to the maximum extent practicable and mariners will be informed of exactly where cable protection exists.

3.3 Vineyard Mid-Atlantic Vessel Traffic

3.3.1 Construction, Installation, and Decommissioning

Construction and installation of Vineyard Mid-Atlantic will require the use of a wide range of construction and support vessels. These vessels will transit within the Lease Area, along the OECC, and along vessel routes between the Lease Area, OECC, and various ports. Estimates of the numbers and types of vessels are provided in Sections 3 and 4 of COP Volume I. Table 3.1 summarizes the type, numbers, and expected activities of some of the larger vessels that might be utilized. As this stage of the development process, vessel data is highly speculative given that the Proponent has not selected the contractors or specific vessels that will carry out construction or decommissioning activities.

Assuming a build-out of the entire Lease Area, the offshore construction activities may occur over a period of approximately 12 to 40 months for each major activity (e.g., offshore export cable installation, WTG foundation installation, ESP installation and commissioning, inter-array and inter-link cable installation, and WTG installation and commissioning), with considerable overlap in the timeframes of each of these activities. A representative draft construction schedule for one potential build-out scenario is provided in Section 3.1 of COP Volume I. The Proponent has identified several ports in New York, New Jersey, Connecticut, Rhode Island, Massachusetts, Maryland, South Carolina, and Canada that may be used during construction to stage offshore components and/or that may be the site of a manufacturing facility (Table 3.2). These staging ports could be used for frequent crew transfer and to offload, store, pre-assemble, inspect, pre-commission, and/or load components onto vessels for delivery to the Lease Area and OECC.[10]

Volume I of the COP provides a summary of the anticipated fleet requirements during construction and installation; however, it is difficult to quantify the numbers of vessels and vessel trips from each port at this time. Assuming the maximum design scenario (see Section 3.11 of COP Volume I), it is estimated that an

[10] Some components (e.g., monopiles) may instead be pulled by tugs while floating in the water rather than loaded onto vessels.

average of ~22 vessels would operate at the Lease Area or along the OECC at any given time during offshore construction. During the most active period of construction, it is conservatively estimated that a maximum of approximately 60 vessels could operate in the Offshore Development Area at one time[11]. Up to approximately 2,200 total vessel round trips are expected to occur during the busiest year of offshore construction. During the most active month of construction, it is anticipated that an average of approximately 12 daily vessel round trips could occur.

Table 3.1: Representative Construction Vessels

Vessel Type	Expected No. of Vessels	Expected Vessel Activity
Anchor handling tug supply (AHTS) vessels	1-6	Vessels that primarily handle and reposition the anchors of other vessels (e.g., cable laying vessels), but may also be used to transport equipment or for other services.
Barges	2-10	Vessels with or without propulsion that may be used for transporting components (e.g., foundations, WTGs, etc.) or installation activities.
Bunkering vessels	1-4	Vessels used to supply fuel and other provisions to other vessels offshore.
Cable laying vessels	1-5	Specialized vessels/barges that lay and bury offshore cables into the seafloor.
Crew transfer vessels (CTVs)	2-14	Smaller vessels that transport crew, marine mammal observers, parts, and/or equipment.
Heavy lift vessels (HLVs)	1-4	Vessels that may be used to lift, support, and orient the WTGs, ESP(s), and foundations during installation.
Heavy transport vessels (HTVs)/modified cargo vessels	2-12	Ocean-going vessels that may transport components to staging ports or directly to the Lease Area.
Jack-up vessels	1-9	Vessels that extend legs to the seafloor to provide a safe, stable working platform. Jack-up vessels may be used to install foundations, ESP topsides, and/or WTGs, to transport components to the Lease Area, for offshore accommodations, for cable splicing activities, and/or for cable pull-in at the landfall sites.
Scour/cable protection installation vessels	1-3	Vessels (e.g., fallpipe vessels) that may be used to deposit a layer of rock around the foundations or over limited sections of the offshore cable system.
Service operation vessels (SOVs) /service accommodation and transfer vessels (SATVs)	1-3	Larger vessels that provide offshore living accommodations and workspace as well as transport crew to and from the Lease Area.
Support vessels	1-8	Multipurpose vessels (e.g., work boats, supply boats, accommodation vessels, diving support vessels) that may be used for a variety of activities, such as the pre-lay grapnel runs, supporting cable installation, commissioning WTGs, or transporting equipment.
Survey vessels	1-3	Specialized vessels used to perform geophysical, geotechnical, and environmental surveys.

[11] This includes vessels at the Lease Area, at the OECC, and in transit to, from, or within a port.

Vessel Type	Expected No. of Vessels	Expected Vessel Activity
Tugboats	2-24	Ocean-going vessels or smaller harbor craft used to transport equipment and barges.

3.3.2 Operations and Maintenance

The Proponent expects to use one or a combination of service operation vessel(s) (SOV), service accommodation and transfer vessels (SATVs), and crew transfer vessels and helicopters during the routine operations and maintenance (O&M) of Vineyard Mid-Atlantic. The Proponent may use one or more SOVs to provide workers with offshore accommodations during multi-week service trips to the Lease Area and/or one or more SATVs for multi-day or week-long service trips to the offshore facilities. In a different approach, multiple CTVs and/or helicopters would make frequent trips (e.g., daily) to transfer crew and supplies between the offshore facilities and shore. The Proponent may periodically use larger vessels (e.g., jack-up vessels, cable laying vessels) to perform certain maintenance and repair activities, if needed. These vessels would be similar to the vessels used during construction.

The Proponent expects to use one or more onshore O&M facilities to support the operation of Vineyard Mid-Atlantic's offshore facilities. The O&M facilities, which could be located at or near any of the ports identified in Table 3.2, are expected to include dock space for SOVs, SATVs, CTVs, and/or other support vessels.

Table 3.2: Potential Construction and O&M Ports

Port
New York Ports
Capital Region Ports (Port of Albany-Rensselaer [construction only], NYS Offshore Wind Port [construction only], Port of Coeymans Marine Terminal [construction only])
Staten Island Ports (Arthur Kill Terminal, Homeport Pier, Staten Island Marine Terminal, Rossville Municipal Site, Atlantic Salt Terminal [O&M only])
Brooklyn Ports (South Brooklyn Marine Terminal, GMD Shipyard, Red Hook Container Terminal, & Ravenswood Generating Station [O&M only])
Port of Tomkins Cove (construction only)
Long Island Ports (Shoreham [O&M only], Port Jefferson Harbor [O&M only], & Greenport Harbor [O&M only])
New Jersey Ports
Paulsboro Marine Terminal (construction only)
Port Newark Container Terminal and Other Areas in Newark Bay
New Jersey Wind Port (construction only)
Connecticut Ports
Port of Bridgeport
New London State Pier
Port of New Haven (O&M only)
Rhode Island Ports
Port of Davisville (Quonset) (construction only)
Port of Providence (ProvPort) (construction only)

Port
South Quay Terminal (construction only)
Massachusetts Ports
Brayton Point Commerce Center (construction only)
Port of New Bedford (New Bedford Marine Commerce Terminal & other areas in New Bedford) (construction only)
Salem Harbor (construction only)
Maryland Ports
Sparrows Point (construction only)
South Carolina Ports
Port of Charleston (Union Pier Terminal [construction only], Columbus Street Terminal [construction only], Hugh K. Leatherman Terminal [construction only], Wando Welch Terminal [construction only])
Goose Creek (construction only)
Canadian Ports
Potential Canadian Ports (Port of Halifax, Sheet Harbor, & Port Saint John)[1] (construction only)

Note: 1. Analysis of potential Canadian ports that may be used is ongoing.

During the busiest year of O&M, an average of approximately nine (9) vessels are anticipated to operate in the Offshore Development Area at any given time, although additional vessels may be required during certain maintenance or repair activities. Based on the maximum design scenario, approximately 575 vessel roundtrips are estimated to take place annually during the O&M; however, these estimates are highly dependent on the logistics approach used during O&M, the location of the O&M facilities, the timing and frequency of activities, and the final design of the offshore facilities. All vessels used during the operation of Vineyard Mid-Atlantic will be equipped with AIS to track vessel activity and monitor compliance with permit requirements.

4. Metocean Characterization and Impacts

Meteorological and oceanographic (metocean) conditions in the Offshore Development Area are summarized in Appendix II-B of the Vineyard Mid-Atlantic Construction and Operations Plan (COP). This Appendix was prepared by Geo Sub Sea LLC to support the COP and inform engineering and design efforts and serve as reference for future construction activities. Available data is presented in Figure 4.1. Key data includes wind data from NOAA's National Data Buoy Center (NDBC) buoys at Station 44025, which is presented as a wind rose in Figure 4.2. The data presented in this section, wind rose from NDBC Buoy 44025 and visibility data from JFK Airport, are the data which were directly used for the navigational risk modeling (Section 6). All other metocean data is detailed in the Appendix II-B of the COP and discussion of impacts on metocean conditions as required in NVIC 02-23 CH 1 is covered below.

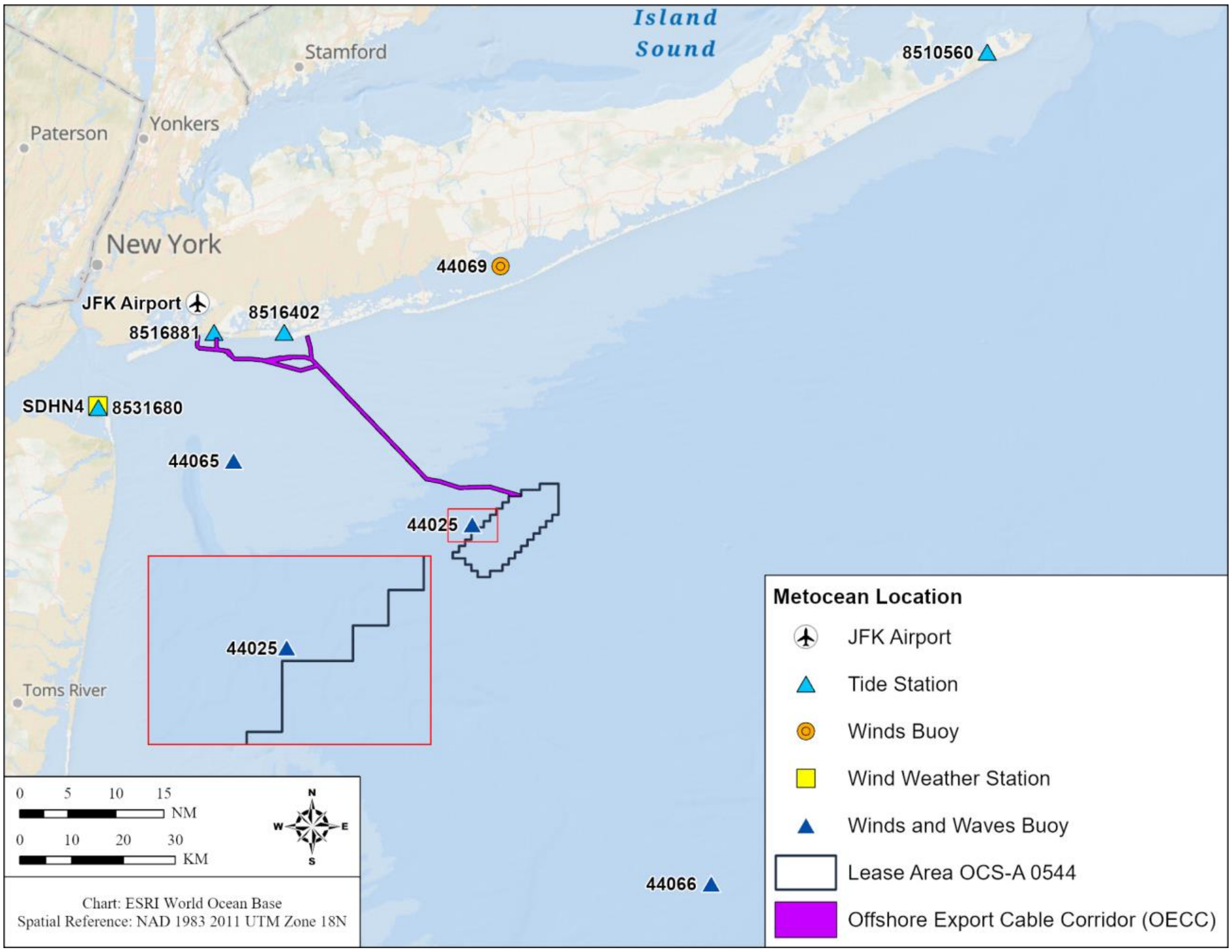


Figure 4.1: Metocean Data Sources

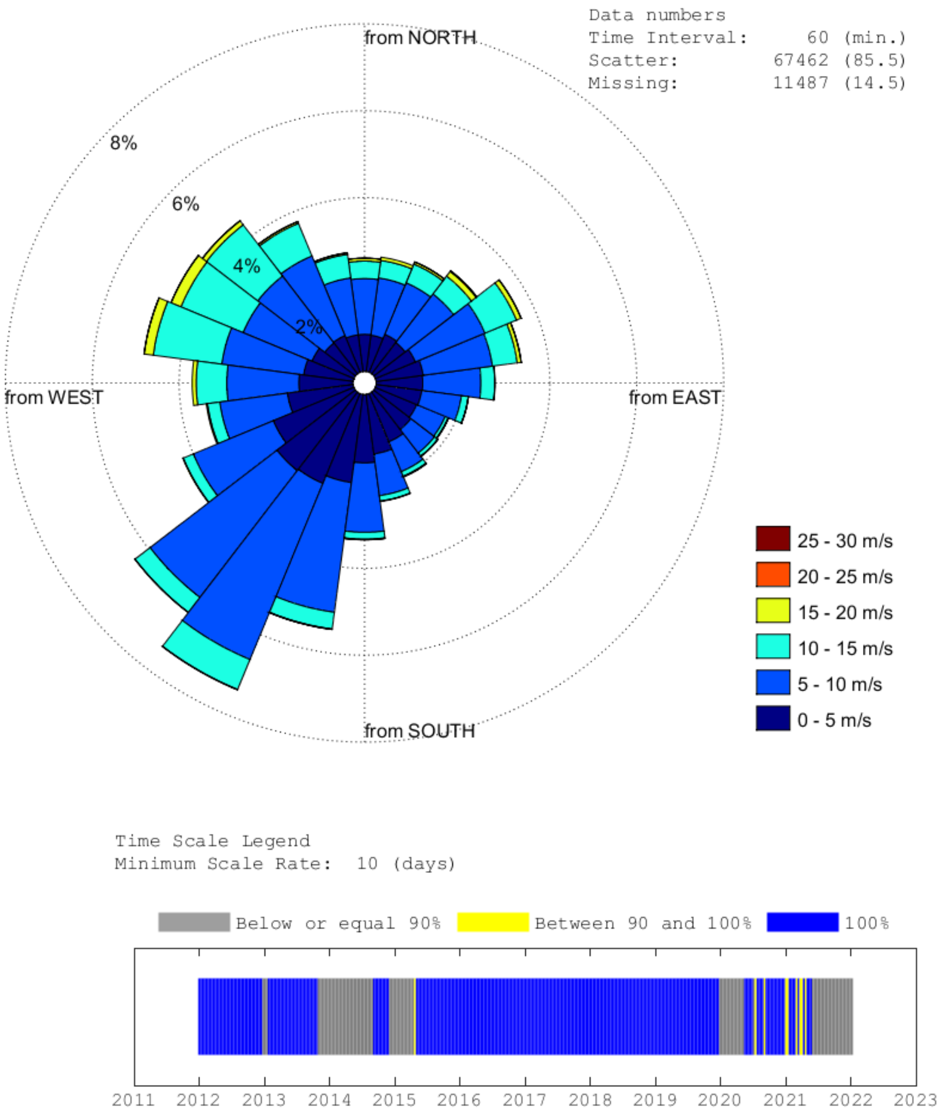


Figure 4.2: NDBC Station 44025 Wind Data

The visibility conditions were obtained from NOAA Weather Data for the John F. Kennedy International Airport ("JFK") from January 1, 2010, to July 27, 2018. This is the closest station to the Lease Area and is considered generally representative of the conditions there, understanding that local variability can occur during certain times of year. Figure 4.3 shows the probability distribution of visibility observed over the time period. Based on this data, visibility can reach extremes of less than 0.5 NM (1 km) approximately 2% of the time.

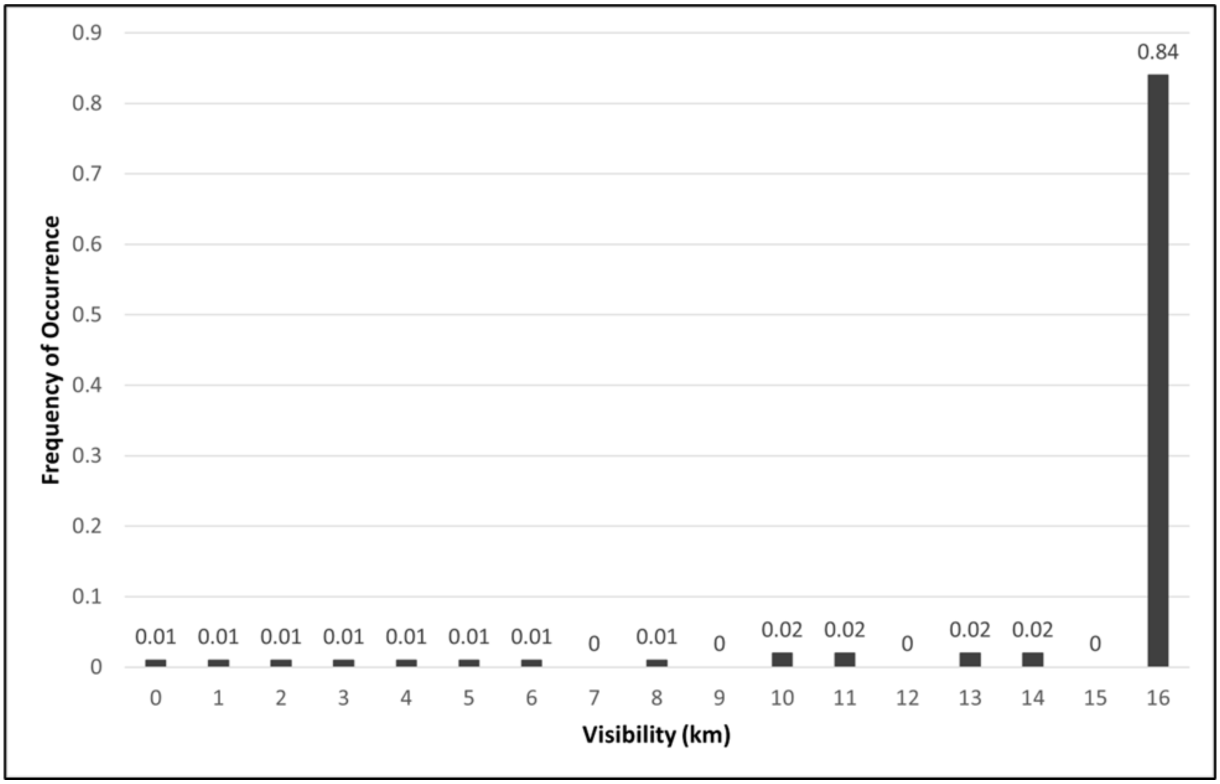


Figure 4.3: Visibility Conditions at the John F. Kennedy International Airport (January 1, 2010 to July 27, 2018)

Seasonally, mean offshore surface current magnitude and direction conditions near the lease area vary. Currents travel towards and vary between the south to south-west directions with magnitudes in the 3 to 5 cm/s (0.06 to 0.10 kts) range (Appendix II-B of COP; Figure 4.4). Mean currents in the Lease Area are influenced by changing seasonal wind patterns, differences in water densities, and tides. The maximum current velocity is dependent upon the storm track. During years where wind behavior is an anomaly and consistently higher, the mean surface currents during the fall can reach a high of 6 to 8 cm/s (0.12 to 0.16 kts; Roarty et al., 2020).

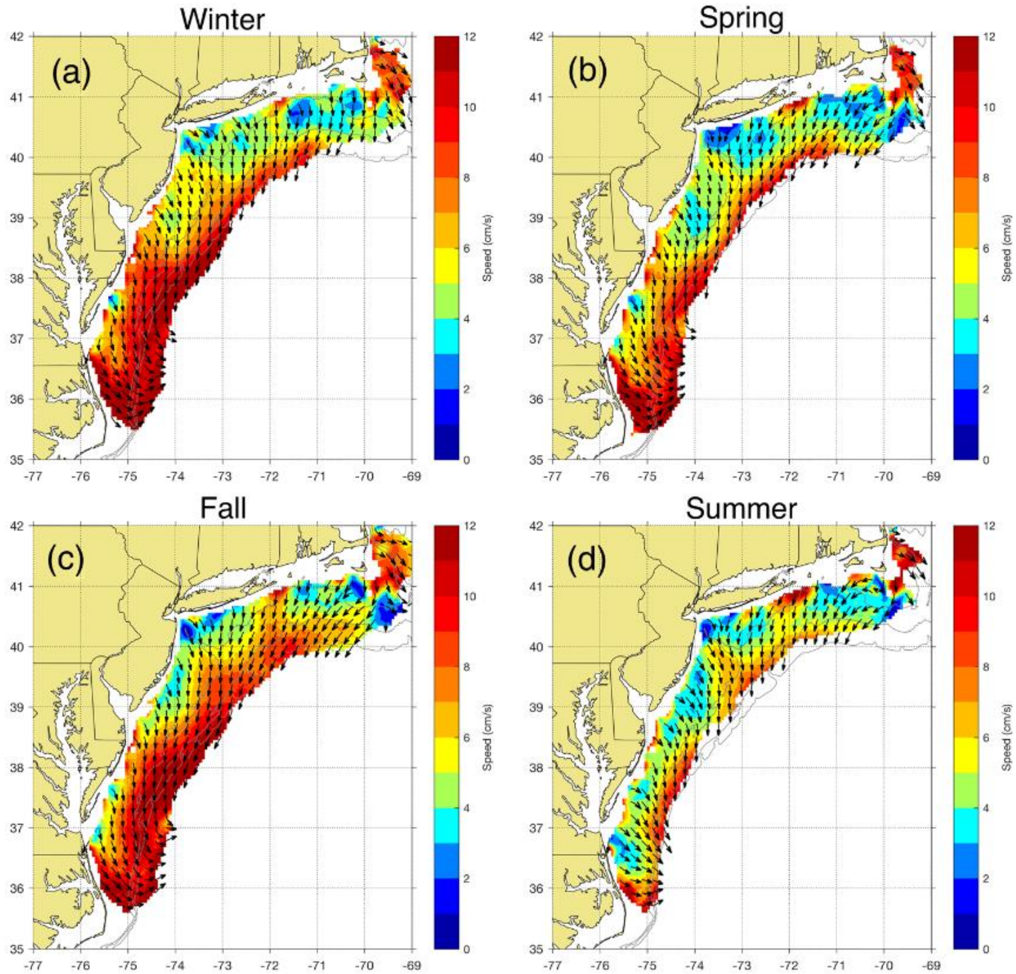


Figure 4.4: Mean surface currents (2007–2016) by season. Color bar indicates magnitude (cm/s) and vectors indicate direction toward of surface current (Roarty et al., 2020)

In terms of navigation, it is not expected that the typically small currents and tidal effects will contribute significantly to risk. However, during more extreme events with strong currents, maintaining proper vessel course can become challenging and maneuverability can be impacted. In addition, in the event of equipment failure and subsequent vessel breakdown, near-surface currents, as well as wind direction, wind strength, and ship characteristics, will dictate the direction and rate at which vessels will drift. Local currents and conditions must be well understood and factored into vessel route planning and emergency protocols.

Given the size and spacing of the proposed structures there is no anticipated impact on currents in the Lease Area's vicinity. Likewise, there are no anticipated impacts on siltation or scour beyond the proposed scour protection. There is no anticipated impact on the air column, water column, seabed, or sub-seabed in the vicinity of the Lease Area beyond those navigation aspects discussed in this NSRA and the non-navigation related impacts presented in the COP.

Ice can affect vessel navigation within an offshore wind farm by two means: (1) collision with floating ice; and (2) ice accretion on turbine rotors that is subsequently thrown by means of centrifugal force or simply falls. Both potential ice conditions were considered.

Analysis of navigation hazards present in the most recent United States Coast Pilot (NOAA 2023) did not indicate the presence of floating ice offshore, although there is a risk of ice closer to fresh water sources and within confined back bay areas inside the barrier islands. Fire Island and Jones Inlets as well as the other bay entrances remain open throughout the year due to tidal flow and offshore currents and waves keep the water moving throughout the New York Bight, so under normal winter conditions, ice does not form offshore on the sea surface. As such, ice formation in open water is not considered a significant source of navigational risk within the vicinity of the Lease Area.

Under certain meteorological conditions ice accretion may occur on WTG blades, presenting a possible falling ice risk if dislodged/ejected. Previous investigations have identified that air temperature, relative humidity, and wind speeds are the key factors controlling the ice accumulation rate (Hudecz [2014], Parent and Ilinca [2011]). Specifically, ice accumulation risk was greatest when air temperatures were less than 0°C, relative humidity (RH) was greater than 95%, and when wind speeds were relatively low (<10 kts [5 m/s]). To evaluate this risk, meteorological data from National Data Buoy Centre (NDBC) ocean buoy (44025) was selected (Figure 4.1). Relative humidity data were only available at JFK Airport. The hours when ice accretion would likely have occurred (wind speeds below 10 kts [5 m/s], air temperatures below 32°F (0°C), and relative humidity above 95%) was determined. The analysis indicated only 1 hour of potential icing, over the analysis period from January 1, 2010 to July 27, 2018, which is 0.0016% of the observations. (Note, periods of missing data were excluded, and these periods represent 19.1% of entire analysis period). It was concluded that the risk of ice formation on the turbine rotors is very low in this area.

The WTG and ESP designs will be reviewed by the third-party Certified Verification Agent (CVA) to verify that the design is able to withstand the site-specific conditions (e.g., sustained wind speeds and gusts) anticipated at the Lease Area. The third-party CVA will conduct an independent assessment of the offshore facilities' design as well as fabrication, installation, and commissioning methods. Prior to construction, the CVA will conduct a facility design review and certify in the Facility Design Reports (FDRs) that the offshore facilities are designed to withstand site-specific environmental and functional load conditions for the duration of the facilities' intended service life. The CVA will also review and certify the Fabrication and Installation Reports (FIRs). During construction, the CVA will conduct periodic on-site inspections to ensure that the facilities are fabricated and installed in conformance with accepted engineering practices, the approved COP, and the FIRs.

5. Navigation Impact Assessment

5.1 Vineyard Mid-Atlantic Configuration & Collision Avoidance

5.1.1 Visual Navigation

5.1.1.1 Marine Navigational Marking and Lighting

Each WTG and ESP will be permitted as a PATON and appropriate markings, lighting, and signaling will be installed in accordance with NVIC 02-33 CH. 1, USCG's *ME, NH, MA, RI, CT, NY, NJ-Atlantic Ocean-Offshore Structure PATON Marking Guidance,*[12] and/or the BOEM's *Guidelines for Lighting and Marking Structures Supporting Renewable Energy Development* (BOEM 2021).[13] Per USCG guidance, the Proponent will include unique alphanumeric identifiers on each WTG and ESP, as indicated in Figure 2.1. All PATONs will meet USCG availability standards and will be maintained throughout the life of Vineyard Mid-Atlantic, including maintaining procedures to correct any discrepancies. The Proponent will provide required information to USCG and/or NOAA to add the WTGs and ESP(s), OECC, and all associated PATONs to appropriate navigation charts.

Based on current USCG, BOEM, and Federal Aviation Administration (FAA) guidance, the following lighting, marking, and signaling requirements are expected; however, all structures will be marked and lit in accordance with USCG, BOEM, and FAA guidance in effect at the time Vineyard Mid-Atlantic is being constructed and operated. The Proponent expects to provide a detailed lighting, marking, and signaling plan to BOEM, the Bureau of Safety and Environmental Enforcement (BSEE), and USCG prior to construction of the offshore facilities. The plan would provide detailed information on the lighting, marking, and signaling of all the WTGs and ESPs.

Structure Color:

- Each WTG will be painted off-white/light grey to reduce their visibility against the horizon. The ESP topsides are expected to be light grey in color.
- Foundation base of all turbines will be painted high-visibility yellow all around from Mean Higher High Water (MHHW) to 50 ft (15.2 m) above MHHW.
- All-around band, retro-reflective material (white, yellow, or silver) will be provided on WTG towers, visible through a 360-degree arc, at least 2-foot (0.6 m) bands around the structure no less than 30 ft (9.1 m) above MHHW.

Structure Identification Marking:

- Each structure (i.e., WTG and ESP) will be uniquely lettered and numbered in an organized pattern as near to rows and columns as possible.
- Letters and numbers on the WTG towers will be as near to 10 ft (3 m) high as possible, at an elevation of 9.1 to 15.2 m (30 to 50 ft) above mean higher high water and duplicated on the top of its nacelle to aid in air identification rendered through use of retro-reflective or high contrast black to maximize visual range for nearby mariners.
- Letters and numbers on the ESP(s) will be as near to 10 ft (3 m) high as possible.

[12] USCG's PATON guidance for offshore wind energy structures in First and Fifth Districts area waters is periodically updated in District 1 and/or District 5 Local Notice to Mariners (LNMs).
[13] Where there are conflicts between BOEM and USCG lighting, marking, and signaling guidance, the Proponent defers to USCG guidance.

- Identification markings will be visible above any servicing platforms (e.g., transition piece platform).
- Structures will also be labelled below the servicing platform, if feasible.
- Identification markings will be visible throughout a 360-degree arc from the water's surface.
- Identification markings on each WTG nacelle will be visible from above.

Structure Lighting:

- Lighting will be located on all structures, preferably on the servicing platform, visible throughout a 360-degree arc from the water's surface.
- WTGs and ESP(s) designated as Significant Peripheral Structures (SPSs) (i.e., located at corners or other significant points on the periphery of the wind farm) will be lighted with quick flashing yellow lights energized at a 5 NM (9.3 km) range.
- Other WTGs or ESP(s) along the outer boundary (Intermediate Peripheral Structures, IPSs) will be lighted with yellow 2.5-second (FL Y 2.5s, 1.0s on 1.5s off, 12 flashes per minute) lights energized at a 3 NM (5.6 km) range.
- All remaining, interior WTGs and ESP(s) will be lighted with yellow 6-second (FL Y 6,1.0s on 5.0s off, 10 flashes per minute) or yellow 10-second (FL Y 10, 1.0s on 9s off, 6 flashes per minute) lights energized at a 2 NM (3.7 km) range.
- All lights will be synchronized by their structure location within the field of structures.
- All temporary base, tower, and construction components preceding the final structure completion will be marked with Quick Yellow (QY) obstruction lights visible throughout 360 degrees at a distance of 5NM (9.3 km).

Sound Signals:

- Sound signals will be located on all structures designated as SPSs (i.e., located at corners or other significant points on the periphery of the wind farm).
- Sound signals will sound every 30 seconds (4 second blast, 26 seconds off).
- Sound signals will be set to project at a range of 2 NM (3.7 km).
- Sound signals will not exceed 3 NM (5.6 km) spacing.
- Sound signals will be MRASS activated by keying VHF Radio frequency 83A five times within 10 seconds.
- Sound signals will be timed to energize for 45 minutes from the last VHF activation.

5.1.1.2 Aviation Obstruction Lighting

The WTGs will include an aviation obstruction lighting system in compliance with U.S. FAA (2017, 2019, and 2020) and/or BOEM (2021) requirements. The aviation obstruction lighting system will consist of two synchronized FAA L-864 red flashing aviation obstruction lights placed on the nacelle of each WTG. If the WTGs' total tip height is 699 ft (213 m) or higher, there will be at least three additional low intensity L-810 flashing red lights on the tower at a point approximately midway between the top of the nacelle and sea level. If approved by BOEM, 30 flashes per minute will be utilized for air navigation lighting. Other temporary lighting (e.g., helicopter hoist status lights) may be utilized for safety purposes when necessary.

The Proponent is working to reduce lighting to lessen the potential impacts of nighttime light on migratory birds and to address potential visual impacts. The Proponent will use an Aircraft Detection Lighting System (ADLS) or similar system that automatically activates all aviation obstruction lights (any FAA lights on both the nacelle and tower) when aircraft approach the WTGs. The ADLS (or similar system) will be active during the operational phase (following installation and commissioning of all WTGs); therefore, the aviation obstruction lights will remain on and flashing during the construction phase. A report on how often the ADLS would likely be activated during the operational phase is included in Appendix II-I of the COP for informational purposes. Aviation concerns are further discussed in Section 5.7 of COP Volume II.

If the height of the ESP(s) exceeds 200 ft (61 m) above mean sea level or any obstruction standard contained in 14 CFR Part 77, the structure will include an aviation obstruction lighting system in compliance with FAA and/or BOEM requirements. If approved by BOEM, 30 flashes per minute will be utilized for air navigation lighting. The aviation lights on the ESP(s) will also be activated by ADLS (or a similar system). Other temporary lighting (e.g., helipad lights) may be utilized for safety purposes when necessary.

5.1.1.3 AIS Marking

AIS systems are used to collect, exchange, present, and analyze information onboard vessels and ashore by electronic means. All Vineyard Mid-Atlantic related vessels will be equipped with operational AIS. AIS transponders are also included in the design of offshore structures (WTGs and ESP(s)) where appropriate to enhance marine navigation safety. These AIS markers would supplement the information on the electronic chart and/or radar overlay. AIS markers will be used to mark, at a minimum, SPSs which are WTGs and/or ESP(s) and can be viewed on an electronic chart display and information system (ECDIS), radar overlay, or a minimum keyboard and display (MKD). The addition of AIS markers will supplement the radar overlay; however, it should be noted that not all vessels have the capacity to receive AIS data and hence, physical aids to navigation would also be employed as described above. The following outlines the AIS reporting structures based on current USCG guidance, which may be modified by the time Vineyard Mid-Atlantic becomes operational:

- AIS devices will be Federal Communications Commission (FCC) certified
- AIS transponder signals will be placed on all SPSs
- AIS transponders will be capable of transmitting signals to mark all locations of all structures throughout Vineyard Mid-Atlantic
- AIS broadcasts will be made at sufficient antenna height and power to provide a relatively uniform coverage extending at least 8 nautical miles beyond the Lease Area
- AIS transponder specifics will be coordinated with the USCG District 1 and approved by USCG headquarters level (CG-NAV)

Subject to USCG's recommendations, the AIS marker system could be installed prior to construction of the turbines in order to facilitate mariners' adaption to the presence of structures in the Lease Area. AIS systems operate on VHF frequency band. Vessels that are equipped and using Class B AIS systems could be recommended to have dual channel receivers to improve the reliability of frequent AIS data updates from multiple targets in the range of reception.

Based on a review of various studies conducted for existing offshore wind fields, and as discussed further in Section 5.1.2.1, the Vineyard Mid-Atlantic WTGs are expected to have little impact on VHF and digital select calling (DSC) communications or AIS reception.

5.1.1.4 Visual Navigation Impacts

The WTGs and ESP(s) will result in a degree of visual blockage for objects or vessels that lie directly beyond and opposite (i.e., behind) the structure from the viewer. The size of object or vessel fully obscured depends on the relative distance between the visual obstruction and both the viewing vessel and the obscured vessel (Figure 5.1). Tables of the maximum size of object fully obscured, as well as the maximum amount of time a 45 ft vessel is fully obscured, are presented in Table 5.1 and Table 5.2 for WTGs with monopile foundations as well as ESP(s) with piled jacket foundations. It is noted that jacket foundations have large amounts of open space between structural members and would result in an object being partially obscured rather than fully obscured. This analysis presumes that the line of sight is perpendicular to the viewing vessel's direction of travel, that the viewing vessel is traveling at 8 kts, and that the object being sighted is stationary.

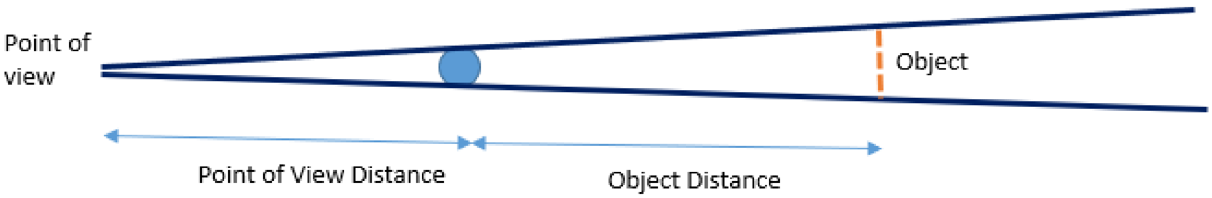


Figure 5.1: Visual Blockage Conceptual Diagram

Table 5.1: Visual Blockage Object Size and Time 45 ft (13 m) Vessel is Fully Obscured at 8 kts Speed for WTG Monopile Foundations

Size of Object Blocked - ft (m)			
Point of View Distance (ft)	Object Distance – ft (m)		
	500 (152)	1000 (305)	1500 (457)
500 (152)	75 (23)	113 (34)	151 (46)
1000 (305)	57 (17)	75 (23)	94 (29)
1500 (457)	50 (15)	63 (19)	75 (23)
Time 45 ft Vessel is Fully Obscured at 8 kts (s)			
Point of View Distance - ft (m)	Vessel Distance – ft (m)		
	500 (152)	1000 (305)	1500 (457)
500 (152)	2	5	8
1000 (305)	1	2	4
1500 (457)	0	1	2

Table 5.2: Visual Blockage Object Size and Time 45 ft (13 m) Vessel is Partially Obscured at 8 kts Speed for ESP Piled Jacket Foundations

Size of Object Blocked – ft (m)			
Point of View Distance - ft (m)	Object Distance - ft (m)		
	500 (152)	1000 (305)	1500 (457)
500 (152)	1247 (380)	1870 (570)	2493 (760)
1000 (305)	935 (285)	1247 (380)	1558 (475)
1500 (457)	831 (253)	1039 (317)	1247 (380)
Time 45 ft Vessel is Partially Obscured at 8 kts (s)			
Point of View Distance - ft (m)	Vessel Distance – ft (m)		
	500 (152)	1000 (305)	1500 (457)
500 (152)	89	135	181
1000 (305)	66	89	112
1500 (457)	58	74	89

As described in Section 2.5.4.1, there are no USCG-maintained ATONs within the Lease Area. The closest lighthouse to the Lease Area is the Fire Island Lighthouse, located on Fire Island, approximately 21 NM (38.9 km) northwest. The lighthouse visibility range is 24 NM, so it is expected that it would be visible at sea level from the northern section of the Lease Area.

5.1.2 Communications, Radar, & Positioning System Impacts (incl. Electromagnetic & Noise)

WTGs, ESP(s), and offshore cables may theoretically distort various types of electromagnetic signals (PIANC 2018), including:

- Radio communications, such as VHF radio;
- AIS;
- Radar systems;
- Global Navigation Satellite Systems (GNSS); and
- Magnetic navigation systems.

The potential effects of Vineyard Mid-Atlantic on these various systems are discussed in this report section.

5.1.2.1 VHF Radio and AIS

Marine vessels typically communicate with each other, with shore-based facilities, and with the USCG by means of VHF radio. These radios are required on vessels greater than 65 ft (19.8 m) in length but are very common on smaller vessels. In general, VHF is intended mainly for short-range communications ("line of sight", normally 10 to 20 NM [18 to 36 km] at sea), although range is affected by the transmission power, height, and quality of the transmitting and receiving antennae. Marine VHF radio has several uses, including voice and digital/data applications, and there are several pre-designated channels regulated by law (see Table 5.3 for a partial listing).

Table 5.3: US VHF Channel Information

Frequency (MHz)	Channel	Use
156.45	9	Boater calling, commercial and non-commercial
156.6	12	Port operations
156.65	13	Bridge-to-bridge safety
156.8	16	International distress, urgency, and safety priority calls
157.1	22A	USCG Maritime Safety Information Broadcasts
156.525	70	Digital Selective Calling
161.975	87B	Automatic Identification System (AIS1)
162.025	88B	Automatic Identification System (AIS2)
162.4 to 162.55	WX1 to WX 7	NOAA Weather Radio marine forecasts, tide predictions, etc.

Source: https://www.navcen.uscg.gov/?pageName=mtvhf

Importantly, digital service calling (DSC) operates in the VHF range. Along with other capabilities, DSC uses digital technology to send an automatic distress signal to the nearest USCG station and to all radio-equipped vessels. The signal identifies the vessel, nature of the distress, and provides contact information. If connected to a Global Positioning System (GPS), the radio also transmits the vessel location.

Also, AIS transponders operate on two specific VHF frequencies, channels 87B and 88B.

VHF operates in a relatively low-frequency band (for example, as compared to marine radar) and is much less affected by WTGs (see for example MCA and QinetiQ 2004). Review of various European studies at sites such as Horns Rev Wind Farm (Elsam Engineering 2004) in Denmark, the Horns Rev 3 Wind Farm (Orbicon 2014), and the North Hoyle Wind Farm (Howard and Brown 2004) indicated that WTGs did not have any significant impact on VHF communications. It was also observed in the Kentish Flat Offshore Wind Farm (BWEA 2007) that AIS-equipped vessels (AIS operates with VHF) did not experience any loss of signal either outside or within the wind farm.

Despite these findings, PIANC (2018) identifies as best practice to carry out a study of radio communication to the extent possible within the constructed turbine field.

5.1.2.2 USCG Rescue 21

Rescue 21 is the USCG's advanced communications and direction-finding communications system designed to locate and communicate with mariners in distress. It helps identify the location of callers in distress by means of towers that generate lines of bearing to the source of VHF radio transmissions (radio direction finding) to reduce search time and has a coverage to a minimum of 20 NM (36 km) from the coast. DSC is an important component of this system. The system is presently operational along the entire Atlantic, Pacific, and Gulf coasts of the continental United States as well as along the shores of the Great Lakes, Puerto Rico, Hawaii, and Guam. Figure 5.2 shows the coverage map for the New York Bight area.

The Rescue 21 system is reliant on VHF transmissions and, as such, would be subject to the same effects mentioned in the previous section.

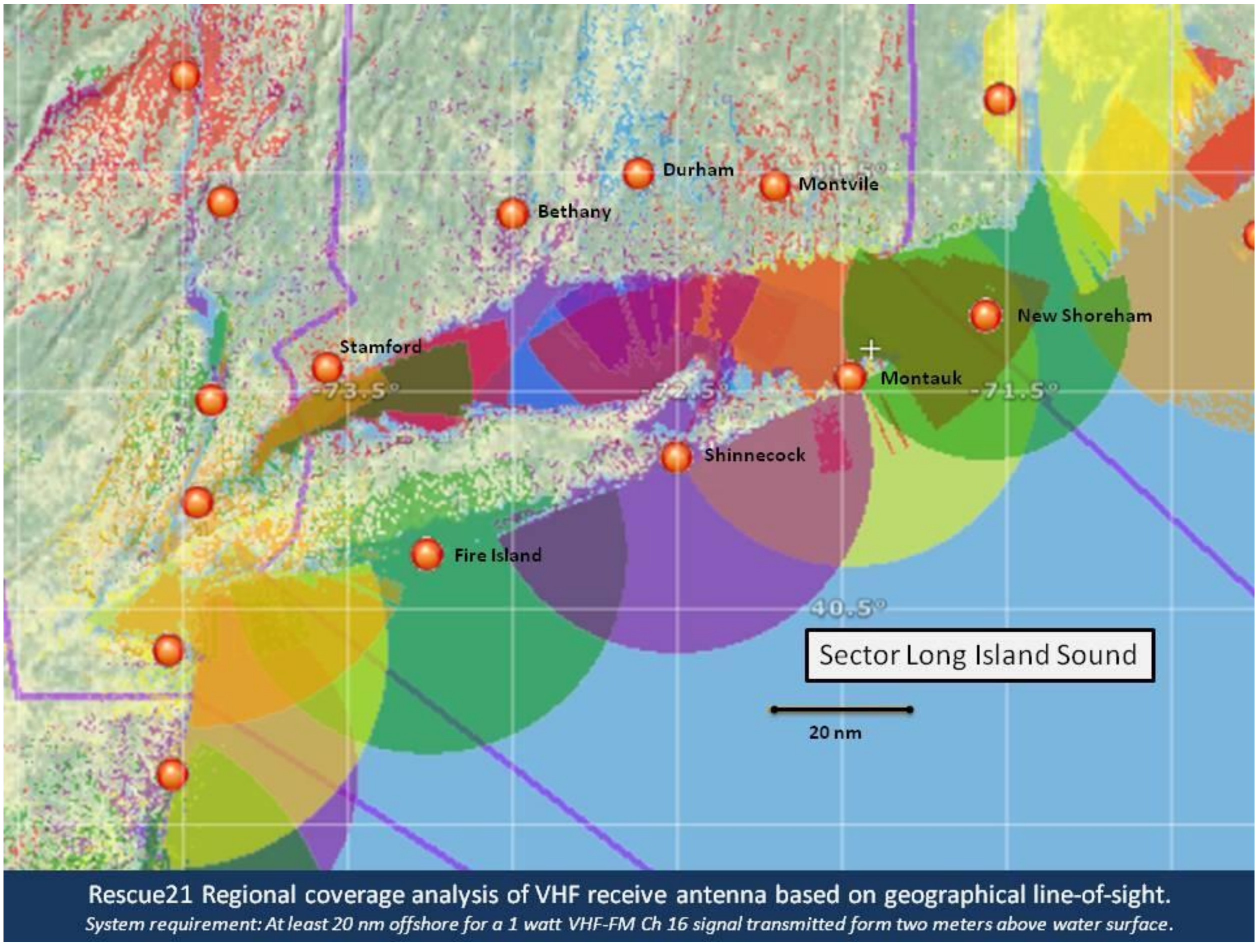


Figure 5.2: Rescue 21 Coverage Map (USCG NAVCEN)

5.1.2.3 Marine Radar Systems

Marine radar is an electromagnetic system used for the detection of ships and obstacles at sea, providing the operator with an estimate of the distance and bearing to any object. It consists of a transmitter producing microwaves, a transmitting antenna, a receiving antenna (generally coinciding with the transmitting antenna), and a receiver with a processor to determine the characteristics of the objects detected. Radio waves from the transmitter reflect off the object and return to the receiver, giving information about the object's location and speed. Depending on purpose, marine radars can operate in two different frequency bands, termed S-band (2.0 to 4.0 GHz) or X-band (8.0 to 12.0 GHz). X-band is used for accurate navigation and to detect objects around the ship. S-band is used for long distance detection and navigation and is less sensitive to sea and rain clutter (unwanted echoes).

Commercial vessels above 3000 Gross Tons are required to carry both types of radar in order to be in compliance with international conventions such as the International Convention for the Safety of Life at Sea (SOLAS). Smaller craft, such as fishing and recreational vessels, tend to carry only X-band. As noted in the MARIPARS report (USCG 2020a), fishing vessels are not required to have radar onboard unless they carry 16 or more people, but most do anyway. If equipped with radar, proper use of the system is required as per the International Regulations for Preventing Collisions at Sea 1972 (COLREGS).

There are three potential sources of signal interference between marine radars and turbine fields:

- Side lobe detections – False targets can show up on the radar display that are at the same distance as the actual targets but are located on a different angle relative to the ship.
- Multiple reflections – When the ship's radar is operating in close proximity to the wind turbines, "ghost" targets and clutter can show on the display due to the interaction of the radar signal with the turbines and ship structure. Re-reflections of the radar signal occur between the ship and turbine.
- Radar shadowing – When structures such as WTGs or ESP(s)are in the line of sight of the radar, shadowing can occur, which reduces the reflected signal of an object that is behind the turbine.

In addition, wind turbines can mask or shadow weaker signal returns from smaller objects within the turbine field (Angulo et al. 2014). PIANC (2018) noted that at distances less than 1.5 NM (2.8 km) from a wind farm, interference from WTGs can generate false targets.

Comprehensive investigations were conducted by the British Wind Energy Association (BWEA) into marine radar effects at the Kentish Flat Offshore Wind Farm (BWEA 2007). In that study, the effect of an existing wind turbine array on the marine radar systems of various types and sizes of vessels passing near the wind farm were documented. Most of the systems tested (two-thirds) experienced false echoes and clutter; however, the spurious echoes were often generated by the ship's structures in combination with the reflection characteristics of the turbines. Trained navigators were able to discern these reflection effects and were able to track other vessels near and within the wind farm. If a small vessel operated in close proximity to a WTG, the return signal of the vessel merged with the signal of the WTG itself and rendered the vessel invisible on the radar system. When the detecting ship was traveling within the turbine array, small vessels proved to be less detectable. Adjustment of the gain setting on the radar could improve the detection in these situations but did require a skilled operator. The Kentish study did identify that often the radar scanner was installed at a poorly selected location on the ships, accentuating the spurious echoes due to the proximity of the ship structures.

As part of the MARIPARS (USCG 2020a), the USCG reviewed several studies related to WTG-induced radar interference and concluded that they were not aware of any authoritative scientific study that confirms or refutes the concern that WTGs will degrade marine radar. It was noted that mariners traveling near or within the WEA "should use extra caution, ensure proper watch and assess all risk factors."

It is important to recognize that there have been significant advances in radar technology in recent years, including Frequency Modulated Continuous Wave transmissions, target detection through Doppler effect, and other similar developments.

In recognition of the concerns associated with radar system impacts, the Wind Turbine Radar Interference (WTRIM) Working Group has been established with the support of a number of agency and partners including BOEM, the Department of Energy, the Department of Defense, the FAA, NOAA, and the Department of Homeland Security. The purpose of the group is to mitigate the technical and operational impacts of wind turbine projects on critical radar missions. The goal is to develop near- (5-year), mid- (10-year) and long-term (20-year) mitigation solution recommendations, recognizing that these will be primarily technology driven. In 2022 the National Academy of Sciences, Engineering, and Medicine published the *Wind Turbine Generator Impacts to Marine Vessel Radar* (NASEM, 2022) which provides a comprehensive overview of marine radar impacts and lays out potential mitigation measures as well as providing recommendations for further work.

In summary, it appears likely that Vineyard Mid-Atlantic, as with many other similar facilities around the world, may have an impact on certain marine radar systems. The principal issue appears to be the shadow effect and the detection of vessels that are located within the turbine field. The issue of radar clutter and false targets when navigating outside the turbine field, as will occur south and east of the Lease Area, is common to wind farms in Europe, some of which are located adjacent to heavily used shipping channels. Vessels do safely navigate outside these wind farms despite the radar impacts. The lighting and marking of the WTGs and ESP(s), as well as the use of AIS and MRASS as per USCG requirements will help mitigate potential allision risk due to the presence of Vineyard Mid-Atlantic offshore facilities.

5.1.2.4 Global Navigation Satellite Systems

GNSSs use satellites to provide autonomous geo-spatial positioning to a high degree of accuracy. There are several GNSSs, including the US GPS. GNSS use a constellation of satellites spread on geo-synchronous orbits. The positioning is achieved by triangulation using line of sight reception from multiple satellites.

Although large structures can block satellite reception, given the relatively small size of the WTG structures and rotors relative to their spacing, it is unlikely that the WTGs would simultaneously block signals from a significant number of satellites visible in the sky. Thus, it is not anticipated that the WTGs will adversely affect GNSS.

5.1.2.5 High Frequency Radar for Current Measurement

NOAA maintains a network of high-frequency radar stations along the coastline, which are capable of measuring currents and wave heights offshore, an example of which is shown in Figure 5.3. These radars can measure currents over a large region of the coastal ocean, from a few miles offshore up to about 60 NM (111 km) and can operate under any weather condition. These systems provide data that is used for a variety of purposes, including aiding search and rescue missions, oil spill response, and marine navigation. In particular, the USCG has integrated the data into their SAR planning systems.

The system operates on a frequency band of approximately 5 to 12 MHz and uses doppler effects to derive ocean currents. There is a documented effect of wind turbines on the doppler shifts used to measure currents and wave heights; however, it is possible that the known interference effects can be partially or fully addressed with additional filtering and software improvements. BOEM sponsored research has recently been completed (Trockel et al 2021) to address and develop mitigations for WTG impacts on high frequency radar systems used for oceanographic measurements.

As part of the COP assessments, Westslope Consulting performed additional analysis on the potential impacts on HF Radar sites which have previously been operational in the project vicinity. Their analysis and a list of potential mitigation options is presented in COP Appendix II-H.

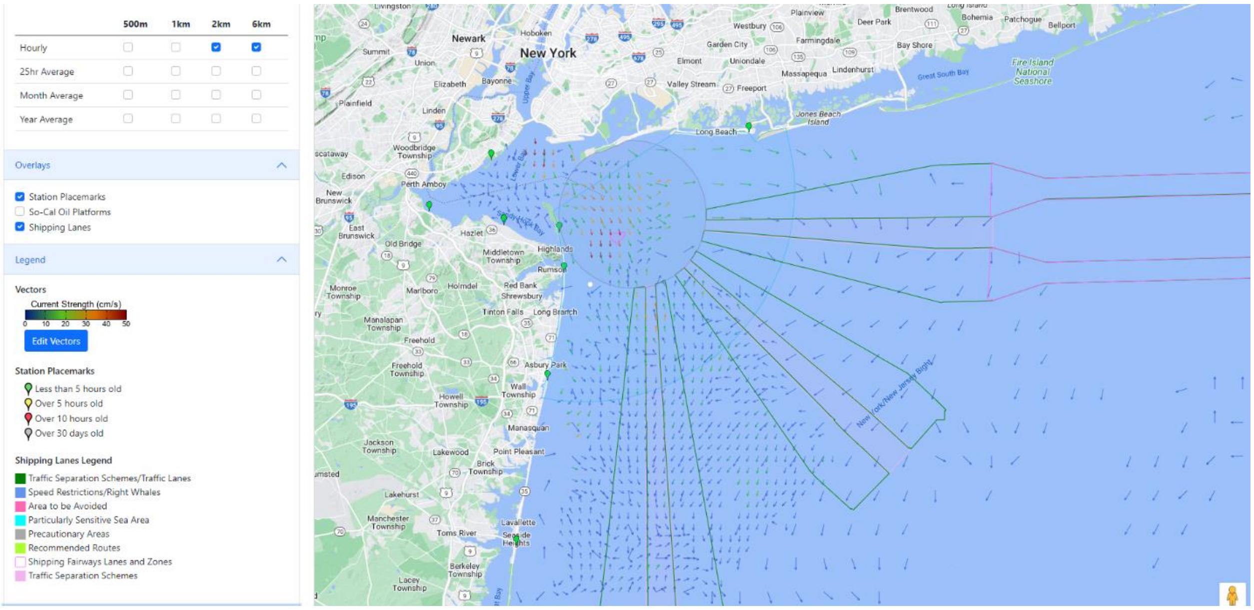


Figure 5.3: Example of Current Fields from HF Radar Output

5.1.2.6 Noise

Sounds of different frequencies are emitted by WTGs as they operate, related to both the aerodynamics of the turbine blades as they rotate and the mechanical sounds of the internal mechanism of the turbine. Noise levels at the turbine can be in the range of 100 to 120 decibels (dB) but diminish rapidly with distance. At a distance of 980 ft (300 m), the sound pressure is in the order of 43 dB, an equivalent level to the noise in a typical home. The New York State Energy Research and Development Authority's (NYSERDA's) (2013) literature review of "Wind Turbine-Related Noise" noted that in several measurement studies, the highest recorded sound levels were in the range of 20 to 50 dB at distances of 1,640 ft (500 m).

The noise emitted from WTGs will not interfere with sound signals from ATONs or other vessels. It also will not affect instrumentation or crew on passing vessels.

5.1.2.7 Sonar

Sonar technology is used by vessels to find fish, determine depth and bathymetric conditions, map the seabed, and identify potential underwater hazards. These instruments use the principle of echolocation to determine the relative position of objects. In active sonar, a sound wave is emitted from a sonar transducer aboard the vessel, which bounces off the object and returns an "echo." The lag time between the emission and response is used in conjunction with the speed of sound underwater to determine distance. In passive sonar, the system does not emit a signal, but only "listens" for signals.

A University of Texas study (Ling et al. 2013) that assessed the effect of offshore wind turbines on various electronic systems noted that wind turbines do not generate underwater noise above background levels at frequencies above 1 kHz. Given that most sonar systems, such as depth sounders, operate at much higher frequencies (25 kHz to 400 kHz typically), it is not expected that the WTGs will affect such equipment.

5.1.2.8 Electromagnetic Interference

The WTGs are not anticipated to generate electromagnetic fields (EMFs), but the inter-array cables, inter-link cables (if used), and export cables could potentially create EMFs. These fields could theoretically interfere with ship equipment only if in very close proximity (within a few feet) of the vessel; however, the water depths at the Lease Area and along the OECC provide a significant physical separation from the vessels. In addition, EMF emissions are greatly reduced due to the effects of cable armor, insulation, bundling, and the target cable burial depth of 4 ft (1.2 m) in federal waters and 6 ft (1.8 m) in state waters beneath the stable seafloor.

The effect of EMFs is expected to be negligible.

5.1.3 Risk to Vessels Under Sail

Potential impacts from Vineyard Mid-Atlantic on sailing vessels, beyond the air draft and other impacts described in the sections above, are expected to be minimal. A slight degree of wind masking and/or increased turbulence in proximity to the WTGs is expected, particularly at higher elevations; however, based on Cunliffe (2021), the impact to sailing vessels is expected to be minimal.

5.1.4 Effect on Anchoring

There will not be any impediment to vessels anchoring within the Lease Area other than the presence of the WTGs and ESP(s) (and associated scour protection) and limited placement of cable protection. The WTG and ESP spacing allows ample space for emergency anchoring of vessels between the structures for the size range of vessel anticipated to continue to operate within the Lease Area, including allowance for an anchor sweep radius. All inter-array, inter-link, and offshore export cables will be buried beneath the stable seafloor at a target depth of 4 ft (1.2 m) in federal waters and 6 ft (1.8 m) in state waters (offshore export cables only). The Proponent's engineers have determined that the target burial depth is at least twice the burial depth required to protect the cables from fishing activities and also generally provides a maximum of 1 in 100,000-year probability of anchor strike, which is considered a negligible risk.

5.1.5 Proximity to Dredge Disposal Sites

There are no active dredge material placement areas in proximity to the Lease Area for which dredge navigation would be affected by the WTGs or ESP(s). The nearest ocean disposal site for dredged material is located approximately 22 NM (40.7 km) southwest from the Lease Area (see Section 2.5.4.3).

5.1.6 Vessel Emissions

The Lease Area is located within the North American Emission Control Area (ECA). More stringent emission and fuel sulfur content standards apply to ships operating within the North American ECA, which extends approximately 200 NM from the US coastline. Fuel switching activities to comply with the North American ECA fuel standards would occur at the ECA boundary well outside of the Lease Area. Thus, there are no anticipated effects resulting from changes in emission/fuel standards upon entering the North American ECA on vessel traffic patterns or collision/allision risks in the Offshore Development Area.

5.1.7 Temporary Safety Zones

Temporary safety zones may be requested to be established by USCG under authority of 33 CFR Part 147 around work areas during construction, maintenance, and/or decommissioning activities. Temporary safety zones are used to help ensure safety within the vicinity of active work areas. These zones would only affect discrete portions of the Lease Area or OECC at any given time. See Section 8.1.1 for a description of temporary safety zones.

6. Risk of Collision, Allision, or Grounding

A quantitative navigational safety risk assessment was conducted for the Lease Area. The analysis was carried out for both the pre-construction and operational (post-construction) phases of Vineyard Mid-Atlantic, to determine the impact and relative change in navigational risk due to the installation of the WTGs and ESP(s). The navigational safety risk assessment was carried out using Baird's proprietary Navigational and Operational Risk Model (NORM); refer to Appendix D for a more detailed outline of the model capabilities and methodology.

6.1 Navigational and Operational Risk Model (NORM)

NORM is a model developed by Baird to assess and quantify navigational risk for both open water and defined waterway conditions. It is a statistically based model that uses raw AIS traffic inputs, bathymetry data, navigational charts, metocean conditions, and fixed structure information (i.e., WTGs, platforms, etc.) to calculate the risk of various accident scenarios. NORM can calculate the occurrence frequency of vessel grounding, head-on collisions, overtaking collisions, crossing collisions, powered allisions, and drifting allisions. These calculations can be performed for intra-class, inter-class, and overall traffic risk analyses.

NORM employs a widely adopted and accepted methodology for calculating navigational risk that is described in the equation below:

$$N_a = P_a * n = P_g * P_c * n$$

Where N_a is the number of accidents occurring over a given period (typically one year), P_a is the probability of an accident occurring, n is the number of vessels over a given period, P_g is the geometric probability of an accident occurring, and P_c is the causation probability. The causation probability is the probability that a potential accident will in fact occur once vessels are on a potential collision/allision course.

The number of vessels considered (n) was obtained from AIS data, while the geometric and causation probabilities have been derived from literature using raw AIS data as input. For calculating the geometric probability of an accident, a widely adopted methodology outlined in Zhang et al. (2019) is employed, which stems from original work outlined in Pedersen (2010).

Causation probabilities have historically been computed using fault tree analysis, Bayesian networks, or derived from historical accident data. NORM utilizes the base causation factors developed by Fuji and Mizuki (1998), rooted in historical observations. These causation factors have been widely applied in the industry and have been used as default factors for navigational risk models, such as IWRAP (IALA n.d.).

Note that causation factors relate to the ability of the vessel to avoid a potential collision or powered allision. Thus, drifting allisions do not make use of causation factors as the vessel is assumed to have lost the ability to maneuver. Instead, a probability (based on Zhang et al. 2019) is used to quantify the frequency of vessels becoming inoperable and being in a potential drifting allision scenario.

The base causation factors may be subsequently modified to account for site-specific conditions, including such considerations as pilotage, tug use, weather conditions, Vessel Traffic Services, and similar.

6.2 Accident Scenarios

The navigational safety risk assessment was carried out for two main categories of accident scenarios: vessel collisions and vessel allisions with WTGs and ESP(s). Average water depths at the WTGs and ESP(s) locations are 42.5 m (Appendix E), because these depths are much larger than vessel drafts in the study area, vessel grounding risk was not considered. Collisions are further broken down into head-on, overtaking, and crossing collisions. Allisions are further broken down into powered and drifting categories. The navigational safety risk assessment resulted in occurrence frequencies and recurrence intervals (return periods) for each potential accident scenario, followed by consideration of the consequences.

6.3 Study Area

To perform the navigational safety risk assessment, the study area was carefully chosen to only contain traffic that may be affected by the WTG and ESP positions. If an overly large area is chosen, it may contain a considerable amount of traffic that may never actually experience any impacts due to the WTG/ESP position, resulting in an underestimation of the change in navigational risk. If an overly small area is chosen, the analysis may only consider vessels that are affected by the WTG/ESP position, biasing the model results towards an overestimation of the change in navigational risk.

The study area used for the navigational safety risk assessment is shown in Figure 6.1. The study area encompasses an approximately 2,317 km^2 (572,543 acre) region around the Lease Boundary and was elongated in the eastward-direction and includes the two traffic separation zones to the south and west of the Lease Area and one to the north. As mentioned above, this area was chosen to best capture only the vessel traffic that may be appreciably affected by the installation.

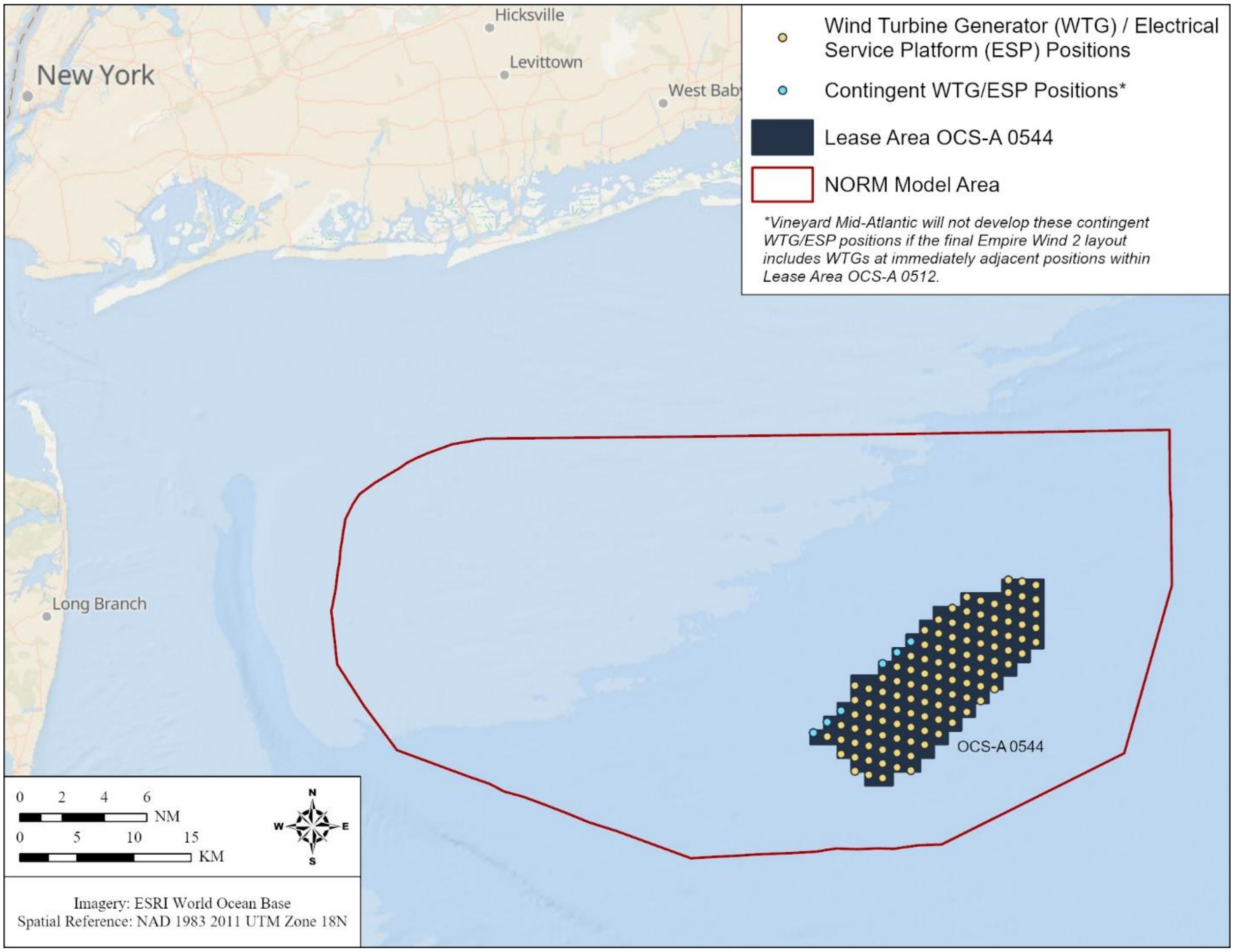


Figure 6.1: NORM Model Area

6.4 AIS Traffic Inputs

NORM makes use of AIS inputs to analyze vessel and traffic patterns and characteristics and is also used to develop statistical relationships used for the risk calculations. For this study, the same set of AIS data was used (Section 2.5.2) from July 2017 through June 2022, clipped to the extents of the NORM area (Figure 6.1). The AIS data was processed and analyzed to determine statistics and distributions of vessel/traffic characteristics within the NORM study area (i.e., length, beam, speed, annual volume, etc.) as well as to determine the range and distribution of track characteristics (e.g., track lengths, crossing angles, etc.). Appendix D outlines NORM's usage of AIS data in further detail.

6.5 Metocean Inputs

6.5.1 Winds

The distribution of near surface current winds and directions are correlated to drifting vessel directions and are used in the drifting allision risk calculations. Near surface wind speeds and directions were extracted from the

National Data Buoy Center (NDBC) Station 44025 (Long Island - 30 NM South of Islip, New York). Wind data and directions distributions were calculated for the period between January 1, 2012, to December 31, 2021.

6.5.2 Visibility

Adverse visibility conditions in potential accident scenarios can reduce vessel reaction and response time and lead to increased navigational risk. According to Fujii and Mizuki (1998), the causation factors utilized by NORM were obtained from historical data where visibility was less than 0.5 NM (1 km) approximately 3% of the year. They also state that the influence of adverse visibility conditions on the causation probability (and thus navigational risk) is approximately inversely proportional to visibility. Suggestions are then provided by these researchers to scale the causation factors by a factor of two if the frequency of visibility less than 0.5 NM (1 km) is between 3% to 10%, and by a factor of eight if it is between 10 to 30%.

The visibility conditions were obtained from NOAA Weather Data for the John F. Kennedy International Airport (JFK) from January 1, 2010, to July 27, 2018. Based on this data and the research, a visibility multiplier factor of one was used in all NORM modeling scenarios.

6.6 GIS and Geometric Inputs

To calculate the navigational risk in the presence of the constructed WTGs and ESP(s), GIS layers of the WTG and ESP positions were used as inputs for the NORM. The positions of the WTGs and ESP(s) and the navigation paths between the positions are detailed in Section 3.

To characterize the potential navigational risk, two scenarios were modeled: (1) a monopile scenario that assumed all positions as WTGs with monopile foundations, and (2) a jacket scenario that assumed all WTGs and two ESP(s) utilized jacket foundations. The jacket scenario provides a conservative assessment of risk as all WTGs are expected to be installed on monopile foundations.

A dimensional range of 54.13 ft (16.5 m) to 624 ft (190.0 m) in width was assumed to encompass the range of maximum sizes for the different WTG/ESP foundation types. For the monopile scenario, monopiles for WTGs were assumed to have a maximum diameter at the waterline of 37.73 ft (11.5 m) with an extra 16.40 ft (5 m) to account ancillary structures assuming they do not cover the entire circumference of the monopile. For the jacket scenario, the max dimension of piled jackets for WTGs on the diagonal was assumed to be 239 ft (73 m). Piled jackets for ESP(s) were assumed to have a maximum dimension (on the diagonal) of 624 ft (190.0 m) at the waterline. (Note, this is based on a cylinder with a diameter of 624 ft [190 m] at the waterline being circumscribed around the rectangular footprint of the jacket structure.) Further, representative ESP(s) on piled jackets were located within the Lease Area to provide a conservative estimate of risk from ESP installation. The two ESPs on piled jackets were presumed to be located in the southwest and northwest corner of the Lease Area, as shown in Figure 6.2.

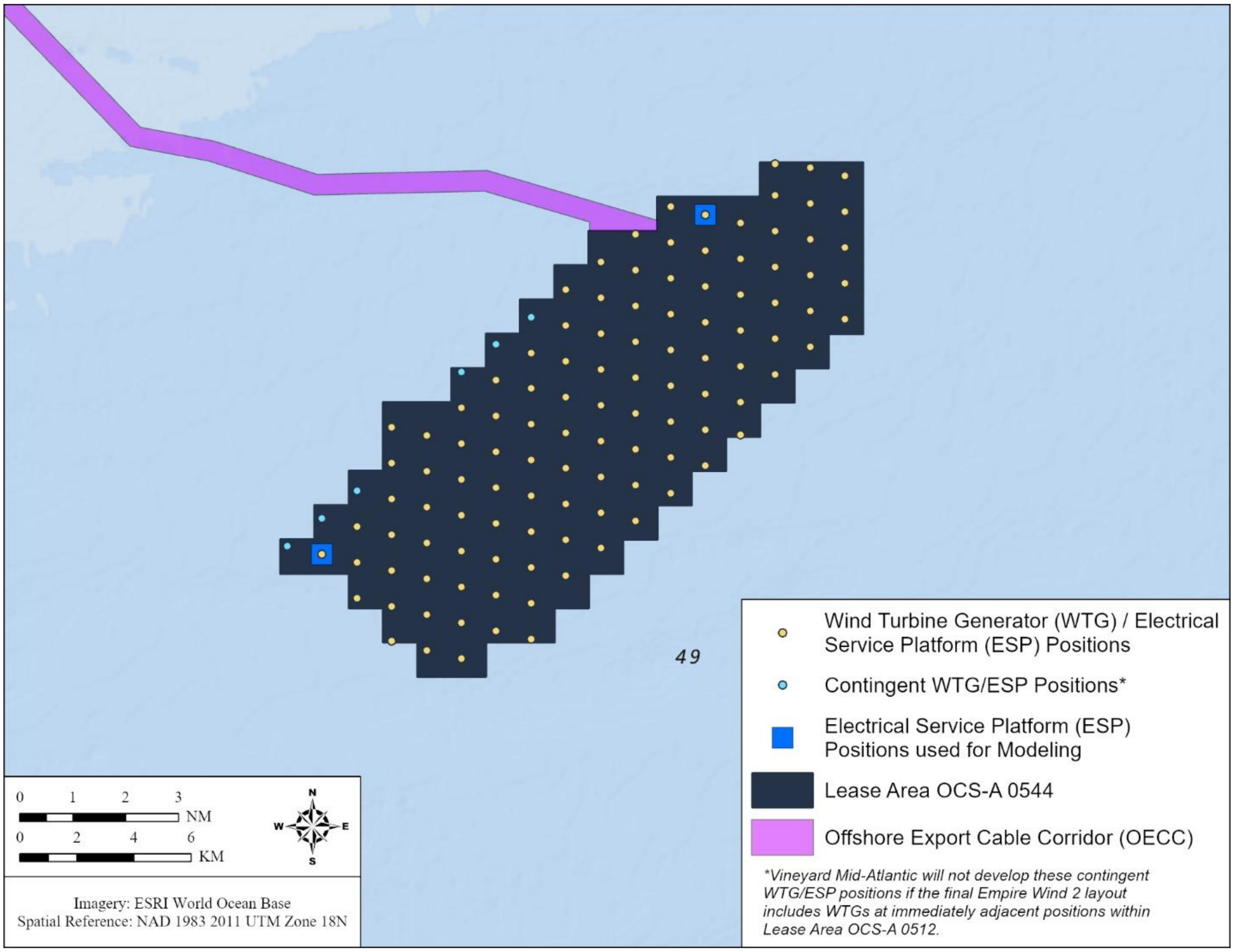


Figure 6.2: Representative Locations of the Two ESPs Used in the Risk Modeling

6.7 Data Adjustments and Assumptions

To compute accident frequencies using NORM, several assumptions were necessary. These assumptions lead to inherent limitations in the modeling approach that are listed and briefly described in this section.

For the vessel characteristics used in the risk calculations (e.g., length, beam, speed, etc.), the 50% percentile (median) value recorded in the AIS data within the NORM study area was considered representative. A set of representative vessels for each AIS type was used for all NORM calculations.

As part of NORM's capabilities, an inter-class overtaking calculation is performed. This calculation would then essentially have two representative vessels of the same type traveling at the same speed, resulting in a null risk of overtaking collision. To account for this limitation, it was assumed that in this situation one of the vessels would be traveling at 50% of the speed of the other.

In the NORM area, there are potential encounters between vessels from various angles. To separate parallel/opposing encounters from oblique encounters (i.e., potential head-on and overtaking collisions from crossing collisions), a crossing angle threshold of 10 degrees was assumed. Encounters occurring at angles greater than 10 degrees were considered crossings, whereas angles less than 10 degrees were considered either head-on or overtaking, depending on direction.

The metocean conditions were used as inputs for NORM's drifting allision methodology to determine the drift direction following a vessel breakdown. Near surface winds were deemed to be of greater influence than currents; thus, it was assumed that the drift direction distribution is equal to the wind direction distribution. Secondly, a constant drift speed was assumed of 2 kts (1 m/s). While the drift speed will ultimately determine the maximum drift extent during a given time period, sensitivity testing of this parameter revealed that it was not a highly sensitive parameter, and the chosen value is in line with frequently occurring surface currents.

The causation factors used by NORM are derived from historical accident data and have been widely used in many navigational risk studies (Fuji and Mizuki 1998). While they are in general agreement with causation factors independently determined from different historical datasets (IALA n.d.), all these datasets have the limitation that they were derived from a particular location with conditions that may not necessarily be reflective of conditions in another location. The relative uniformity in the spread of causation factors independently determined suggests that the values employed by NORM are generally representative and applicable to the Offshore Development Area. In addition, the probability of causation was kept consistent between the pre-construction and operational phase scenarios so the relative change in risk could be evaluated.

Only commercial vessels greater than 65 ft (20 m) length overall are required to carry AIS under USCG requirements. This can lead to an underestimation of vessel traffic, particularly for recreational and small fishing vessels which make up a large portion of vessel traffic in the NORM area. Based on past experiences performing NSRAs in the region, a value of two (i.e., an AIS adoption rate of 50%) was chosen for fishing and recreational vessels.

As part of the post-construction NORM modeling, synthetic tracks were created that avoid the WTGs once constructed. Two scenarios considered include the Lease Area OCS-A 0544 only and a cumulative scenario which adds the buildout of the adjacent Lease Area OCS-A 0512. Commercial fishing and recreational vessels were assumed to transit through the Lease Area around the WTGs and ESP(s). Whereas the larger commercial cargo vessels are assumed to route around the Lease Area. Rerouting was based on typical vessel operational behavior and historical traffic patterns. Greater detail on the approach can be found in Appendix D.

Further, several survey vessels in the AIS traffic analysis that was used that may not be representative of the post-construction traffic, but they were not excluded in the analysis as it remained intractable to determine whether or not these vessels were solely performing survey activities or additionally performing other activities, such as fishing. In this sense, results can be considered conservative. These survey vessel types are represented in the “other “vessel category.

6.8 Navigational Risk Results

This section presents the results of the quantitative navigational safety risk assessment for Lease Area OCS-A 0544. Three scenarios were modeled using NORM: one for the pre-construction (present) conditions, one for the post-construction conditions with Lease Area OCS-A 0544 only, and another for cumulative post-construction conditions, which includes the additional Lease Area OCS-A 0512. The NORM model was run using AIS data from July 2017 to June 2022. Performing pre-construction and post-construction scenarios individually allows for a comparison of the relative change in risk due to Vineyard Mid-Atlantic.

6.8.1 Pre-construction

The AIS data used in NORM covers July 2017 to June 2022 inclusive. The navigational risk calculated using inputs from this period is considered as the reference point for future comparisons. Table 6.1, Table 6.2, and Figure 6.3 present NORM's output for this pre-construction scenario in terms of average collision frequency per year and as average recurrence intervals. The average recurrence interval, or "return period", is computed as the inverse of the annual frequency. It is a statistical measure of the expected average time between "events" (i.e., a collision). For example, a risk of 2.0E-5 (0.00002) incidents per year is equal to an average recurrence interval of one incident per 50,000 years.

Table 6.1: Estimated Pre-construction Inter-class Collision Annual Frequencies

Vessel Class	Collisions	Total
Tug	2.75E-05	2.75E-05
Tanker	5.93E-04	5.93E-04
Recreational	6.69E-04	6.69E-04
Passenger	3.77E-04	3.77E-04
Fishing	1.77E-03	1.77E-03
Cargo	1.09E-03	1.09E-03
Other	2.56E-05	2.56E-05
All	4.55E-03	4.55E-03

Table 6.2: Estimated Pre-construction Inter-class Collision Average Recurrence Intervals (Years)

Vessel Class	Collisions	Total
Tug	36,310	36,310
Tanker	1,687	1,687
Recreational	1,495	1,495
Passenger	2,655	2,655
Fishing	564	564
Cargo	919	919
Other	39,003	39,003
All	219.7	219.7

1. *Average Recurrence Interval refers to the average time in years between collision events.*
2. *For clarity ground risk is not shown above 1,000,000 year expected return periods.*

As can be seen in Table 6.1, much of the pre-construction navigational risk is associated with fishing, recreational, tanker, and cargo vessels, due to the volume of traffic associated with these vessel categories.

Much of the pre-construction navigational risk is a result of crossing collisions in comparison to head-on and overtaking scenarios. Given the well-defined traffic separation scheme to the south and north of the Lease Area, most of the traffic traverses the NORM area in one-way traffic lanes, thus minimizing the probability of head-on collision scenarios; however, fishing and recreational vessel classes do not necessarily travel following the traffic separation scheme, and there are active fishing grounds intersecting these traffic lanes. As a result, overtaking crossing risk is greater.

Overall, the total frequency of all accident scenarios for all vessel classes was calculated to be 0.00455 accidents per year (0.455% annual probability), corresponding to an approximately 219.7-year average recurrence interval.

The SAR incident data presented in Section 7.1 indicates that the collision incident frequency in the area is very low and the NORM model is within the statistical uncertainty associated with the observed incident rate in the vicinity of the Lease Area.

6.8.2 Post-construction

The operational phase (post-construction) scenario was carried out in NORM using synthetic post-construction vessel track dataset and incorporating the 118 WTG and ESP positions as obstacles into the model.

Vineyard Mid-Atlantic's O&M vessels are expected to transit to and from the Lease Area. This was accounted for in the NORM model by assuming: (1) All O&M tracks originate from a port in New York Harbor, (2) transit to the Lease Area in eastbound TSS north of the Lease Area, and (3) return to port through the westbound TSS south of the Lease Area.

It was assumed that these vessels will consist of crew transfer vessels (CTVs) originating from this location (as use of CTVs produced the largest number of transits). The CTVs were conservatively assigned a 98 ft (30 m) LOA, 33 ft (10 m) beam, and an average speed of 10 kts. Though it is expected that CTVs will be smaller than these dimensions, this assumption leads to more conservative (higher) estimates of collision risk. The volume of O&M traffic was estimated to be up to 575 round trips per year. O&M tracks are assumed to be distributed equally in space throughout each navigation path.

As explained in Section 6.6, allisions were carried out in NORM for two post-construction scenarios: the first was a monopile scenario that assumed all positions were occupied by WTG(s) with monopile foundations with a diameter of 54.13 ft (16.5 m); the second was a more conservative jacket scenario that a) assumed two ESP(s) installed on jacket foundations were located in the southwest and northwest corners of the Lease Area (areas with higher traffic density which generate highest risk) and, b) all WTG(s) have piled jacket foundations[14] with a circumscribed diameter of 239 ft (73 m). In the second, jacket, scenario ESP(s) in the Lease Area were modeled based on a piled jacket foundation with a circumscribed diameter of 624 ft (190 m) at the waterline.

Table 6.3 shows the NORM model results for the post-construction scenarios as an annual accident frequency. Table 6.4 presents the same information as recurrence intervals; Figure 6.3 also graphically presents a comparison between the pre-construction and post-construction scenarios.

The increase in accident frequencies is generally dominated by crossing collisions and mostly by fishing and recreational vessels. For the post-construction phase, there are also the contributions from potential collisions with O&M vessels, which becomes a factor that increases frequencies in the post-construction phase. Note that all collision and allision scenarios between Vineyard Mid-Atlantic's O&M vessels and structures or other O&M vessels are neglected. Overall, the allision results suggest that jacket-type foundations result in slightly

[14] The jacket scenario provides a conservative assessment of risk as all WTGs are proposed to be installed on monopile foundations.

more overall risk than monopile type foundations. Due to the local water depth, vessel draft characteristics, and frequency and distribution of vessel traffic, grounding does not pose a serious risk to navigation in the area.

Table 6.3: Estimated Post-construction Inter-class Collision/Allision Annual Frequencies

Vessel Class	Collisions	Allisions	Total
Tug	2.92E-05 (2.92E-05)	7.36E-06 (1.24E-05)	3.66E-05 (4.16E-05)
Tanker	5.89E-04 (5.89E-04)	4.25E-05 (4.90E-05)	6.32E-04 (6.38E-04)
Recreational	7.25E-04 (7.25E-04)	2.77E-04 (6.33E-04)	1.00E-03 (1.36E-03)
Passenger	3.95E-04 (3.95E-04)	2.58E-05 (2.86E-05)	4.20E-04 (4.23E-04)
Fishing	1.87E-03 (1.87E-03)	2.36E-03 (4.80E-03)	4.23E-03 (6.67E-03)
Cargo	1.11E-03 (1.11E-03)	9.68E-05 (1.08E-04)	1.20E-03 (1.22E-03)
Other	2.36E-05 (2.36E-05)	1.40E-05 (2.01E-05)	3.76E-05 (4.36E-05)
O&M	3.12E-04 (3.12E-04)	-- --	3.12E-04 (3.12E-04)
All	5.05E-03 (5.05E-03)	2.82E-03 (5.65E-03)	7.87E-03 (1.07E-02)

Note that results for both the monopile and jacket scenarios are presented. The results for jacket foundation types are presented in parentheses. Dashes indicate the annual frequency is less than 1E-14.

Table 6.4: Estimated Post-construction Inter-class Collision Average Recurrence Intervals (Years)

Vessel Class	Collisions	Allisions	Total
Tug	34,229 (34,229)	135,785 (80,827)	27,338 (24,046)
Tanker	1,697 (1,697)	23,546 (20,398)	1,583 (1,566)
Recreational	1,379 (1,379)	3,614 (1,579)	998 (736)
Passenger	2,534 (2,534)	38,791 (34,978)	2,379 (2,363)
Fishing	535 (535)	424 (208)	236 (150)
Cargo	902 (902)	10,326 (9,234)	830 (822)
Other	42,424 (42,424)	71,314 (49,823)	26,600 (22,913)
O&M	3,207 (3,207)	-- --	3,207 (3,207)
All	197.9 (197.9)	354.5 (177.0)	127.0 (93.4)

1. Average Recurrence Interval refers to the average time in years between collision events.

Note that results for both the monopile and jacket scenarios are presented. The results for jacket foundation types are presented in parentheses. Dashes indicate the annual frequency is less than 1E-14.

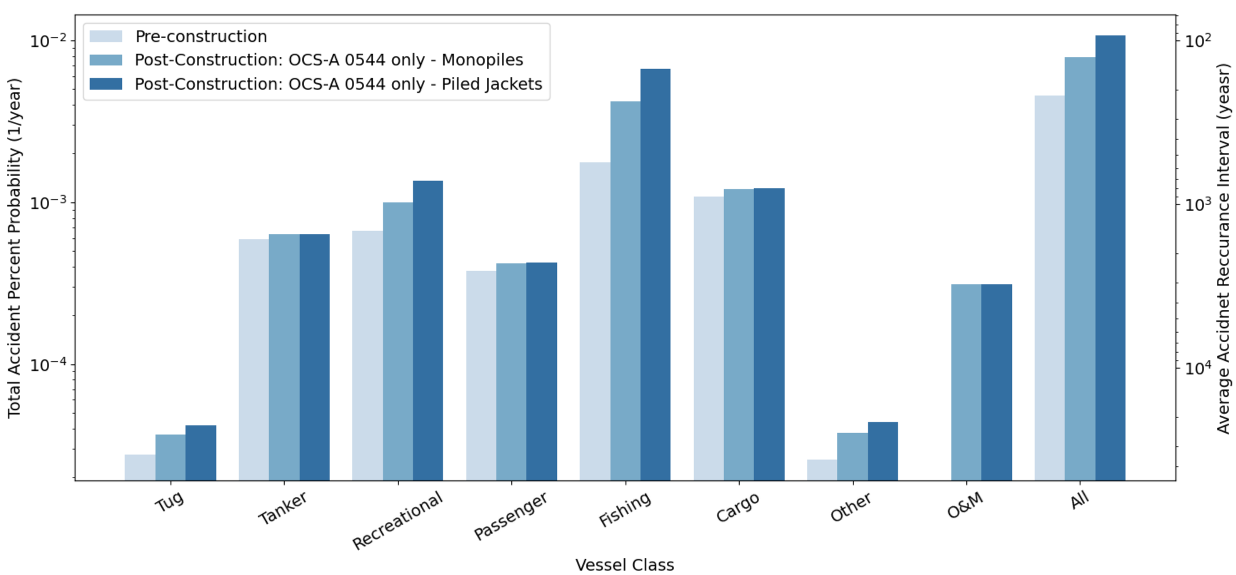


Figure 6.3: NORM Results for Pre-construction and Post-constructions Phases by Vessel Type (for Monopile and Piled Jacket Scenarios)

6.8.3 Interpretation of Results

The NORM model predicts relatively low frequency of accidents in the analysis area under existing conditions with an average accident recurrence interval of approximately 220 years. The large commercial vessels generally follow well defined traffic patterns due to the traffic lanes of the TSSs located north and south of the Lease Area. Fishing vessels have the largest percentage of tracks in the lease area and have the highest potential for a collision. The probability of an accident increases post-construction with the average recurrence interval decreasing to 127 years for monopile foundations, representing an additional accident once every 300 years on average. The average recurrence interval for piled jacket foundations was estimated to decrease to 93 years, representing an additional accident once every 163 years on average. The bulk of the increase in frequency arises from two sources: (1) the presence of O&M vessels, which add to the overall vessel traffic volume; and (2) allision potential with the WTGs and ESPs. The larger piled jacket foundation footprints slightly increase calculated allision risk as compared to the monopile foundation.[15]

The collision avoidance measures outlined in Section 5.1 are expected to maintain safe operation of vessels both day and night, and in all weather conditions. No prohibitions or restrictions on navigation are proposed with the exception of the temporary construction measures outlined in Section 8.1.1.

6.8.4 Potential Consequences of an Allision with a WTG or ESP

There are two types of potential allision (i.e., drifting and powered) each with different potential consequences. A drifting allision is the result of an inoperable vessel (generally, a mechanical breakdown) drifting due to environmental conditions. During such an event, the vessel drift speed will be low (assumed at 1.9 knot [1.0 m/s]), as it is moved by the actions of wind and current, and results in a smaller amount of energy transfer during impact as compared to a powered allision. Given that the traffic expected to be transiting within the Lease Area during the operational phase is comprised of recreational and fishing vessels with relatively small sized vessels, it is not anticipated that there would be any appreciable structural damage to the WTGs or ESP(s) for either type of allision. The potential damage to the vessel is expected to be moderate due to the low speed, though wave conditions will be important in the outcome.

For a direct-powered allision event, the consequences could be severe depending on the vessel characteristics and approach conditions. Most of the traffic expected to transit through the Lease Area after construction (and thus at risk of powered allisions) will be either recreational or fishing vessels. As such, the small size of the vessels in relation to the WTG and ESP foundations would likely result in only minor consequences for the WTG or ESP and likely more damage to the vessel. In addition, fishing vessels undertaking fishing activities in the Lease Area would be traveling at low speeds, typically less than 4 kts. The consequences to the vessel may be moderate to severe, depending on the speed of the allision, and could result in crew injury or may be life threatening.

Larger vessels (e.g., cargo, tanker, passenger) will likely be present near the perimeter of the Lease Area as the TSS is located near the southern boundary of the Lease Area and vessels transiting to or from the Port of New York/New Jersey are expected to reroute around the Lease Area. In the unlikely event one of these larger vessels drifts off-course and strikes a perimeter WTG or ESP at speed, the consequences could be significant. Structural damage could be experienced by the WTG or ESP structure, though the design of the WTGs and ESP(s) considers an allision potential. The vessel may also be significantly damaged, the crew may be injured, and/or the vessel may lose cargo containment. As noted previously, the NORM model reported overall allision risk that was very small with average recurrence intervals of greater than 177 years.

[15] The jacket scenario provides a conservative assessment of risk as all WTGs are proposed to be installed on monopile foundations.

6.9 Future Vessel Traffic Changes Resulting from Vineyard Mid-Atlantic

The proposed development of the Lease Area will have some potential impacts on future vessel traffic, particularly with respect to commercial fishing and recreational vessels which are the primary vessels which presently transit through the Lease Area based on the AIS traffic analysis. Figure 6.4 presents a selection of prevailing transit routes of commercial fishing vessels through the Lease Area and various alternative bypass routes to avoid the Lease Area during and post-construction. Table 6.5 presents a summary of the transit distances and estimated transit times (based on an assumed transit speed in the AIS dataset). The impact on the transit time because of bypassing the Lease Area is relatively small (typically 3 to 11 minutes or less). Figure 6.5, Figure 6.6, and Figure 6.7 present similar existing transit routes through the Lease Area and bypass routes for recreational, cargo and tanker, and tug vessel types and the impact on transit times because of bypassing the Lease Area, which is also found to be 1 to 30 minutes or less.

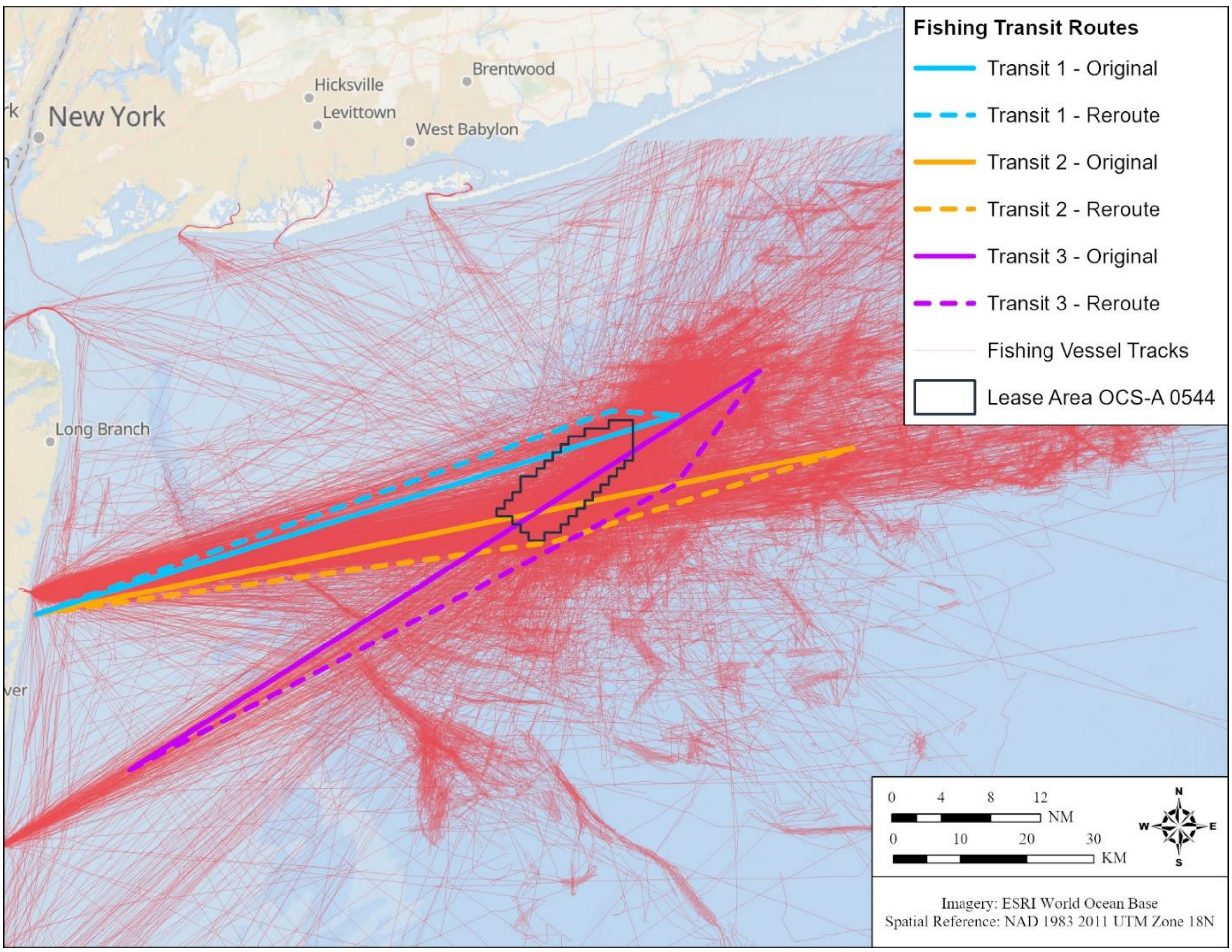


Figure 6.4: Analysis of Transit Routes for Commercial Fishing Vessels: Existing and Post-construction (Bypassing Lease Area)

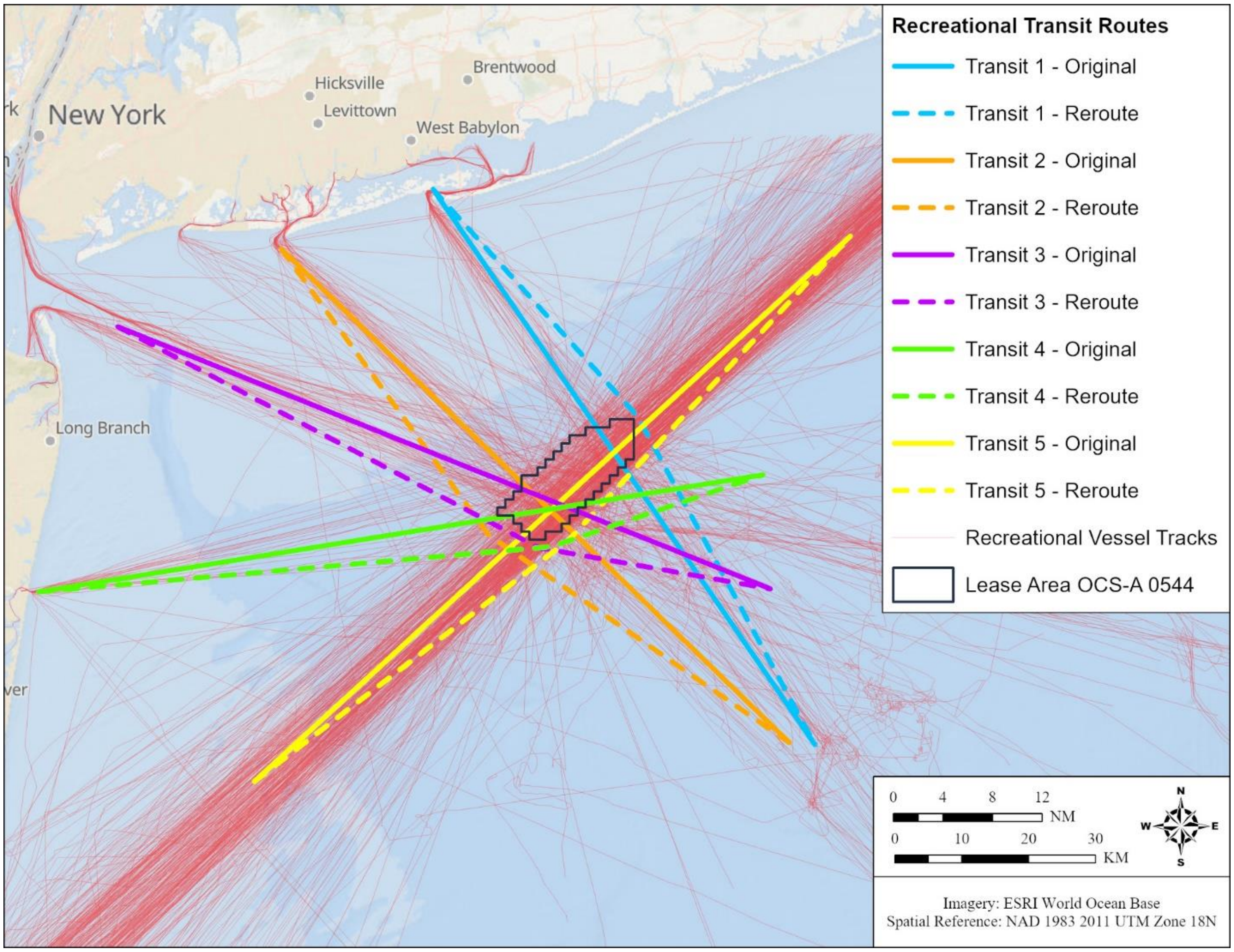


Figure 6.5: Analysis of Transit Routes for Recreational Vessels: Existing and Post-construction (Bypassing Lease Area)

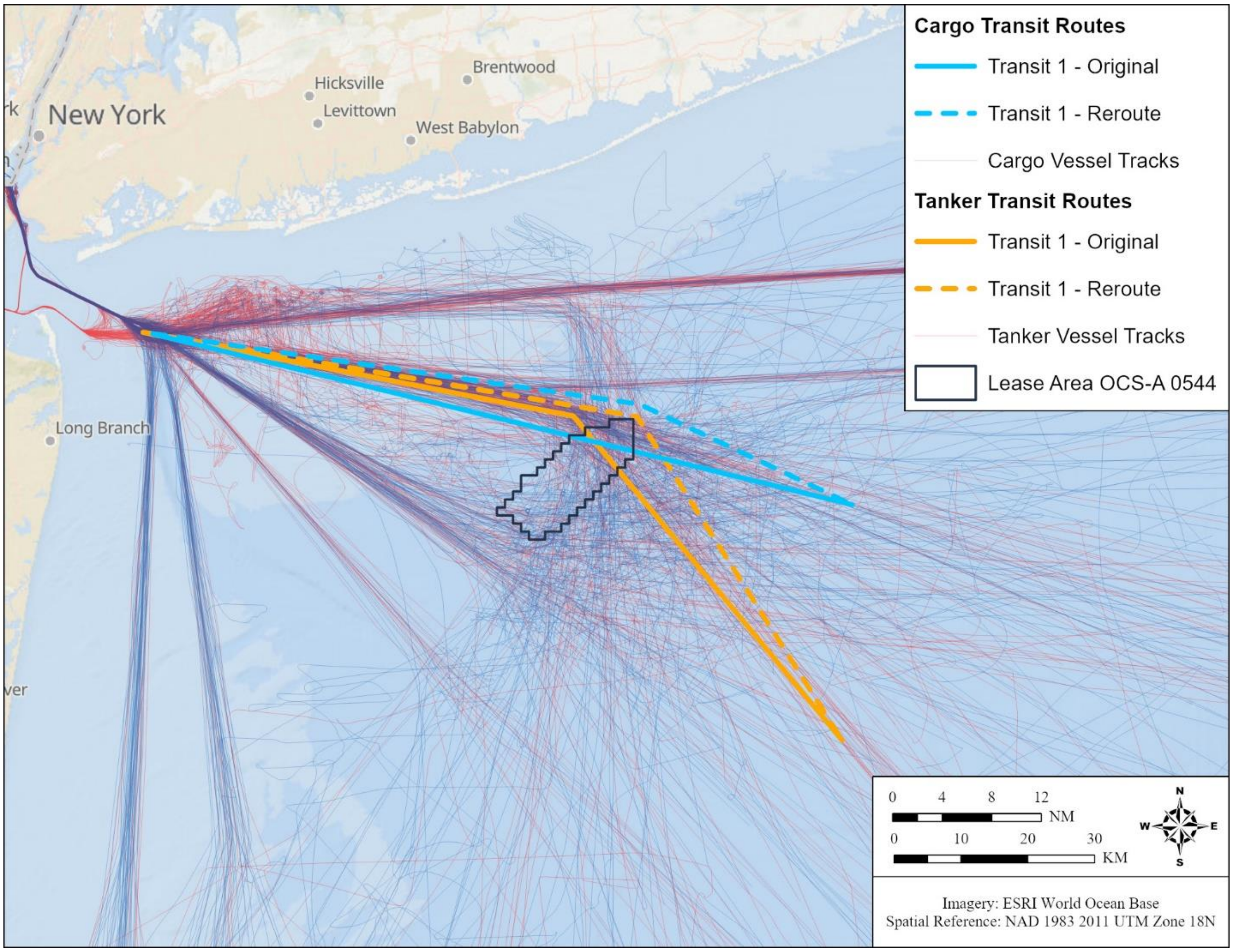


Figure 6.6: Analysis of Transit Routes for Cargo and Tanker Vessels: Existing and Post-construction (Bypassing Lease Area)

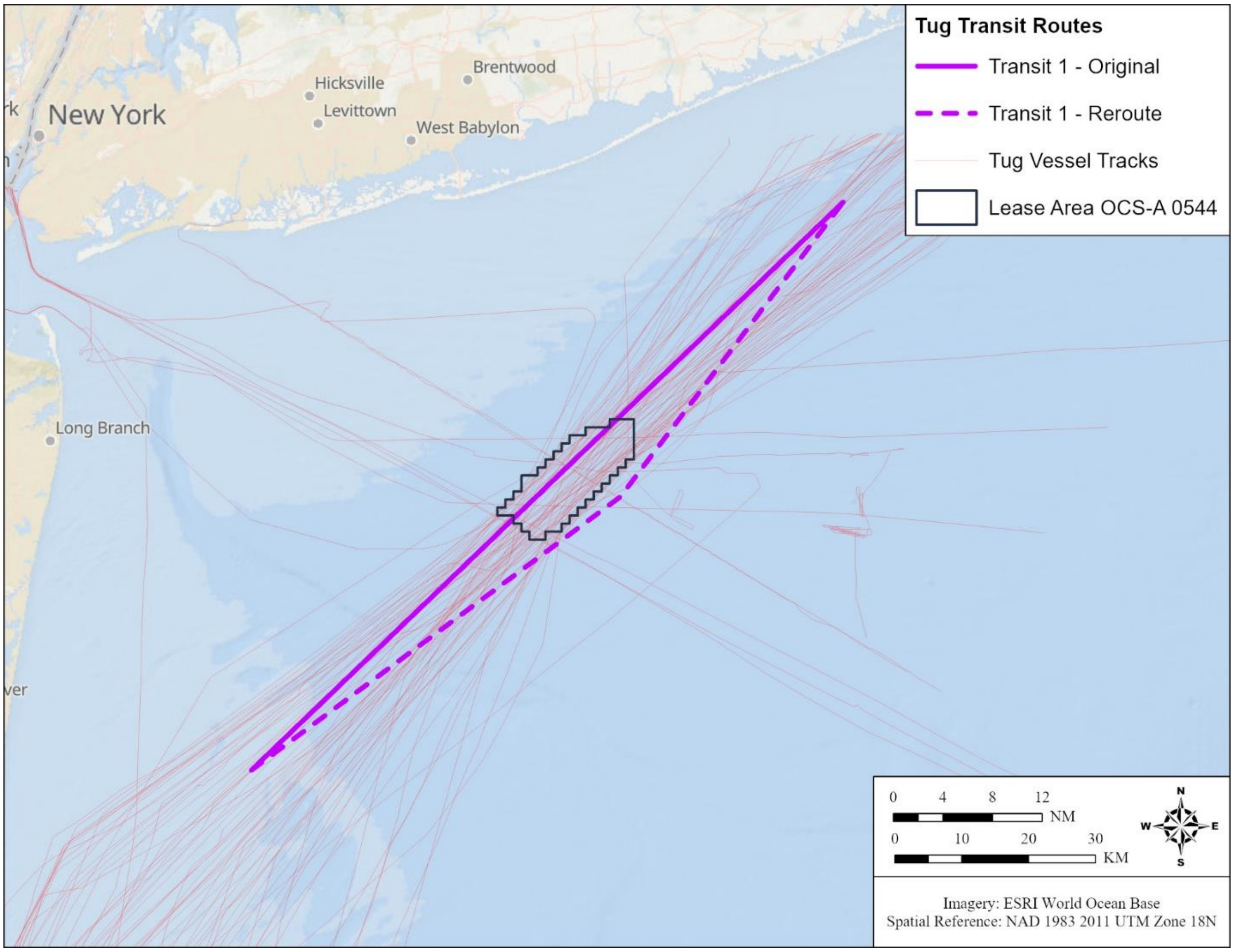


Figure 6.7: Analysis of Transit Routes for Tug Vessels: Existing and Post-construction (Bypassing Lease Area)

Table 6.5: Transit Route Analysis for Vessels Currently Transiting the Lease Area: Existing and Lease Area Bypass Route

Vessel Type	Transit Route	Assumed Transit Speed - kts (m/s)	Existing Route		Bypass Route		Change in Time (min.)
			Distance – NM (km)	Transit Time (hr)	Distance – NM (km)	Transit Time (hr)	
Fishing	1	6.8 (3.5)	54.28 (100.5)	8.0	54.66 (101.23)	8.0	3.4
	2	6.8 (3.5)	67.34 (124.7)	9.9	67.56 (125.12)	9.9	1.9
	3	6.8 (3.5)	60.29 (111.7)	8.9	61.22 (113.38)	9.0	8.2
Recreational	1	11.5 (5.9)	54.39 (100.7)	4.7	54.77 (101.43)	4.8	2.0
	2	11.5 (5.9)	57.16 (105.9)	5.0	57.99 (107.40)	5.1	4.3
	3	11.5 (5.9)	56.73 (105.1)	4.9	57.33 (106.17)	5.0	3.1
	4	11.5 (5.9)	59.21 (109.7)	5.2	59.48 (110.17)	5.2	1.4
	5	11.5 (5.9)	65.17 (120.7)	5.7	65.40 (121.12)	5.7	1.2
Cargo	1	12.1 (6.2)	58.13 (107.7)	4.8	58.71 (108.73)	4.9	2.9
Tanker	1	11.5 (5.9)	69.36 (128.5)	6.0	71.37 (132.17)	6.2	10.5
Tug	1	8.7 (4.5)	66.18 (122.6)	7.6	66.86 (123.82)	7.6	4.7

6.10 Cumulative Effects of Vineyard Mid-Atlantic and Nearby Offshore Wind Projects

The NORM model was also applied to estimate the cumulative effect of the full build-out of both Lease Area OCS-A 0544 and adjacent Lease Area OCS-A 0512 (Empire Wind) to the west. Similar scenarios were simulated in the model with large vessels re-routing around both lease areas. The following assumptions were also made:

- An additional 726 O&M vessel round trips per year added to account for the addition of the Empire Wind Lease Area.
- Empire Wind's Lease Area was modelled with all 147 WTG(s) having monopile foundations with a diameter of 32.81 ft (10 m) at the sea surface and the two ESP locations were modeled with similar widths as outlined in BOEM (2023a).[16]

Table 6.6 summarizes the annual accident frequency for the post-construction scenario while Table 6.7 presents the same information as average annual recurrence intervals. Figure 6.8 presents a comparison between the two post-construction scenarios. The average recurrence interval for a potential accident changes from one in every 219.7 years to one in every 90 years. The change in accident frequency is primarily associated with allisions.

[16] The NSRA was developed using 149 foundations based on Final Environmental Impact Statement document (BOEM 2023a). The maximum number of foundations that will be installed for Empire Wind has subsequently been updated to 140 foundations (BOEM 2023b).

Table 6.6: Estimated Post-construction Inter-class Collision Annual Frequencies

Vessel Class	Collisions	Allisions	Total
Tug	3.02E-05	2.17E-05	5.19E-05
Tanker	6.18E-04	1.00E-04	7.18E-04
Recreational	7.94E-04	5.39E-04	1.33E-03
Passenger	3.94E-04	5.95E-05	4.54E-04
Fishing	2.09E-03	4.20E-03	6.28E-03
Cargo	1.14E-03	2.27E-04	1.36E-03
Other	2.25E-05	2.92E-05	5.17E-05
O&M	8.63E-04	--	8.63E-04
All	5.94E-03	5.17E-03	1.11E-02

1. *Note dashes indicate risk is less than 1E-14.*

Table 6.7: Estimated Post-construction Inter-class Collision Average Recurrence Intervals (Years)

Vessel Class	Collisions	Allisions	Total
Tug	33,103	46,083	19,264
Tanker	1,619	9,998	1,393
Recreational	1,259	1,856	750
Passenger	2,535	16,807	2,203
Fishing	479	238	159
Cargo	881	4,404	734
Other	44,416	34,247	19,337
O&M	1,159	--	1,159
All	168	193	90

1. *Average Recurrence Interval refers to the average time in years between collision events.*

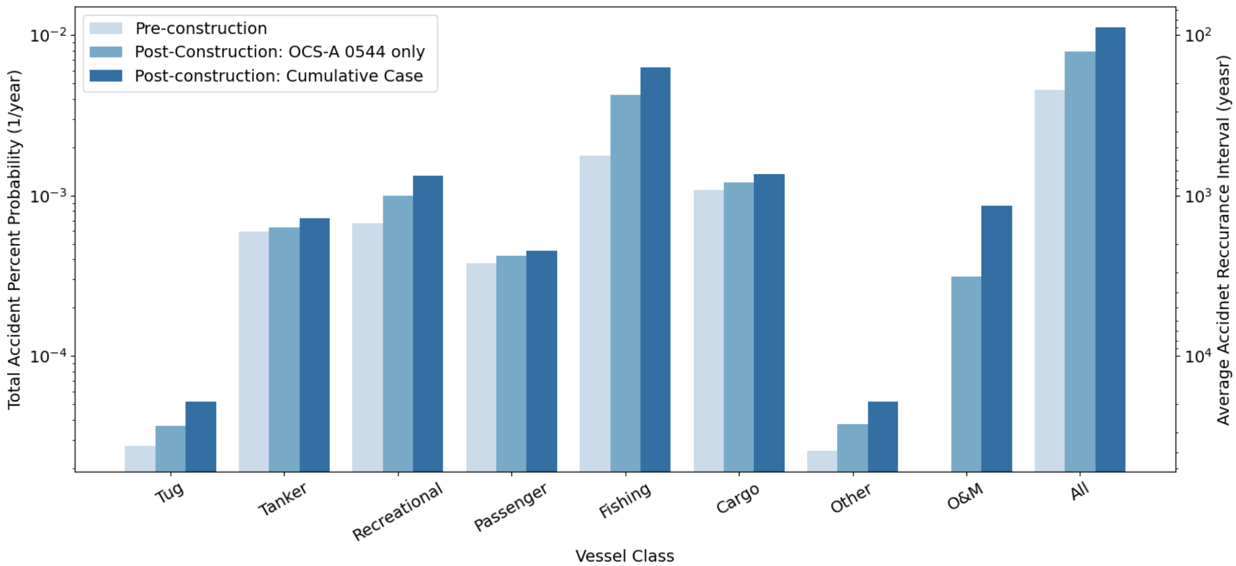


Figure 6.8: NORM Results for Pre-construction and Post-construction Phases (Lease Area OCS-A 0544 Only and Cumulative) by Vessel Type (for Monopile-type WTG Foundations)

7. Emergency Response Considerations

7.1 USCG SAR Assets

The USCG SAR and MER assets in the Offshore Development Area are summarized below.

7.1.1 Aerial Assets

The nearest USCG aviation facility is Coast Guard Air Station Atlantic City (New Jersey) located approximately 80 NM (148 km) southwest of the Lease Area. Additionally, Air Station Cape Cod (ASCC), approximately 143 NM (265 km) east of the Lease Area. This facility has a mission area spanning from New Jersey to the Canadian border. The base is located at the Joint Base Cape Cod (JBCC) in Bourne, Massachusetts. This base is a full scale, joint-use base that is home to five military commands training for missions both domestic and abroad, conducting airborne SAR missions, and intelligence command and control.

Aviation assets at ASCC and Air Station Atlantic City include MH-60T Jayhawk and MH-65E Dolphin helicopters and HC-144A Ocean Sentry fixed-wing aircraft. These assets can be operational within 30 minutes of a distress call in any weather, all year round. The Jayhawk helicopters are designed for high maneuverability and are capable of performing hoisting operations and deploying dewatering equipment in SAR mission scenarios. The Sentry aircraft are designed for high-speed response and reconnaissance and are capable of longer flight times and distances than the Jayhawk helicopters; the Sentry aircraft are typically used for long-range missions.

7.1.2 Marine Assets

The USCG maintains a fleet of vessels at these stations for use in SAR and environmental response missions. Table 7.1 summarizes the USCG vessel fleet in the vicinity of the Lease Area with home ports shown in Figure 7.1.

Table 7.1: USCG Marine Assets in New York Sector – District 1 Jurisdiction – and Nearby Areas[17]

Vessel Name	Type	Home Port
USCG Campbell	270 ft (82 m) USCG Medium Endurance Cutter	Newport, RI
USCG Kingfisher	87 ft (27 m) Cutter	Montauk, NY
USCG Coho	87 ft (27 m) Cutter	New London, CT
USCG Oak	225 ft (69 m) USCG Buoy Tender	Newport, RI
USCG Sycamore	225 ft (69 m) USCG Buoy Tender	Newport, RI
USCG Katherine Walker	175 ft (53.3 m) USCG Patrol Boat	Bayonne, NJ
USCG Ida Lewis	175 ft (53.3 m) USCG Patrol Boat	Newport, RI

The USCG stations shown in Figure 7.1 also have additional vessels active in the area.

[17] Best publicly available data from a variety of sources was used to identify vessels based within the project area.

This group of USCG stations and vessel assets coordinates as an integrated team to conduct active patrols, SAR missions, and environmental response missions. The vessels listed in Table 7.1 are active in the area surrounding the Lease Area and are capable of multiple-day-at-sea missions. The vessels at the USCG stations are geared towards rapid response missions near their home-port locations and USCG Stations.

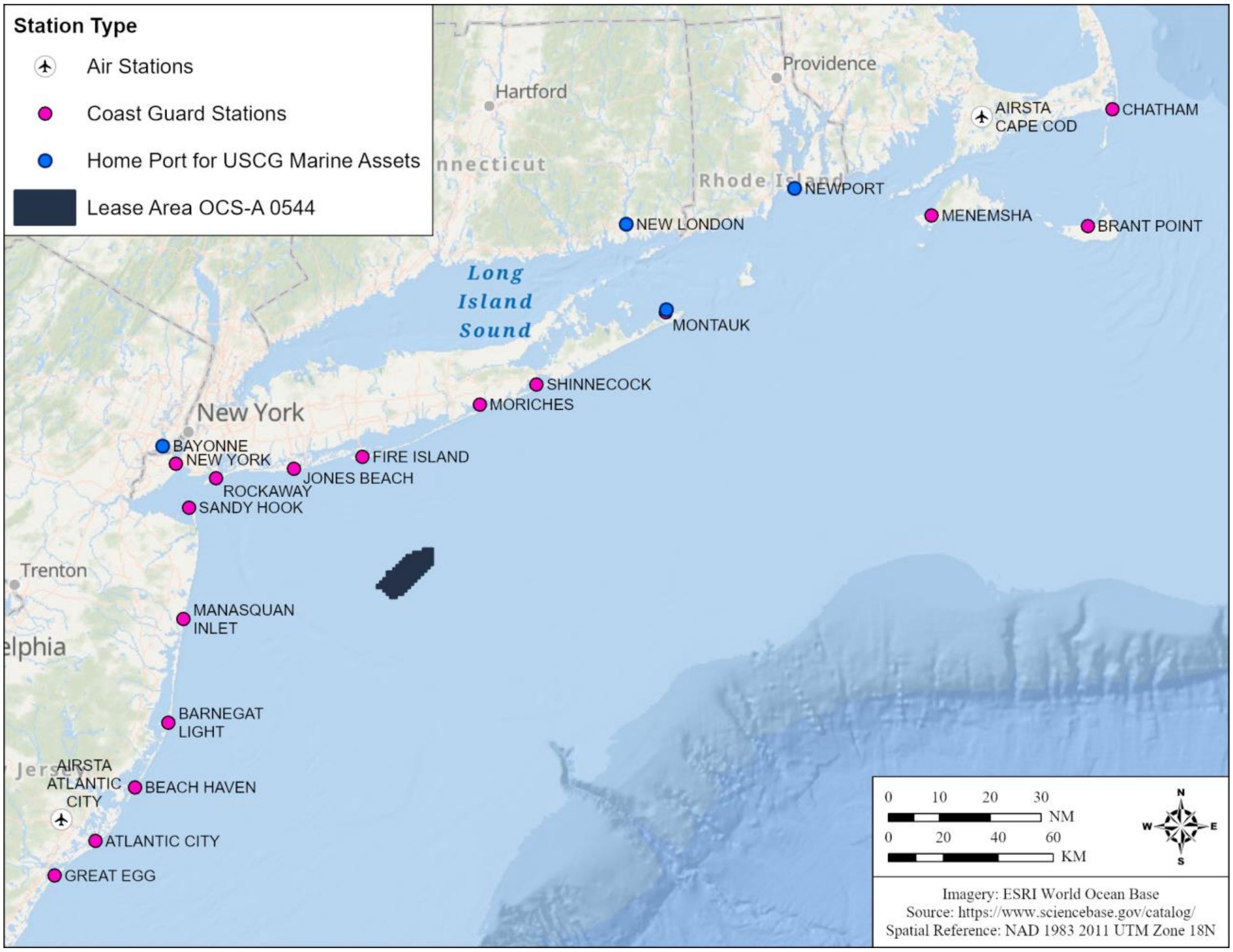


Figure 7.1: USCG Stations and Home Ports

7.2 Historical SAR and Marine Casualty Incidents

USCG SAR data were compiled by USCG from the Marine Information for Safety and Law Enforcement (MISLE) database for an approximate 10.5-year period from January 2014 to July 2024 and supplied to the Proponent by USCG. Though the search area from individual incidents is not explicitly defined, Figure 7.2 shows the spatial positioning of the SAR incidents that were obtained in this dataset, which are within a 20 NM (37 km) range around the Lease Area.

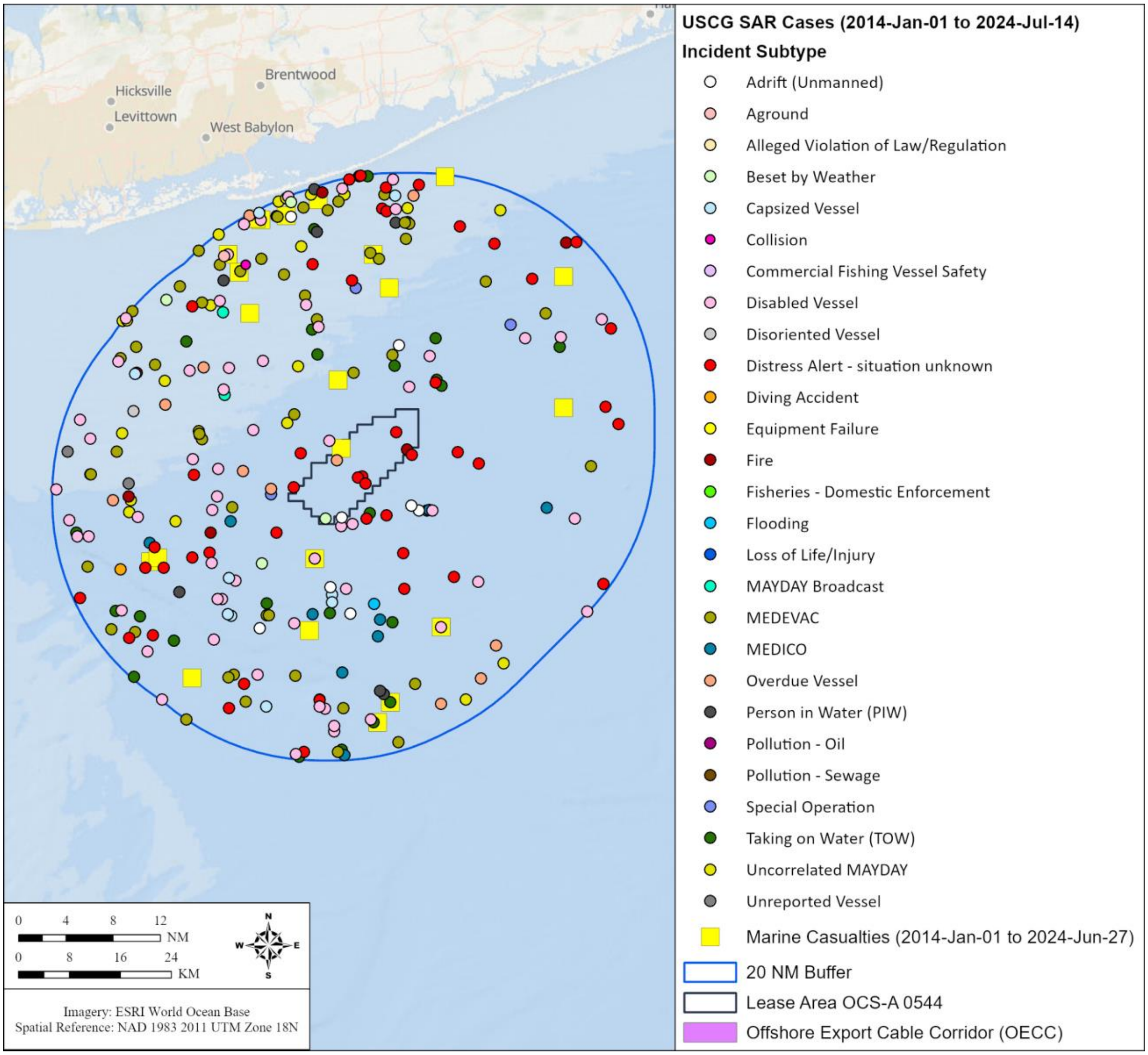


Figure 7.2: USCG Historical SAR Sorties and Marine Casualties

Eleven incidents occurred within or immediately adjacent (within 1 NM [1.9 km]) to the Lease Area. These consisted of four distress alerts for unknown situations, three disabled vessels, one beset by weather, one adrift vessel, one overdue vessel, and one fire.

Of the 226 reported SAR incidents within a 20 NM (37 km) buffer of the Lease Area, approximately half of the incidents occurred in the months of June, July, and August, and approximately three quarters of the incidents occurred between June and October. There was an average of 21.5 incidents per year. The types of incidents are shown in Table 7.2, the uninvestigated causes of the incidents are shown in Table 7.3, and the results of the first on scene sortie are shown in Table 7.4. There was one reported collision incident and one uninvestigated cause type collision with neither being identified as within the Lease Area. For the collision, there was no other data provided on the details of the incident, root causes, or outcome. There were 12 person-in-water incidents, with one noted as a hoax or false alarm, but no other data was provided on the details of the incidents, root causes, or outcomes.

Table 7.2: SAR Incident Type for Incidents Within 20 NM of the Lease Area (2014-2024)

SAR Incident Type	Count
Adrift (Unmanned)	7
Aground	1
Beset by Weather	4
Capsized Vessel	6
Collision	1
Disabled Vessel	54
Disoriented Vessel	1
Distress Alert - situation unknown	39
Diving Accident	1
Fire	6
Flooding	1
MAYDAY Broadcast	1
MEDEVAC	42
MEDICO	7
Overdue Vessel	11
Person in Water (PIW)	7
Special Operation	3
Taking on Water (TOW)	18
Uncorrelated MAYDAY	14
Unreported Vessel	2

Table 7.3: SAR Incident Uninvestigated Cause Type for Incidents Within 20 NM of the Lease Area (2014-2024)

Uninvestigated Cause Type	Count
Cause Unknown	56
Collision	1
Dead Battery	2
Engine Failure	27
Fall/other mishap on vessel	6
False alarm/Hoax	10
High winds/high waves	2

Uninvestigated Cause Type	Count
Hull/airframe failure (not from collision)	2
Incapacitating attack/seizure	1
Low on fuel	3
Misjudgment/errors/inexperience	7
Other communications problems	1
Other electrical problems	1
Other medical condition	11
Other navigational problems	1
Other personnel related cause	2
Other weather factor	3
Out of fuel	2
Propulsion problem (shaft or propeller)	4
Steering or controls failure	1
Unspecified	83

Table 7.4: SAR Results of First On-scene Sortie for Incidents Within 20 NM of the Lease Area (2014-2024)

First On Scene Sortie Result	Count
Located directly (no search conducted)	20
Mission Complete	47
Recalled (assistance rendered by non-CG unit)	3
Recalled/returned, assistance no longer required	11
Searched/failed to locate	25
Searched/located	37
Unspecified	83

Table 7.5: Marine Casualties within 20 NM of the Lease Area (2014-2024)

Incident Type	Total # of Incidents	Vessel Types (Number of Incidents)	Injuries, Fatalities, Missing Person, or Spill
Loss/Reduction of Vessel Propulsion/Steering	6	Fishing (4) General Dry Cargo Ship (1) Passenger Ship (1)	1 Injury Reported
Allision	1	Charter Fishing Vessel (1)	None
Collision	1	Fishing (1)	1 Injury Reported
Flooding – Initial	1	Research Ship (1)	None

Incident Type	Total # of Incidents	Vessel Types (Number of Incidents)	Injuries, Fatalities, Missing Person, or Spill
Flooding - Progressive	2	Fishing (1) Not Listed (1)	2 Persons Missing
Fouling	2	Fishing (2)	None
Loss of Electrical Power	1	Container Ship (1)	None
Material Failure / Malfunction	8	Fishing (3) Container Ship (1) Work Boat (2) Petroleum Oil Tank Ship (1) Not Listed (1)	None
Vessel Maneuver	1	Fishing (1)	None

As shown Figure 7.2 and further reported in Table 7.5, 23 casualties were reported between 2014 and 2024 within 20 NM (37 km) of the Lease Area. Material Failure/Malfunction and Loss/Reduction of Vessel Propulsion/Steering were the most commonly reported types of incidents, accounting for more than half of the incidents. One collision and one allision were reported. Of the incidents reported, two involved injuries or missing persons. One Loss/Reduction of Vessel Propulsion/Steering incident resulted in one injury and one Flooding – Progressive incident resulted in two persons missing.

7.3 Private Salvors

Commercial salvors also exist in the area that provide a range of marine services to recreational and commercial boaters, such as towing, engine start, vessel salvage, and general assistance to mariners. Commercial salvors have also historically assisted the USCG in SAR operations when requested. The commercial salvors tend to operate during the boating season (April through October) and are generally located in boating communities and ports. Below is a list of nearby commercial salvors that service the area around the Lease Area:

- TowBoatUS Bay Shore – Bay Shore, New York;
- TowBoatUS Jones Beach – Short Beach, New York;
- TowBoatUS Jamaica Bay, Far Rockaway, New York;
- TowBoatUS Fire Island – Fire Island, New York;
- TowBoatUS Moriches – Mastic Beach, New York;
- TowBoatUS Sandy Hook – Atlantic Highlands, New Jersey;
- TowBoatUS Manasquan Inlet – Brick, New Jersey;
- Sea Tow Great South Bay – Oakdale, New York; and
- Sea Tow Shinnecock/Moriches - Hampton Bays, New York.

Through conversations with staff from various TowBoatUS locations, it is evident that the Lease Area receives limited service due to its significant distance offshore. Typically, TowBoatUS responds to incidents within a 15 NM (27.8 km) radius. On the rare occasion that they attend to a situation near this area, it is mostly to tow recreational vessels measuring 25 to 35 ft (7.6 to 10.7 m). TowBoatUS anticipates this happens less than once annually. While the organization is equipped to support the USCG in Search and Rescue (SAR) missions, their involvement near the Lease Area is reserved for major emergencies, like plane crashes, because of its remote location.

Similarly, Sea Tow seldom attends to incidents in the vicinity of the Lease Area due to its offshore location. Their fleet comprises 25 ft Privateers utilized for salvage operations. The Shinnecock/Moriches location, boasting a 40 ft (12 m) ex-Army Corps patrol vessel, is most likely to service waters around this Lease Area. According to the captain at Shinnecock/Moriches, while they do consider calls from this area, they are rare, estimated at 5-20 annually. These calls predominantly involve towing recreational vessels during summer and assisting fishing vessels in winter. This assistance can range from towing a boat that is lost power to deploying a dive team to help a stuck clam dredger. Notably, these clam dredgers vary significantly in size, from 50 to 180 ft (15 to 55 m). Sea Tow, like TowBoatUS, is capable of assisting USCG with SAR missions, though infrequently. They've reportedly contributed to approximately three missions in this region over the past 15 years.

Comprehensive information detailing all operations and their spatial distribution was not available.

7.4 SAR Impacts

The presence of offshore structures in the ocean, such as the Vineyard Mid-Atlantic WTGs and ESP(s), can potentially increase the risk of incident with SAR marine response vessels and the presence of WTGs may affect the USCG's airborne SAR assets.

As described in the previous section, the USCG responds to several emergency, environmental, and law enforcement related matters each year in the area surrounding and containing the Lease Area. During the operations phase of Vineyard Mid-Atlantic, the primary impacts related to SAR operations will be confined to the immediate vicinity surrounding the Lease Area.

The WTG spacing and minimum tip clearance of the blades are not expected to impact the operation of USCG marine assets that are in use in the area. The WTG tip clearance of approximately 77 ft (23.4 m) at high tide, allowing for a 5 ft (1.5 m) safety margin, exceeds the mast height of the primary surface vessels expected to be involved in SAR activities in the area including the 154 ft (47 m) Sentinel class fast response cutters or the 87 ft (27 m) Protector class patrol vessels. It is expected that these marine assets will be able to safely navigate and maneuver adequately within the Lease Area. Given the WTG spacing and relative size, it is not expected that Vineyard Mid-Atlantic will significantly affect travel times to and within the Lease Area by vessels responding to SAR distress calls; however, search patterns may need to be altered to account for presence of structures. Section 5.1.2 outlines potential impacts to radar and communication within the Lease Area during the operations phase; further investigation is required to fully quantify the subsequent impact on USCG SAR operations. No major impact is expected to affect the operation of emergency transponder systems used by many ocean-going vessels.

As noted, aerial SAR may be affected. In particular, search patterns will need to take into account the presence of the WTGs and ESPs in both the Lease Area as well as that of the adjacent lease. Various mitigations have been considered. For example, the WTG/ESP layout of Vineyard Mid-Atlantic has been designed to be consistent with the USCG's WTG uniform spacing recommendations to accommodate SAR operations, with the exception that the spacing at 0.68 NM is less than the recommended 1 NM spacing; however, the proposed spacing and layout are consistent with the adjacent Empire Wind (OCS-A 0512) project in accordance with the Proponent's lease stipulations in order to facilitate navigation through the area. In addition, the WTGs and ESP(s) will be marked and lit, and Vineyard Mid-Atlantic vessels will operate frequently within the Lease Area. Alphanumeric markings on the WTG towers may also aid mariners in reporting their position during distress calls and alphanumeric markings on the WTG nacelles, visible to SAR pilots, could also aid SAR pilots during a SAR response.

Response times for USCG aviation assets should not be impacted by Vineyard Mid-Atlantic, except for missions directly within the Lease Area, where aviation assets may have their operations affected when near a physical WTG. The Proponent will work with the USCG to develop an operational protocol that outlines the procedures for the braking system on requested Vineyard Mid-Atlantic WTGs to be engaged within a specified time upon request from the USCG during SAR operations and other emergency response situations.

The specific mitigations for SAR operations are discussed in Section 8.1.3.

8. Facility Operations

8.1 Communications

8.1.1 During Construction

Coordination among the USCG, port authorities/operators, ferry operators, local pilots, and other entities will be necessary to ensure that impacts from Vineyard Mid-Atlantic's construction and installation vessels are minimized. The Proponent is committed to working with each stakeholder to address navigation and other concerns during the construction of Vineyard Mid-Atlantic. As part of this effort, the Proponent plans to develop and implement a marine communications procedure to engage these stakeholders.

To facilitate effective and regular engagement with fisheries stakeholders throughout the life of Vineyard Mid-Atlantic, the Proponent has developed a Fisheries Communication Plan (FCP) (see Appendix I-H of the COP). The communication protocols outlined in the FCP are designed to help avoid interactions with fishing vessels and fishing gear. The Vineyard Mid-Atlantic FCP will be updated periodically as needed, in response to stakeholder feedback and to incorporate lessons learned, to ensure that the communication protocols and tools remain relevant and effective. Additional information about the Proponent's fisheries communication methods and fisheries team is provided in Section 2.5.1.

The Proponent employs a Marine Liaison Officer who is responsible for safe marine operations and ensuring that the Proponent is a good neighbor while on the water. The Marine Liaison Officer currently serves as the Proponent's point of contact for all external maritime agencies, partners, and stakeholders, including USCG, US Navy, port authorities, state and local law enforcement, and commercial operators (e.g., ferry, tourist vessels, cargo vessels, tankers, fishing boat operators, and other offshore wind developers). There is frequent interaction, information exchange, and coordination between the Marine Liaison Officer and the fisheries team regarding fisheries outreach.

During construction of Vineyard Mid-Atlantic, the Proponent expects to employ a dedicated Marine Coordinator to manage all construction vessel logistics and implement communication protocols with external vessels at the harbor and offshore. During construction, the Marine Coordinator will be the primary point of contact for day-to-day operations with the USCG, port authorities, state and local law enforcement, marine patrol, and commercial operators. As such, the Marine Coordinator will be responsible for coordination with USCG regarding any required LNMs. The Marine Coordinator will operate from a marine coordination center that will be established to control vessel movements throughout the Offshore Development Area. The marine coordination center is expected to be located at a staging port near the Lease Area. Daily meetings will be held by the Proponent to coordinate between contractors and avoid unnecessary simultaneous operations at the port facilities and routes to the Offshore Development Area. The Marine Coordinator will use tools such as radio communications and safety vessels to address vessels entering active work sites. The safety vessels would provide guidance to mariners and fishing vessels, explain the ongoing activities, and request that they give a wide berth to the work site or construction vessel(s), if necessary. These safety vessels would have no enforcement authority; the safety vessels would only assist mariners in navigating in the vicinity of the activity.

As further described in Section 2.5.1, the Proponent will provide Offshore Wind Mariner Updates to notify maritime stakeholders of the Proponent's offshore activities. Depending on the activity, the Offshore Wind Mariner Update may request that mariners give a wide berth to the work site or construction vessel(s). The Proponent will also coordinate with the USCG to issue LNMs advising other vessel operators of Vineyard Mid-Atlantic's construction and installation activities. Local port communities and local media will also be notified and kept informed as the construction progresses. The Proponent's website will be updated regularly to provide information on the construction activities and specific Vineyard Mid-Atlantic information. The Proponent will regularly provide updates as to the locations of installed structures (e.g., WTGs, ESP[s]) to the USCG and NOAA for use in navigational charts.

To minimize hazards to navigation, all Vineyard Mid-Atlantic related vessels and equipment will display the required navigation lighting and day shapes. Vineyard Mid-Atlantic related vessels will be also equipped with operational AIS and will comply with applicable US or SOLAS standards, with regards to vessel construction, vessel safety equipment, and crewing practices.

The WTGs and ESP(s)will become PATONs once they are installed. Temporary marine navigation lighting and marking will be installed on the foundation structures as they are being constructed, depending on the timing and sequence of foundation installation. Per USCG's current *ME, NH, MA, RI, CT, NY, NJ-Atlantic Ocean-Offshore Structure PATON Marking Guidance*[18] and BOEM's *Guidelines for Lighting and Marking Structures Supporting Renewable Energy Development* (BOEM 2021), all temporary base, tower, and construction components preceding the final structure completion will be marked with Quick Yellow (QY) obstruction lights visible 360 degrees around the structure at a distance of 5 NM. The USCG will be notified as temporary lights are planned and activated in order for the USCG to provide appropriate marine notices and broadcasts until the final structure marking is established. The Proponent is committed to working with the USCG to mitigate safety concerns during construction.

During construction and certain maintenance activities, the Proponent may request that the USCG establish safety zones around the WTGs and ESP(s) pursuant to 33 CFR Part 147, which provides USCG with authority to implement safety zones on the Outer Continental Shelf (OCS) for offshore renewable energy installations (OREIs). These temporary safety zones would extend up to 1,640 ft (500 m) around each structure. The safety zones would be enforced by USCG individually as construction progresses from one structure to the next. The USCG would make notice of each enforcement period via Notice to Mariners. When enforced, only attending vessels and those vessels specifically authorized by the USCG would be permitted to enter or remain in the temporary safety zones. It is very unlikely that USCG will have vessels actively monitoring the safety zones (unless there are compliance issues). The USCG may grant the Proponent permission to use their own safety vessels to communicate safety information and/or safety zone parameters to mariners in the vicinity of active work sites. The Proponent's safety vessels would monitor the zones, document any compliance issues, and report those issues to the USCG who would then investigate the incident and issue fines or warnings to the owner of the vessel.

Additional construction-related vessel traffic at individual port facilities, as identified in Section 3.3, will result in a relatively small increase in traffic at these facilities and the adjacent waterways. LNM's will be issued by the USCG to address potential conflicts which may be identified.

8.1.2 Operations and Maintenance

The following are mitigation approaches affecting vessel operations that could be adopted to reduce the impacts of Vineyard Mid-Atlantic on navigation:

- The USCG could advise mariners of the air draft restriction within the Lease Area by means of LNMs.
- The use of a consistent layout will allow recreational and fishing vessels to continue to operate along three consistent headings (and their reciprocal courses) through the Lease Area if they chose to transit through or operate within the Lease Area. Additionally, the uniform grid pattern for the 0.68 x 0.68 NM WTG/ESP

[18] USCG's PATON guidance for offshore wind energy structures is periodically updated in District 1 LNMs.

layout provides two common lines of orientation with the layout proposed for neighboring Lease Area OCS-A 0512.

- NOAA could update navigational charts to show the turbine locations and provide guidance as to limits to air draft and vessel lengths. Each WTG will be marked with an alphanumeric identifier to serve as a point of reference for mariners when visually determining their position within the Lease Area.

The Proponent will provide required information to USCG and/or NOAA to add the WTGs, ESP(s), OECC, and all associated PATONs to appropriate navigation charts. As an example, Figure 8.1 shows how the Block Island Wind Farm's WTGs and cable routes are depicted on the NOAA navigation chart (see the portion of the chart outlined in a red box).

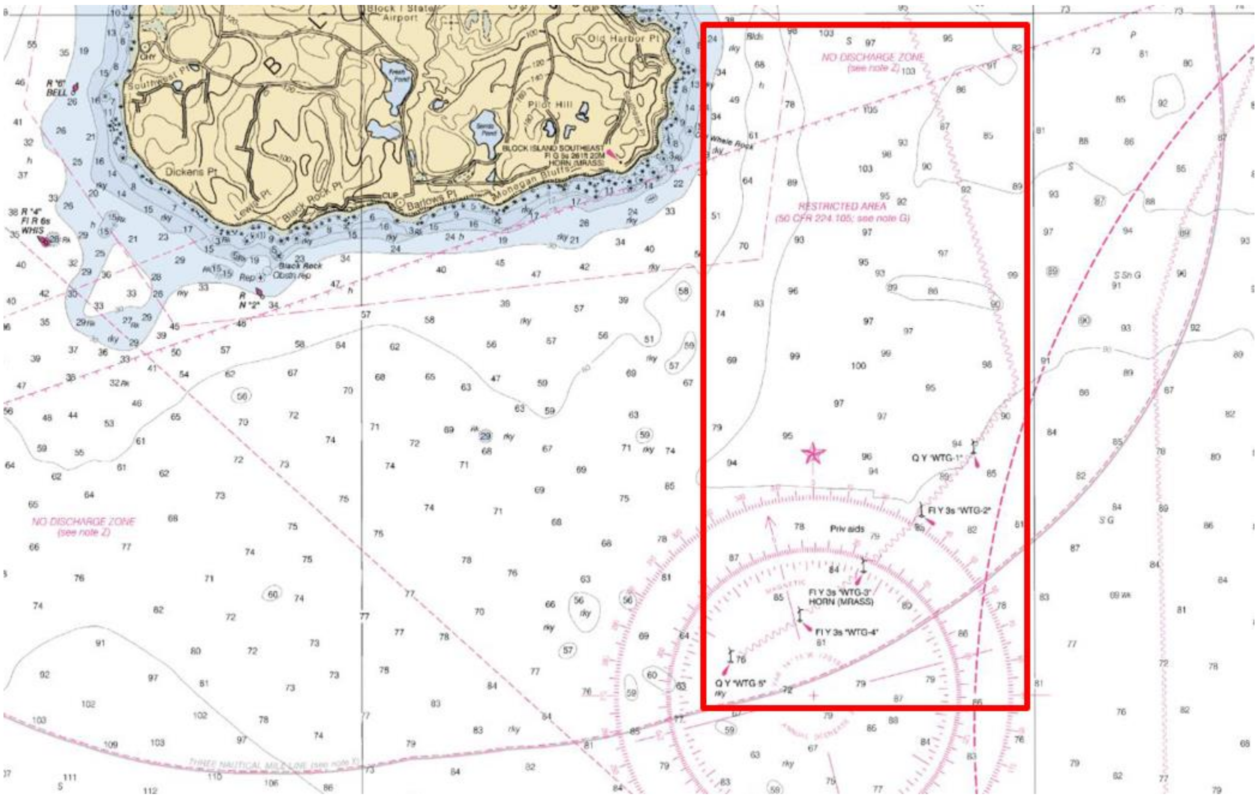


Figure 8.1: Example Offshore Wind Facility Mapping on Navigation Chart (Block Island, Rhode Island, Chart 13215)

The following sections 8.1.3 and 8.2 provide additional information on proposed mitigation and monitoring measures during Vineyard Mid-Atlantic's operations and maintenance phase. All mitigation measures described below would be maintained constantly throughout the life of Vineyard Mid-Atlantic to ensure navigational safety.

8.1.3 Emergency Response

To mitigate potential impacts to SAR aircraft operating in the Lease Area, the Proponent will work with the USCG and the Department of Defense (DoD) to develop an operational protocol that outlines the procedures for the braking system on requested Vineyard Mid-Atlantic WTGs to be engaged within a specified time upon request from the USCG or DoD during SAR operations and other emergency response situations. The protocol will include formal procedures that will enable efficient, effective processes for communicating and engaging the braking mechanism requests during SAR operations and other emergency response situations. These communications and shutdown procedures, as well as the brake systems, will be satisfactorily tested at least twice per year. The Proponent will participate in periodic USCG-coordinated training and exercises to test and refine notification and shutdown procedures and to provide SAR training opportunities for USCG vessels and aircraft.

The Proponent will maintain continuously operated (24 hours per day) operations center(s) throughout the life of Vineyard Mid-Atlantic to monitor the offshore facilities. The center(s) will be located at the Proponent's O&M facilities and/or a third party's facilities. The location of the center(s) has not been determined at present. The center(s) will be able to immediately initiate the shutdown of any ordered WTG(s) and assist the USCG and/or the DOD in the response to distress calls through active control over the WTG braking system. The operations center personnel will have access to charts providing GPS position and identification numbers for each structure. The USCG will also be provided with this chart. The contact telephone number for the operations center(s) will be provided to the USCG and posted in various public notices that are issued. Additional details regarding the location, staffing, and capabilities of the control center(s) will be provided as part of the Proponent's Emergency Response Plan (ERP), which is expected to be prepared prior to construction. The Proponent plans to coordinate with USCG during the development of the ERP.

If the ESP(s) include a helipad, the helipad will be designed to accommodate USCG rescue helicopters. Enabling USCG helicopters to land on the ESP(s) could allow for more efficient responses to potential emergency situations within and outside the Lease Area. The Proponent is also evaluating the use of cameras on WTGs and/or ESP(s), which may aid in the detection of distressed mariners and enhance the USCG's ability to respond in emergency situations. In the event that a vessel allides with a structure, the Proponent will conduct a structural inspection as quickly as possible and advise the USCG if the structure has become a hazard to navigation.

The WTG nacelle hatches for access will be designed to enable opening, access, entry, and exit from both inside and outside. It will be possible to unsecure and open the nacelle roof hatch from the outside of the nacelle to facilitate emergency rescue from the nacelle top.

As described in Section 5.1.2.5, the presence of the WTGs may impact high frequency radar stations along the coastline, which are capable of measuring currents and wave heights offshore. The USCG has integrated the data from these high frequency radar systems into their SAR planning systems. The Proponent is committed to investigating and working with USCG and other agencies to assess and identify mitigation for potential impacts that Vineyard Mid-Atlantic may have on HF radars. Potential mitigation measures could include installing current sensors or other monitoring systems in the Lease Area to provide real-time meteorological and oceanographic data (e.g., current velocity, wave height, wave period, wave direction) to support SAR planning. Potential mitigation options are further described in the Radar and Navigational Aid Screening Study presented in COP Appendix II-H.

8.2 System Controls and Operations

The Proponent employs a Marine Liaison Officer who is responsible for safe marine operations and ensuring that the Proponent is a good neighbor while on the water. The Marine Liaison Officer currently serves as the liaison between the Proponent's internal parties and all external maritime partners and stakeholders (e.g., USCG, US Navy, port authorities, state and local law enforcement, marine patrol, commercial operators, etc.). The Marine Liaison Officer is also expected to be responsible for coordinating and issuing Offshore Wind Mariner Updates to notify maritime stakeholders of the Proponent's offshore activities. The Marine Liaison Officer will also assist in coordination of vessel inspections for construction and ongoing operations.

The Proponent will provide Offshore Wind Mariner Updates and coordinate with the USCG to issue LNMs advising other vessel operators of O&M activities. The Proponent's website will be regularly updated to provide information on the O&M activities occurring in the Offshore Development Area. The WTGs and ESP(s)will also be clearly identified on NOAA nautical charts.

Finally, the Proponent will continue to work with the USCG, BOEM, and other stakeholders to maintain safe navigation within the Offshore Development Area and to identify additional potential mitigation measures, as necessary.

Impacts associated with decommissioning activities will be adequately mitigated through the implementation of best management practices, where practicable. Avoidance, minimization, and mitigation measures are anticipated to be similar to those described above in Section 8.1.1.

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Appendix A

NVIC Checklist

ISSUE	REPORT SECTION	NOTES
1. SITE LOCATION AND INSTALLATION COORDINATES - District		
Has the developer ensured that proposed or draft coordinates and subsequent variations of site perimeters and individual structures are made available, upon request, to interested parties at all, relevant project stages?	**App. E**	
Has the coordinate data been supplied as authoritative GIS data, preferably in ESRI format with metadata that facilitates the identification of the data creator, its date and purpose? Appropriate data should also be provided with latitude and longitude coordinates in WGS84 datum.	**N/A**	ESRI Shapefile can be provided upon request; however, for a single WTG it is understood that latitude/longitude coordinates for the point should be sufficient. Latitude/longitude coordinates are provided in App. E.
Have proposed cable routes addressed any potential conflicts and avoided all ATON (federal and private)?	**Sec. 2.5.4.1**	
2. TRAFFIC SURVEY - NAVCEN Reference (f), Coast Guard Navigation Center Work Instruction 2022-01 will be used to review and validate the data analysis and safety assessment provided by the NSRA on all vessel traffic in the study area.		
Does the data include an assessment of historical users of a waterway via analysis of AIS data within one year of commencement of site survey operations?	**Sec. 2.5.2**	
Does the survey include all vessel types?	**Sec. 2.5.2**	Table 2.6
Does the NSRA cover a period of at least 12 months duration?	**Sect. 2.5.2**	
Does the survey include consultation with recreational vessel organizations?	**Sec. 2.5.1**	
Does the survey include consultation with fishing vessel organizations?	**Sec. 2.5.1**	
Does the survey include consultation with pilot organizations?	**Sec. 2.5.1**	Vineyard Mid-Atlantic plans to engage with pilots thorough future participation at NY Harbor Safety Committee meetings and other venues.
Does the survey include consultation with commercial vessel organizations?	**Sec. 2.5.1**	
Does the survey include consultation with port authorities?	**Sec. 2.5.1**	
Does the survey include proposed IFS location relative to areas used by any type of vessel?	**Sec. 2.5.2 and Sec. 2.5.4**	See Figure 2.3 for Lease Area proximity to principal traffic routes See Figure 2.10 and Figure 2.11 for Lease Area and OECC proximity to designated fairways and TSS
Does the survey include numbers, types, sizes and other characteristics of vessels presently using such areas?	**Sec. 2.5.2 and App. B**	App. B.1 through B.4 presents traffic data on various types of vessels and characteristics for those vessels. Similarly, B.5 summarizes traffic which crosses the OECC.
Does the survey include types of cargo carried by vessels presently using such areas?	**Sec. 2.5.2.1**	App. B.2 presents data on commercial traffic including cargo carrying vessels

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	and App. B	
Does the survey identify non-transit uses of the areas (for example, fishing, day cruising of leisure craft, racing, marine regattas and parades, aggregate mining)?	**Sec. 2.5.4.3**	
Does the survey include whether these areas contain transit routes used by coastal or deep-draft vessels, ferry routes, and fishing vessel route?	**Sec. 2.5.4.2**	
Does the survey include proposed alignment and proximity of the site relative to adjacent shipping routes?	**Sec. 2.5.4.2**	
Does the survey include whether the nearby area contains routing measures or precautionary areas?	**Sec. 2.5.4.2**	
Does the survey include whether the site lies on or near a traffic separation scheme?	**Sec. 2.5.4.2**	
Does the survey include the proximity of the site to anchorage grounds or areas, safe havens, port approaches, and pilot boarding or landing areas?	**Sec. 2.5.4.3**	
Does the survey include the feasibility of allowing vessels to anchor within the vicinity of the project?	**Sec. 2.5.4.3 and Sec. 5.1.4**	
Does the survey include the proximity of the site to existing fishing grounds, or to routes used by fishing vessels to such grounds?	**Sec. 2.5.2.2 and Sec. 6.9**	Sec. 2.5.2.2 presents existing routes and Sec. 6.9 presents anticipated changes to routes
Does the survey include whether the site lies within the limits of jurisdiction of a port and/or navigation authority?	**Sec. 2.5.4.3**	
Does the survey include the proximity of the site to offshore firing/bombing ranges and areas used for any marine or airborne military purposes?	**Sec. 2.5.4.3**	
Does the survey include the proximity of the site to existing or proposed offshore OREIs/gas platform or marine aggregate mining?	**Sec. 2.5.4.3**	
Does the survey include the proximity of the site to existing or proposed OREI developments?	**Sec. 2.5.4.3 and 2.1**	
Does the survey include the proximity of the site relative to any designated areas for the disposal of dredging material or ocean disposal site?	**Sec. 2.5.4.3**	
Does the survey include the proximity of the site to ATON and/or Vessel Traffic Services in or adjacent to the area and any impact thereon?	**Sec. 2.5.4.1 and Sec. 2.5.5**	
Does the survey include a researched opinion using computer simulation techniques with respect to the displacement of traffic, mixing of vessel types that were previously segregated; changes in traffic density and resultant change in vessels encounters; and the creation of 'choke points' in areas of high traffic?	**Sec. 6 and App. D**	App. D provide summary of model used for analysis in Sec. 6
Does the survey include whether the site lies in or near	**Sec. 5.1.6**	

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areas that will be affected by variations in traffic patterns as a result of changes to vessel emission requirements?		
3. OFFSHORE ABOVE WATER INSTALLATION, FACILITY, OR STRUCTURE (IFS) – Sector or District		
Does the NSRA contain a proposed layout and estimated location of all IFS?	**Sec. 2.1**	
Does the NSRA denote whether any features of the offshore above water IFS, including auxiliary platforms outside the main generator site and cabling to the shore, could pose any type of difficulty or danger to vessels underway, performing normal operations, or anchoring? Such dangers would include clearances of wind turbine blades above the sea surface, the burial depth of cabling, and lateral movement of floating wind turbines.	**Sec. 3.1.2, Sec. 3.2.3 and Sec. 5**	
Does the NSRA denote whether minimum safe (air) clearances between sea level conditions at Highest Astronomical Tide and wind turbine blade are suitable for the vessel types identified in the traffic survey? Depths, clearances, and similar features of other IFS which might affect navigation safety and other Coast Guard missions should be determined on a case-by-case basis.	**Sec. 3.1.1 and 3.1.2.1**	
Does the NSRA denote whether any feature of the installation could impede or assist emergency rescue services, including the use of lifeboats, helicopters and emergency towing vessels?	**Sec. 7.4**	
Does the NSRA denote how rotor blade rotation and power transmission, etc., will be controlled by the designated services if required in an emergency?	**Sec. 8.1.3**	
Does the NSRA denote whether any noise or vibrations generated by an IFS above and below the water column would impact navigation safety or affect other Coast Guard missions?	**Sec. 5.1.2.6**	
Does the NSRA denote the ability of an IFS to withstand collision damage by vessels without toppling for a range of vessel types, speeds, and sizes?	**Sec. 6.8.4**	
Does the NSRA contain specific layout and location of all IFS including moorings and anchors?	**Sec. 2.1**	
4. ASSESSMENT OF, ACCESS TO, AND NAVIGATION AROUND OR NEAR AN INSTALLATION, FACILITY OF STRUCTURE (IFS) - District		
Does the NSRA address and discuss navigation around or near the IFS by different vessel types and sizes?	**Sec. 6.8.3 and Sec. 6.9**	
Does the developer suggest mitigations to improve safety of navigation where IFS obstruct traffic or change vessel traffic patterns?	**Sec. 5.1 and Sec. 8**	Sec. 8.1.1 discusses proposed temporary measures during construction.
Does the NSRA suggest mitigations for impacts to SAR near and around the IFS?	**Sec. 8.1.3**	

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Does the NSRA address impacts of IFS creating a visual obstruction?	**Sec. 5.1.1.4**	
Does the NSRA discusses impacts to electronic navigation from the IFS presence?	**Sec. 5.1.2**	
Does the NSRA contain enough information for the Coast Guard to determine whether or not exclusion from the site could cause navigation, safety, or transiting problems for vessels operating in the area?		The NSRA in its entirety addresses this question.
5. THE EFFECT OF TIDES, TIDAL STREAMS, AND CURRENTS – Sector or District		
Does the NSRA address current maritime traffic flows and operations in the general area affected by the depth of water in which the proposed IFS is situated at various states of the tide? That is, whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa?	**Sec. 3.2.3**	
Does the NSRA address if current maritime traffic flows and operations in the general area are affected by existing currents in the area in which the proposed IFS is situated?	**Appendix II-B in COP and Sec. 4**	
Does the NSRA address if the set and rate of the tidal stream, at any state of the tide, would have a significant effect on vessels in the area of the IFS?	**Appendix II-B in COP and Sec. 4**	
Does the NSRA address how/if current directions and velocities might aggravate or mitigate the likelihood of allision with the IFS?	**Appendix II-B in COP and Sec. 4**	
Does the NSRA address the effect of the maximum rate tidal stream and its direction?	**Appendix II-B in COP and Sec. 4**	
Does the NSRA address if set is across the major axis of the layout at any time, and, at what rate?	**Appendix II-B in COP and Sec. 4**	
Does the NSRA address, in general, whether engine failure or other circumstances could cause vessels to be set into danger by the tidal stream or currents?	**Appendix II-B in COP, Sec. 4, and Sec. 6**	Appendix II-B in COP presents information on currents and Sec. 6 presents results of allision modeling.
Does the NSRA address if IFS cause changes in the set and rate of the tidal stream or direction and rate of the currents?	**Appendix II-B in COP and Sec. 4**	
Does the NSRA address if IFS in the tidal stream produce siltation, deposition of sediment or scouring, any other suction or discharge aspects, which could affect navigable water depths in the IFS area or adjacent to the area?	**Appendix II-B in COP and Sec. 4**	
Does the NSRA provide mitigations that provide data to support search and rescue planning in the area where IFS impede this original data?	**Sec. 8.1.3**	
Does the NSRA suggest mitigations that provide updated data feed of currents, tides, seas, and water temperatures	**Sec. 8.1.3**	

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for the area impacted by the projects?		
6. WEATHER – Sector or District The NSRA should provide an analysis of expected weather conditions, water depths and sea states that might aggravate or mitigate the likelihood of allision with the structure by vessels.		
Does the NSRA adequately address all weather conditions, and the difficulties or dangers to vessels, which might pass near the IFS?	**Sec. 6.8.3 and Sec. 4**	
Does the NSRA adequately address the effects of the IFS in the area for vessels under sail, such as wind masking, turbulence, or sheer?	**Sec. 5.1.3**	
Does the NSRA adequately address the effects of the prevailing winds in the study area, whether engine failure or other circumstances could cause vessels to drift into danger, particularly if in conjunction with a tidal set such as referenced above?	**Sec. 4 and Sec. 6 and Sec. 4**	
Does the NSRA adequately address the effects the location of the IFS and the influence of tropical weather and high winds on the IFS?	**Appendix II-B in COP and Sec. 4**	
Does the NSRA adequately address the effects of the location of the IFS and the presence of cold weather?	**Appendix II-B in COP and Sec. 4**	
Is there an opportunity for sea ice and/or icing of the IFS and if so, does the NSRA adequately address the effects of how the presence of the IFS would mitigate or exacerbate icing?	**Appendix II-B in COP and Sec. 4**	
Does the NSRA adequately address the effects of the ability for IFS to withstand anticipated ice floes be conducted by the applicant, if applicable?	**N/A**	
Does the NSRA adequately address the effects and the likelihood that ice may form on the IFS, especially for those types that have rotating blades such as a (WTG)? This should include an analysis of the ability of the IFS to withstand anticipated ice accumulation on the IFS, the potential for ice to be thrown from the blades, and the likely consequences of that happening and possible actions to mitigate that occurrence.	**Appendix II-B in COP and Sec. 4**	
Does the NSRA adequately address the effects of the IFS on weather data as it feeds into the Search and Rescue Optimal Planning System and weather buoy data or provide mitigations to supplement that lost or impacted weather data?	**Sec. 8.1.3**	
7. CONFIGURATION AND COLLISION AVOIDANCE – District The NSRA, based on the data collected in the Traffic Survey, provides an evaluation to determine the likely frequency of collision between vessels, of allisions with IFSs, or grounding because of the establishment of a IFS. This may include but is not limited to a researched opinion using computer simulation techniques with respect to the displacement of traffic, mixing of vessel types that were previously segregated; changes in traffic density and resultant		

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change in vessels encounters; particularly, the creation of 'choke points' in areas of high traffic around the OREI.		
Does the NSRA address 10 years of marine casualty data in the study area to provide an incident change analysis resulting from the project development in the waterway? Are the data and analysis included in the NSRA to be validated by the Coast Guard?	**Sec. 7.2**	
Does the incident change analysis build on earlier work conducted as part of the NSRA and the mitigations identified as part of that process? Reference (f) should be used as guidance in this evaluation. The original data and traffic survey should be referenced to confirm where information or the analysis remains the same or can be further refined due to the later stages of project development.	**Sec. 6.8**	
Does the incident change analysis present information to enable the USCG to adequately understand how the risks associated with the proposed layout have been reduced to ALARP?	**Sec. 5, Sec. 6, Sec. 7, and Sec. 8**	
Does the NSRA consider and analyze frequency of collision (vessel to vessel) by type (crossing, meeting, overtaking) including the likely vessel type involved in a collision?	**Sec. 6.8**	
Does the NSRA consider and analyze the likely location of allision (vessel to structure), and likely vessel type involved in allision?	**Sec. 6.8**	
Does the NSRA consider and analyze frequency of allision and consequences of allision ("What if" analysis)?	**Sec. 6.8.4**	
Does the NSRA consider and analyze any likely location of grounding and likely vessel type involved in grounding?	**N/A**	
Does the NSRA analyze the frequency of grounding and consequences of grounding ("What if" analysis)?	**N/A**	
Does the IFS layout conform to guidance presented by the Coast Guard to OREI developers (i.e. IFS are aligned and in straight rows or columns and shared border issues are adequately addressed)?	**Sec. 2.1**	
Has the developer conducted additional site- specific assessments, if necessary, to assess the proposed locations of individual turbine devices, substations, platforms and any other IFS within the study area?	**Sec. 6.8**	
8. VISUAL NAVIGATION – District The NSRA should consider and evaluate the impact on surface visual navigation resulting from the introduction of IFS on the OCS.		
Could the IFS (singly or as a development) block or hinder the view of other vessels underway on any route near the project?	**Sec. 5.1.1.4**	

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Could the IFS block or hinder the view of the coastline or of any other navigational feature such as ATON, landmarks, promontories?	**Sec. 5.1.1.4**	
Could the IFS locations limit the ability of vessels to maneuver in order to avoid collisions?	**Sec. 2.6.1**	
9. COMMUNICATIONS, RADAR AND POSITIONING SYSTEMS - NAVCEN The NSRA should consider the impact from IFS on all electronic systems in and around the project.		
Could the IFS produce interference such as shadowing, reflections or phase changes, with marine positioning, navigation, or communications, including AIS, Direction Finding Capabilities, GPS, and Digital Selective Calling (DSC) whether ship borne, ashore, or fitted to any of the proposed IFS?	**Sec. 5.1.2.1 & 5.1.2.4**	
Could the IFS produce radar reflections, blind spots, shadow areas or other adverse effects in the following interrelationships: • Vessel to vessel; • Vessel to shore; • Vessel Traffic Service radar to vessel; • Radio Beacons (RACONS) to/from vessel; • Aircraft and Air Traffic Control	**Sec. 5.1.2.3**	
Do the IFS comply with current recommendations concerning electromagnetic interference?	**Sec. 5.1.2.8**	
Does the NSRA consider whether IFS produce acoustic noise or noise absorption or reflections that mask or interfere with prescribed sound signals from other vessels or ATON?	**Sec. 5.1.2.6**	
Does the NSRA consider whether IFS, generators, and the seabed cabling within the site and onshore might produce electro-magnetic fields affecting compasses and other navigation systems?	**Sec. 5.1.2.8**	
10. FACILITY CHARACTERISTICS – District The NSRA should identify and describe how IFS are marked to ensure visual identification and avoidance.		
Does the NSRA illustrate how the site is marked by day and night, including details on perimeter marking?	**Sec. 5.1.1.1 and Sec. 5.1.1.2**	
Does the NSRA show if the site is marked with one or more RACONS or, an AIS transceiver, or both and if so, what AIS data it will transmit?	**Sec. 5.1.1.3**	
If the site is fitted with a sound signal, does the NSRA show characteristics of the sound signal, and where the signal or signals are sited?	**Sec. 5.1.1.1**	
Does the NSRA show how the proposed site and/or its individual generators comply in general with markings for such IFS, as required by the Coast Guard?	**Sec. 5.1.1.1**	

ISSUE	REPORT SECTION	NOTES
Does the NSRA illustrate how the marking, lighting or signaling of the IFS impacts existing Federal ATON in the vicinity of the IFS?	**Sec. 5.1.1.4**	
11. DESIGN REQUIREMENTS – Sector or District The NSRA contains sufficient information to ensure:		
Are all above surface IFS proposed to be marked in accordance with NVIC 02-23-CH 1 Enclosure (6)?	**Sec. 5.1.1.1**	
Are all generators and transmission systems equipped with control mechanisms that can be operated from an operations center 24/7?	**Sec. 8.1.3**	
Throughout the design process, are appropriate assessments and methods for safe shutdown established and agreed to through consultation with the Coast Guard and other emergency support services?	**Sec. 8.1.3**	
Are there control mechanisms that allow operations center personnel to fix and maintain the position of the any appropriate moving parts of an OREI? Enclosed spaces such as nacelle hatches in which personnel are working should be capable of being opened from the outside to allow rescuers (for example, helicopter winch-operators) to access the space if occupants are unable to assist or when sea-borne approach is not possible.	**Sec. 8.1.3**	
12. OPERATIONAL PROCEDURES – Sector The NSRA contains sufficient detail to ensure connectivity and collaboration with local emergency responders.		
Can the operations center immediately initiate shut-down procedures for WTG as requested by the SAR Mission Coordinator (SMC) and maintain the WTG in the appropriate shut-down position until notification from the SMC that it is safe to restart the WTG?	**Sec. 8.1.3**	
Is there a plan to test communication and shutdown procedures at least twice each year?	**Sec. 8.1.3**	
Does the plan include a process for the operator to submit documentation that verifies the structural integrity of the IFS following an allision?	**Sec. 8.1.3**	
13. EXISTING AIDS TO NAVIGATION – DISTRICT The NSRA adequately addresses export and inter array cable routes.		
Does the NSRA determine if the proposed project impact any existing ATON in the leased area or along the export cable route?	**Sec. 2.5.4.1**	
Have developers calculated the Minimum Safe Distance (MSD) to existing ATON and ensured cables and IFS do not intrude into the MSD?	**Sec. 2.5.4.1**	

Appendix B

AIS Data Analyses

B.1 AIS Data Summary

AIS data were compiled in a consistent format from different data sets to the cover the period from July 1, 2017 to June 30, 2022. Table B.1 summarizes the details of the AIS datasets available for each year. Figure B.1 presents the spatial extent of the analysis regions adopted for the AIS data in this report which covered longitudes between 75°14'51.7"W to 71°47'06.4"W and latitudes between 38°46'36.5"N to 40°41'19.3"N. The AIS data analysis has focused on Lease Area OSC-A 0544 (the "Lease Area"). Regional level traffic patterns are presented in Section 2.5.2, this appendix presents further detail on the tracks and vessels which passed through the Lease Area at some point in their trip(s).

In total over the five-year period analyzed, there are 1,195 unique vessels interacting with the Lease Area, a majority of which are fishing and recreational. A total of 251 unique fishing vessels and 530 unique recreational vessels are in the data set. Note that the number of unique vessels for a given year as compared to the total number of unique vessels per 2017-2022 will not add up to the same number since the same vessel may frequent the area in different years.

Table B.1: Summary of AIS Dataset Analyzed (Data Source: Marine Cadastre)

Parameter	2017	2018	2019	2020	2021	2022	Jul. 2017- Sep. 2022
Number of Unique Vessels	191	247	298	320	315	150	1,195
Number of Unique Fishing Vessels	63	65	80	137	73	24	251
Number of Unique Recreational Vessels	74	100	117	103	156	63	530

***Note that the number of unique vessels for a given year as compared to the total number of unique vessels per 2017-2022 will not add up to the same number since the same vessel may frequent the area in different years.*

Table B.2 summarizes the vessel categories that each AIS vessel code has been assigned to in this study while Table B.3 provides a summary of numbers of unique vessels and unique tracks by vessel type. The seasonal breakdown of vessel traffic is given Table B.4.

Table B.2: AIS Vessel Type Codes and Vessel Classes

AIS Code	Description	Vessel Class in this NSRA
0	Not available (default) – Not used	Unspecified AIS Type
9,10,12	Reserved for future use	Other
20	Wing in ground (WIG), all ships of this type	Other
21	Wing in ground (WIG), Hazardous category A – Not used	Other
22	Wing in ground (WIG), Hazardous category B – Not used	Other
23	Wing in ground (WIG), Hazardous category C – Not used	Other
24	Wing in ground (WIG), Hazardous category D – Not used	Other
25	Wing in ground (WIG), Reserved for future use – Not used	Other
26	Wing in ground (WIG), Reserved for future use – Not used	Other
27	Wing in ground (WIG), Reserved for future use – Not used	Other

AIS Code	Description	Vessel Class in this NSRA
28	Wing in ground (WIG), Reserved for future use – Not used	Other
29	Wing in ground (WIG), Reserved for future use – Not used	Other
30	Fishing	Fishing
31	Towing	Tug Tows
32	Towing: length exceeds 200m or breadth exceeds 25m	Tug Tows
33	Dredging or underwater ops	Other
34	Diving ops	Other
35	Military ops	Military
36	Sailing	Recreational
37	Pleasure Craft	Recreational
38	Reserved	Other
39	Reserved	Other
40	High speed craft (HSC), all ships of this type	Other
41	High speed craft (HSC), Hazardous category A – Not used	Other
42	High speed craft (HSC), Hazardous category B – Not used	Other
43	High speed craft (HSC), Hazardous category C – Not used	Other
44	High speed craft (HSC), Hazardous category D – Not used	Other
45	High speed craft (HSC), Reserved for future use – Not used	Other
46	High speed craft (HSC), Reserved for future use – Not used	Other
47	High speed craft (HSC), Reserved for future use	Other
48	High speed craft (HSC), Reserved for future use – Not used	Other
49	High speed craft (HSC), No additional information	Other
50	Pilot Vessel	Other
51	Search and Rescue vessel	Military
52	Tug	Tug Tows
53	Port Tender	Other
54	Anti-pollution equipment – Not used	Other
55	Law Enforcement	Military
56	Spare - Local Vessel – Not used	Tug Tows
57	Spare - Local Vessel	Tug Tows
58	Medical Transport – Not used	Other
59	Noncombatant ship according to RR Resolution No. 18	Other
60	Passenger, all ships of this type	Passenger
61	Passenger, Hazardous category A – Not used	Passenger
62	Passenger, Hazardous category B – Not used	Passenger
63	Passenger, Hazardous category C – Not used	Passenger

AIS Code	Description	Vessel Class in this NSRA
64	Passenger, Hazardous category D – Not used	Passenger
65	Passenger, Reserved for future use	Passenger
66	Passenger, Reserved for future use – Not used	Passenger
67	Passenger, Reserved for future use	Passenger
68	Passenger, Reserved for future use – Not used	Passenger
69	Passenger, No additional information	Passenger
70	Cargo, all ships of this type	Cargo
71	Cargo, Hazardous category A	Cargo
72	Cargo, Hazardous category B	Cargo
73	Cargo, Hazardous category C	Cargo
74	Cargo, Hazardous category D	Cargo
75	Cargo, Reserved for future use – Not used	Cargo
76	Cargo, Reserved for future use – Not used	Cargo
77	Cargo, Reserved for future use	Cargo
78	Cargo, Reserved for future use – Not used	Cargo
79	Cargo, No additional information	Cargo
80	Tanker, all ships of this type	Tanker
81	Tanker, Hazardous category A	Tanker
82	Tanker, Hazardous category B	Tanker
83	Tanker, Hazardous category C	Tanker
84	Tanker, Hazardous category D	Tanker
85	Tanker, Reserved for future use – Not used	Tanker
86	Tanker, Reserved for future use – Not used	Tanker
87	Tanker, Reserved for future use – Not used	Tanker
88	Tanker, Reserved for future use – Not used	Tanker
89	Tanker, No additional information	Tanker
90	Other Type, all ships of this type	Other
91	Other Type, Hazardous category A	Other
92	Other Type, Hazardous category B – Not used	Other
93	Other Type, Hazardous category C – Not used	Other
94	Other Type, Hazardous category D – Not used	Other
95	Other Type, Reserved for future use	Other
96	Other Type, Reserved for future use	Other
97	Other Type, Reserved for future use	Other
98	Other Type, Reserved for future use – Not used	Other
99	Other Type, no additional information	Other

AIS Code	Description	Vessel Class in this NSRA
107	Reserved for regional use	Other
200 to 255	Reserved for future use – Not used	Other
256 to 999	No designation – Not used	Other
1001	Commercial Fishing Vessel	Fishing
1002	Fish Processing Vessel – Not used	Fishing
1003	Freight Barge	Cargo
1004	Freight Ship	Cargo
1005	Industrial Vessel	Other
1006	Miscellaneous Vessel – Not used	Other
1007	Mobile Offshore Drilling Unit – Not used	Other
1008 and 1009	Non-Vessel – Not used	Other
1010	Offshore Supply Vessel	Other
1011	Oil Recovery	Other
1012	Passenger (Inspected)	Passenger
1013	Passenger (Uninspected)	Passenger
1014	Passenger Barge (Inspected)	Passenger
1015	Passenger Barge (Uninspected)	Passenger
1016	Public Freight	Cargo
1017	Public Tankship/Barge – Not used	Tanker
1018	Public Vessel, Unclassified	Other
1019	Pleasure Craft/Sailing	Recreational
1020	Research Vessel	Other
1021	SAR Aircraft – Not used	Military
1022	School Ship	Other
1023	Tank Barge – Not used	Tug Tows
1024	Tank Ship	Tanker
1025	Towing Vessel	Tug Tows
1026 to 1051	No designation – Not used	Other
1052	Towing Vessel – Not used	Tug Tows
1053 to 2000	No designation – Not used	Other

Table B.3: Vessel Types Within the Lease Area Based on July 2017 to June 2022 AIS Data

	Unique Vessels		Unique Tracks	
	Number	Percentage	Number	Percentage
Cargo Vessels	163	14%	208	7%
Tankers	127	11%	148	5%
Passenger Vessels	19	2%	42	1%
Tug Tow Vessels	43	4%	74	3%
Military Vessels	0	0%	0	0%
Recreational Vessels	530	44%	733	26%
Fishing Vessels, All[1]	251	21%	1,480	52%
Fishing Vessels, In Transit [1]	209	17%	961	34%
Fishing Vessels, Fishing [1]	125	10%	519	18%
Other Vessels	62	5%	155	5%
Total (July 2017–June 2022)	1,195	100%	2,840	100%
Annual Average	304[2]	-	568	-

[1]Any track that intersects with the Lease Area and has pings inside the Lease Area that are less than 4 knots are considered actively fishing.
[2] The number of unique vessels in each year is determined, summed, and divided by the total number of years used in the analysis (five years)

Table B.4: Vessel Types Within the Lease Area by Month on July 2017 to June 2022 AIS Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (July 2017-June 2022)
Number of Unique Vessels - Cargo Vessels	25	13	24	19	11	13	12	14	14	11	9	21	163
Number of Unique Tracks - Cargo Vessels	26	13	25	20	12	28	12	15	14	12	9	22	208
Number of Unique Vessels - Fishing Vessels (all)	29	33	55	39	27	48	61	51	61	57	44	22	251
Number of Unique Tracks - Fishing Vessels (all)	83	83	118	78	102	129	172	181	137	189	142	66	1,480
Number of Unique Vessels - Passenger Vessels	-	-	1	4	7	6	2	2	1	5	3	-	19
Number of Unique Tracks - Passenger Vessels	-	-	1	5	10	8	3	3	2	6	4	-	42
Number of Unique Vessels - Recreational Vessels	2	1	1	7	66	161	114	98	81	67	18	2	530
Number of Unique Tracks - Recreational Vessels	2	1	1	7	71	204	148	115	89	72	21	2	733
Number of Unique Vessels - Tankers	8	4	15	20	16	7	13	14	14	17	7	8	127
Number of Unique Tracks - Tankers	8	4	15	22	16	7	13	15	15	18	7	8	148
Number of Unique Vessels - Tug Tow Vessels	7	2	7	8	5	6	9	4	6	4	3	2	43
Number of Unique Tracks - Tug Tow Vessels	9	4	9	8	6	7	10	5	6	4	3	3	74
Number of Unique Vessels - Other Vessels	3	3	6	7	15	11	15	9	8	6	12	3	62
Number of Unique Tracks - Other Vessels	7	11	20	7	18	12	21	13	14	10	19	3	155
Total (July 2017- June 2022)													
Total Number of Unique Vessels	74	56	109	104	147	252	226	192	185	167	96	58	1,195
Total Number of Unique Tracks	135	116	189	147	235	395	379	347	277	311	205	104	2,840

Vessel track density plots for all vessels that transited through the Lease Area is presented in Figure B.1. Figure B.2 provides a polar histogram showing the distribution of vessel courses and speeds of vessels that transited through the Lease Area. The dominant courses are noted to be west, east, northeast, and southwest.

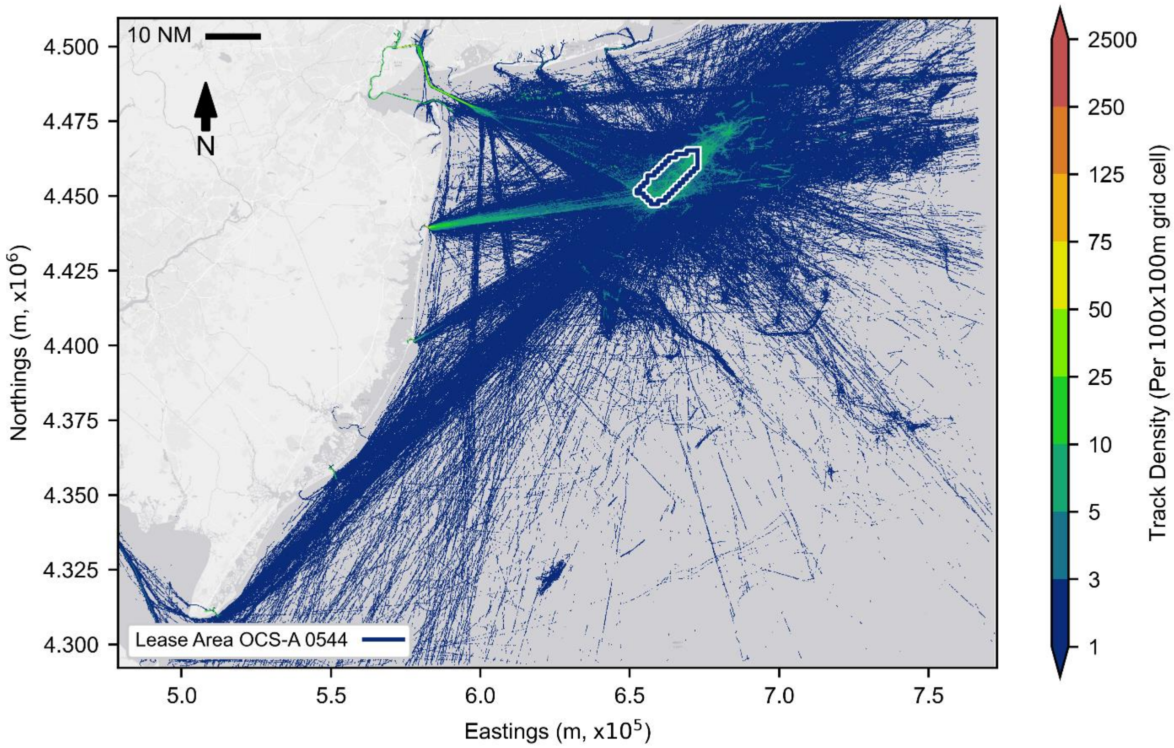

Figure B.1: AIS Vessel Traffic Density for All Vessels that Transited Through the Lease Area (July 2017 to June 2022)

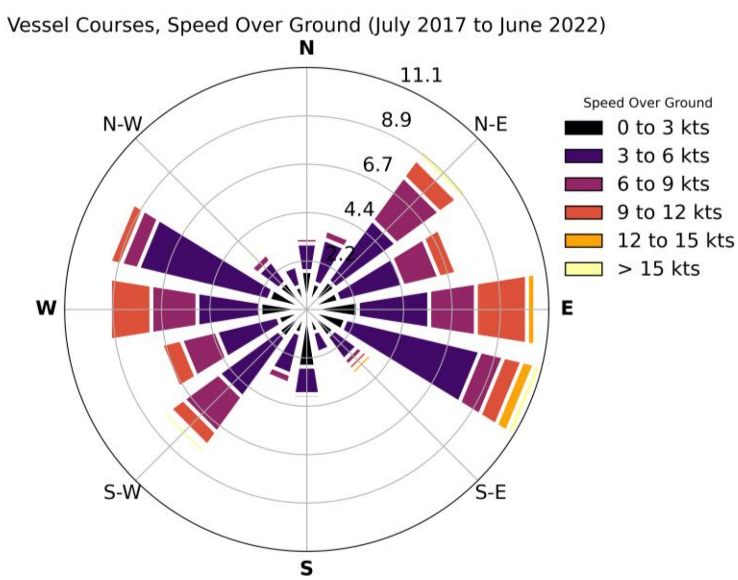

Figure B.2: All Vessels' Courses Throughout and Speed Through the Lease Area

B.2 Commercial Traffic

A summary of the various commercial vessels that transited through the Lease Area is presented in the following sections.

B.2.1 Passenger Vessels

A total of 19 unique passenger vessels transited through the Lease Area during the 5 -year AIS data record. The total passenger vessel tracks passing through the Lease Area was 42. Table B.5 summarizes the vessel details for the 10 largest (LOA) passenger vessels that transited though the AIS analysis area. A histogram of vessel length is also presented in Figure B.3. Vessel length ranges from 45 to 965 ft (14 to 294 m) LOA. The vessel dimensions in Table B.5 were updated based on dimensions registered on the Coast Guard database, but the histogram in Figure B.3 is based on AIS data.

Table B.5: Vessel Details – 10 Largest Passenger Vessels Transiting the Lease Area

Vessel Name	AIS Code	MMSI Number	IMO Number	LOA (ft)	LOA (m)	Beam (ft)	Beam (m)
NORWEGIAN DAWN	1012	311307000	9195169	964.7	294.0	105.6	32.2
SILVER WIND	60	308814000	8903935	533.3	162.5	70.2	21.4
FRAM	60	258932000	9370018	379.9	115.8	66.3	20.2
NEW JERSEY	1012	366914190	8643078	284.0	86.6	67.6	20.6
INDEPENDENCE*	1012	367438210	9583366	221.5	67.5	50.0	15.2
AMERICAN STAR	1012	367184740	9427615	187.5	57.2	45.0	13.7
SORENSEN MILLER	1012	367116570		105.0	32.0	24.9	7.6
JAMES K GOODWIN	1012	367110550		97.2	29.6	25.9	7.9
PROVINCETOWN III	1012	366954420	9329394	90.9	27.7	29.9	9.1
VOYAGER*	1012	367034570		90.0	27.4	23.0	7.0

NOTE: Vessel dimensions updated based on dimensions registered on the Coast Guard database (https://cgmix.uscg.mil/PSIX/PSIXSearch.aspx)
*Vessel dimensions could not be verified through the Coast Guard database

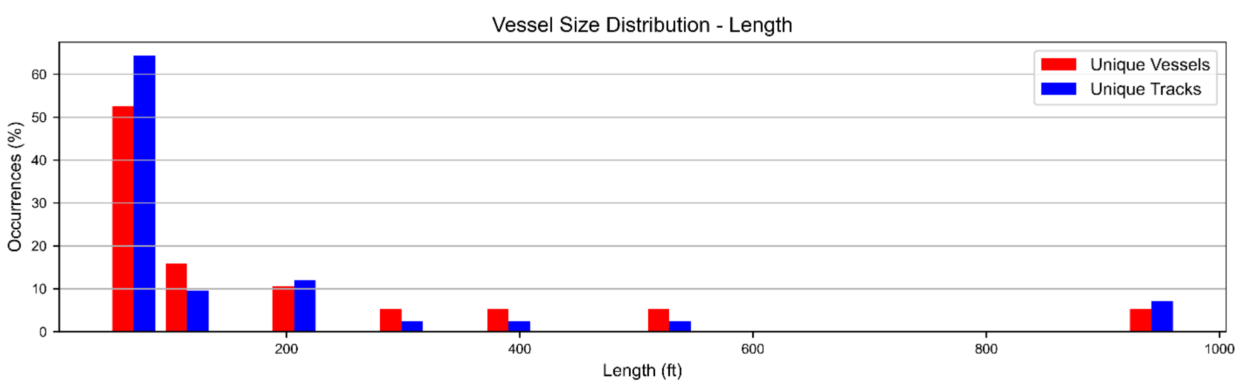

Figure B.3: Histogram of Passenger Vessel Size (LOA) Transiting Through the Lease Area Based on AIS Data

Figure B.4 presents a plot of all passenger vessel tracks, and Figure B.5 presents the courses and speeds of the passenger vessels in the Lease Area. The dominant course observed is northeast.

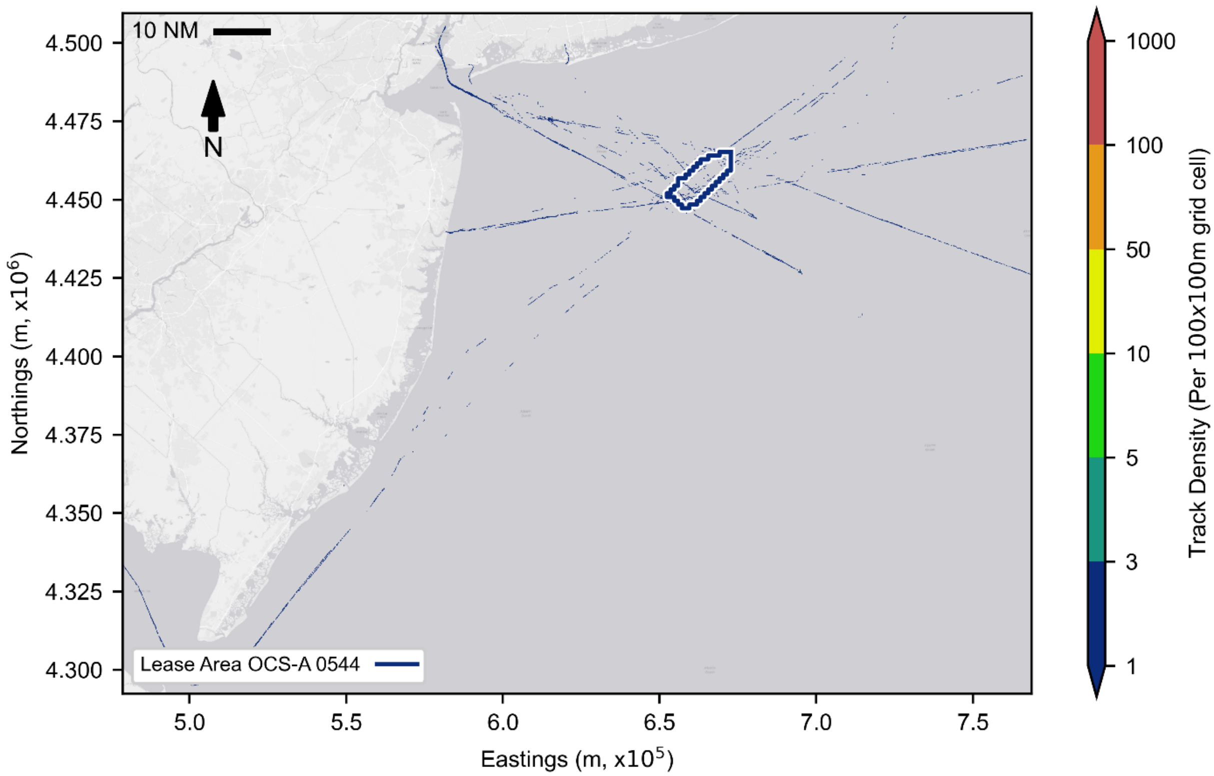

Figure B.4: Total (July 2017 - June 2022) Passenger Vessel Tracks Through the Lease Area

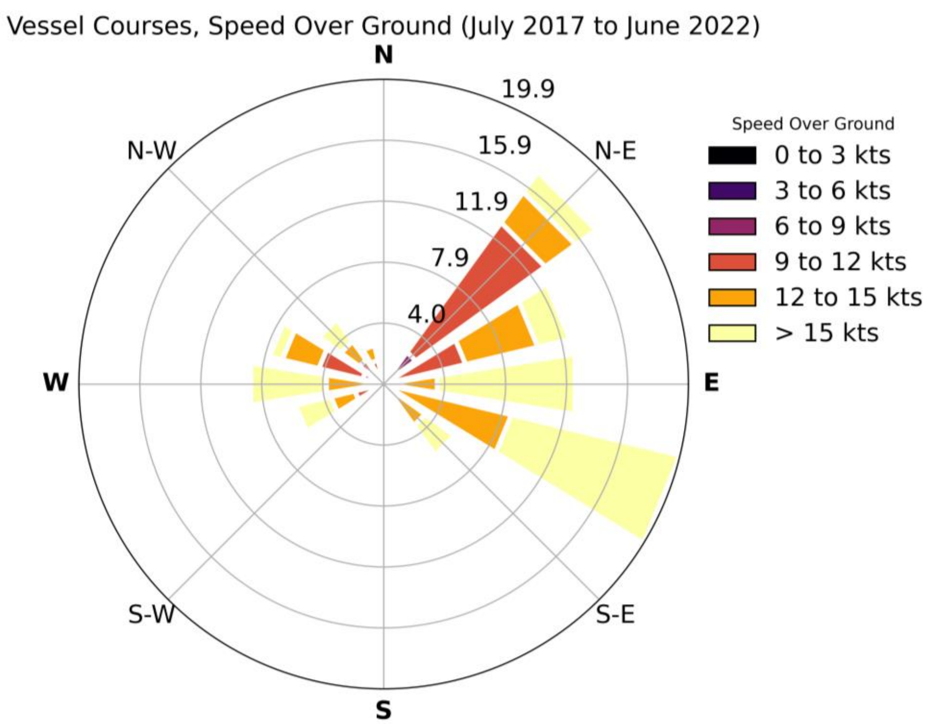

Figure B.5: Passenger Vessels' Courses and Speed Through the Lease Area

B.2.2 Tanker Vessels

A total of 127 unique tanker vessels transited through the Lease Area during the 5-year AIS data record. The total number of unique tanker vessel tracks through the Lease Area was 148. Table B.6 summarizes the vessel details for the 10 largest (LOA) tanker vessels that transited through the Lease Area. A histogram of vessel length is presented in Figure B.6 with most tankers having an approximate 600 ft (183 m) LOA.

Figure B.7 presents a plot of all tanker vessel tracks, and Figure B.8 presents the distribution of courses and speeds of the tanker vessels in the Lease Area. The dominant courses observed are west, east to southeast, and south.

Table B.6: Vessel Details – 10 Largest Tanker Vessels Transiting The Lease Area

Vessel Name	AIS Code	MMSI Number	IMO Number	LOA (ft)	LOA (m)	Beam (ft)	Beam (m)
SK SUMMIT	80	357357000	9157624	908.8	277.0	142.4	43.4
DILONG SPIRIT	80	311807000	9390628	901.2	274.7	157.5	48.0
SKS SKEENA	80	258722000	9301536	899.8	274.3	158.7	48.4
CHEROKEE	1024	241473000	9749491	899.5	274.2	157.5	48.0
ASTRO POLARIS	80	240125000	9281152	899.0	274.0	157.5	48.0
AUSTRALIAN SPIRIT	1024	311498000	9247455	840.5	256.2	146.9	44.8
PACIFIC TREASURES	1024	538006773	9732242	839.6	255.9	141.1	43.0
AITOLOS	80	538008713	9867619	819.9	249.9	144.4	44.0
WONDER SIRIUS	80	538009332	9285847	819.7	249.8	143.8	43.8
FRONT LYNX	80	538006769	9726592	790.7	241.0	144.4	44.0

NOTE: Vessel dimensions updated based on dimensions registered on the Coast Guard database (https://cgmix.uscg.mil/PSIX/PSIXSearch.aspx)

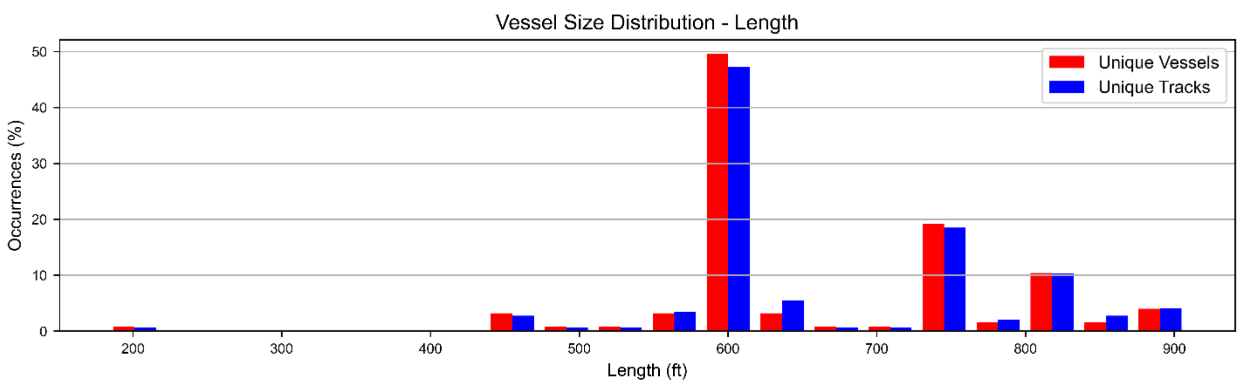

Figure B.6: Histogram Of Tanker Vessel Size (LOA) Transiting Through the Lease Area

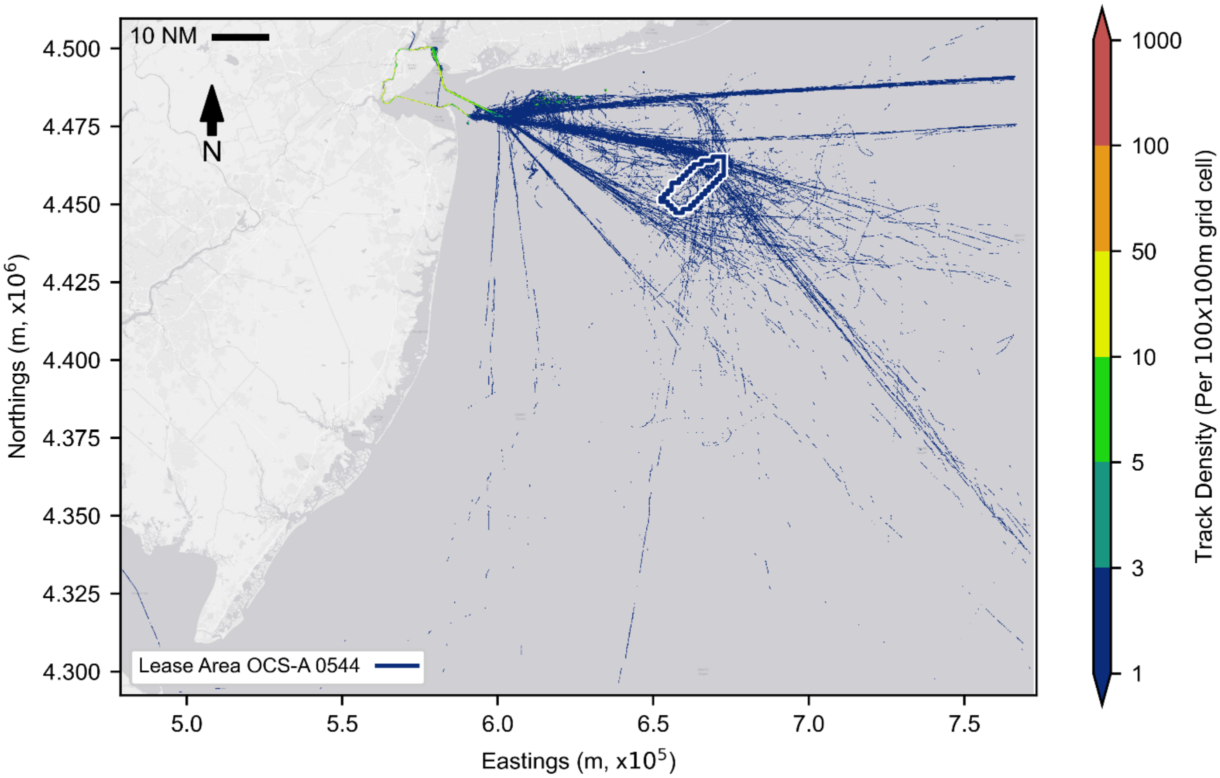

Figure B.7: Total (July 2017 - June 2022) Tanker Vessel Tracks Through the Lease Area

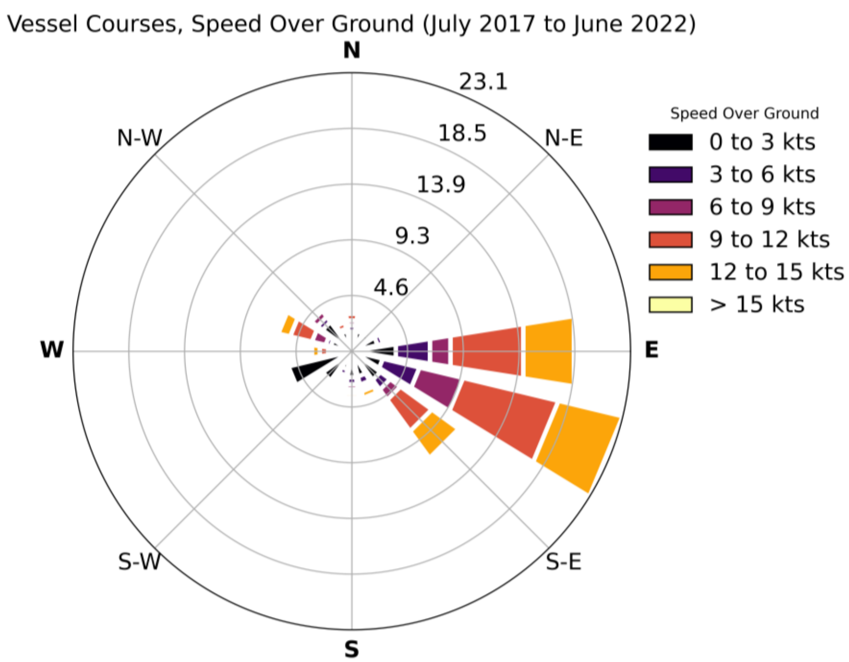

Figure B.8: Tanker Vessels' Courses Throughout and Speed Through the Lease Area

B.2.3 Dry Cargo Vessels

A total of 163 unique cargo vessels transited through the Lease Area during the 5-year AIS data record. The total number of unique cargo vessel tracks through the Lease Area was 208. Table B.7 summarizes the vessel details for the 10 largest (LOA) cargo vessels that transited through the Lease Area. A histogram of vessel lengths is presented in Figure B.9. Vessel length ranges from 354 to 1204 ft (108 to 367 m) LOA.

Table B.7: Vessel Details – 10 Largest Dry Cargo Vessels Transiting the Lease Area

Vessel Name	AIS Code	MMSI Number	IMO Number	LOA (ft)	LOA (m)	Beam (ft)	Beam (m)
GRETE MAERSK	70	220397000	9302889	1203.8	366.9	140.4	42.8
COSCO EXCELLENCE	70	477135600	9472189	1202.3	366.5	158.1	48.2
OOCL CHONGQING	70	477832400	9622629	1202.3	366.5	158.1	48.2
ROME EXPRESS	71	219258000	9447861	1200.7	366.0	158.1	48.2
GEORG MAERSK	70	220416000	9320257	1203.7	366.0	140.4	42.8
COSCO HOPE	72	477598800	9472165	1157.7	352.9	158.1	48.2
ESSEN EXPRESS	70	218474000	9501370	1157.7	352.9	157.5	48.0
OOCL BRUSSELS	74	477182300	9622590	1157.6	352.8	158.1	48.2
GUNVOR MAERSK	70	220413000	9302891	1154.8	352.0	140.4	42.8
GUDRUN MAERSK	70	220379000	9302877	1154.8	352.0	140.4	42.8

NOTE: Vessel dimensions updated based on dimensions registered on the Coast Guard database (https://cgmix.uscg.mil/PSIX/PSIXSearch.aspx)

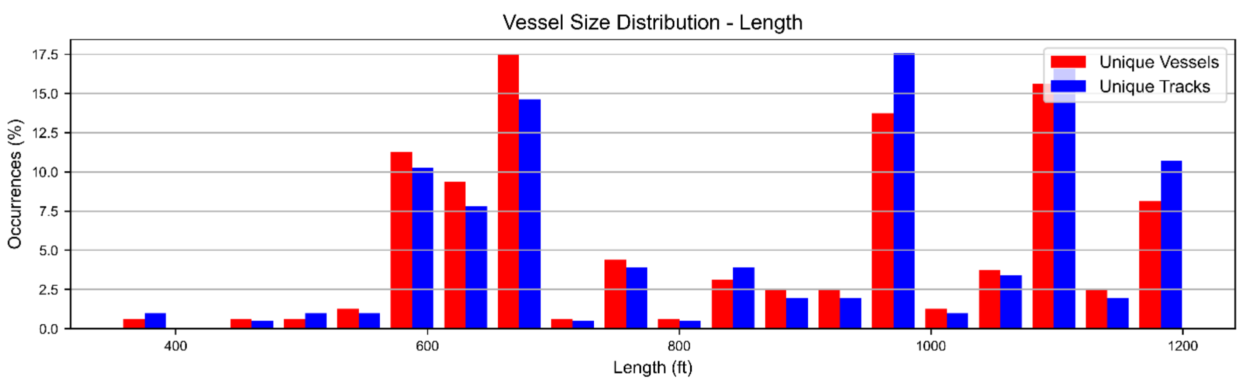

Figure B.9: Histogram of Dry Cargo Vessel Size (LOA) Transiting Through the Lease Area

Figure B.10 presents a plot of all cargo vessel tracks, and Figure B.11 presents the distribution of courses and speeds of the cargo vessels in the Lease Area. The dominant courses observed are west, west-northwest, east, east-southeast, as well as north and south.

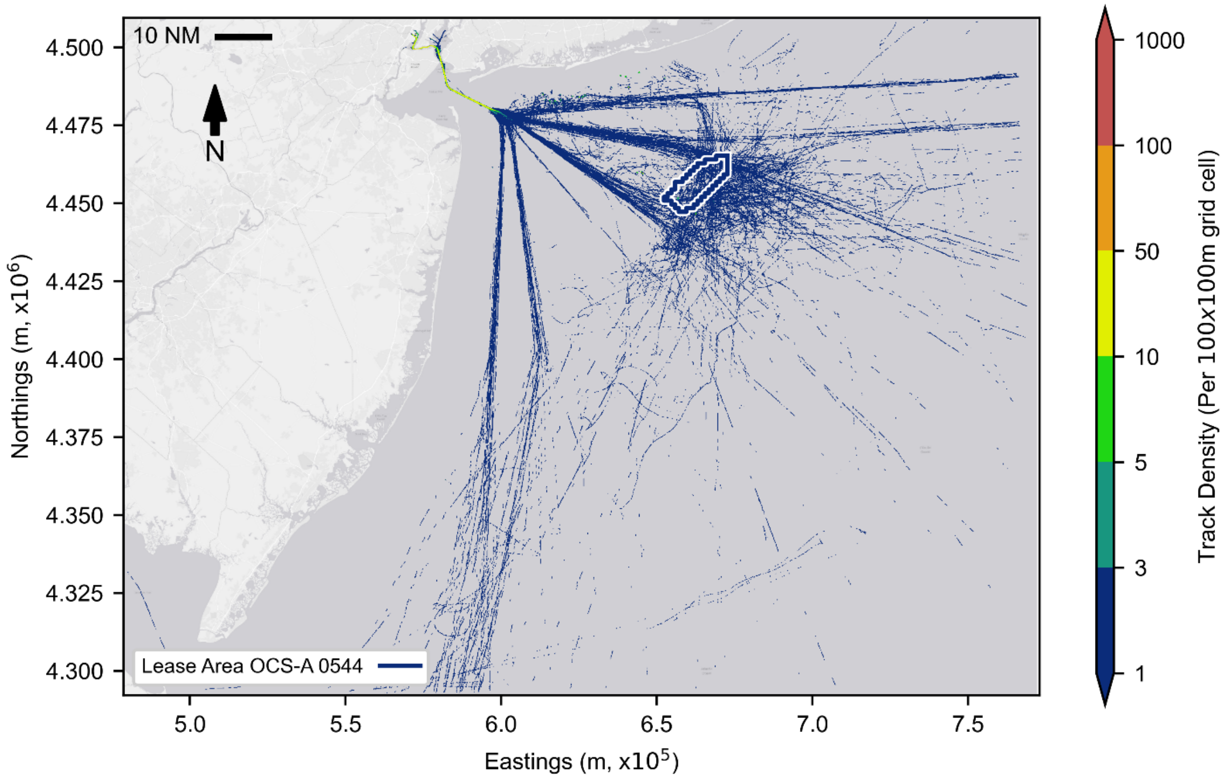

Figure B.10: Total (July 2017- June 2022) Dry Cargo Vessel Tracks Through the Lease Area

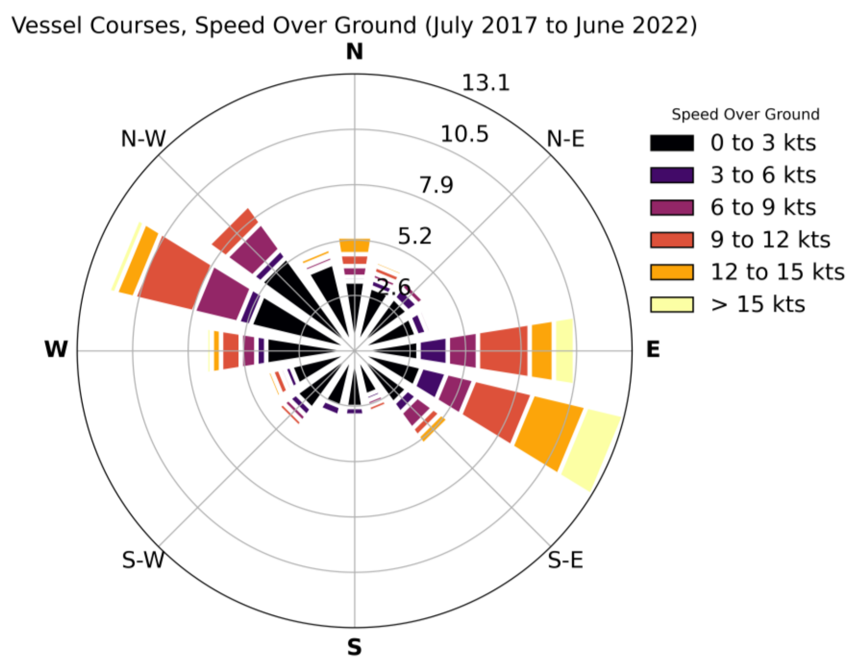

Figure B.11: Cargo Vessels' Courses Throughout and Speed Through the Lease Area

B.2.4 Tugs and Tug Tows

A total of 43 unique tug and towing vessels transited through the Lease Area during the 5-year AIS data record. The total number of unique tug and towing vessel tracks through the Lease Area was 74. Table B.8 summarizes the vessel details for the 10 largest (LOA) towing vessels that transited through the Lease Area. A histogram of vessel lengths based on AIS data is presented in Figure B.12. After updating the 10 largest vessel lengths with the Coast Guard database, the vessel length ranges from 59 to 202 ft (18 to 62 m) LOA.

Table B.8: Vessel Details –10 Largest Towing Tracks and Their Towing Vessel which Transited Through the Lease Area

Vessel Name	AIS Code	MMSI Number	IMO Number	LOA (ft)	LOA (m)	Beam (ft)	Beam (m)
VOS STAR	52	244820666	9697131	201.7	61.5	49.0	14.9
FREEPORT	1025	367690000	9447249	144.0	43.9	46.0	14.0
ATLANTIC SALVOR	1025	366744010	7719624	140.7	42.9	40.0	12.2
ATLANTIC ENTERPRISE	1025	367313240	7417240	140.7	42.9	40.0	12.2
OSG ENDURANCE	31	367501540	9441477	131.4	40.1	38.0	11.6
JANE A BOUCHARD	1025	366897920	9269702	125.0	38.1	38.0	11.6
MORGAN REINAUER	1025	366516380	8101733	119.4	36.4	34.0	10.4
SOUTHERN DAWN	31	369812000	7303853	108.0	32.9	34.0	10.4
FREDERICK E BOUCHARD	1025	367728870	9794692	105.0	32.0	-	-
MORTON S BOUCHARD JR	1025	367707480	9794680	100.4	30.6	31.2	9.5

NOTE: Vessel dimensions updated based on dimensions registered on the Coast Guard database (https://cgmix.uscg.mil/PSIX/PSIXSearch.aspx)

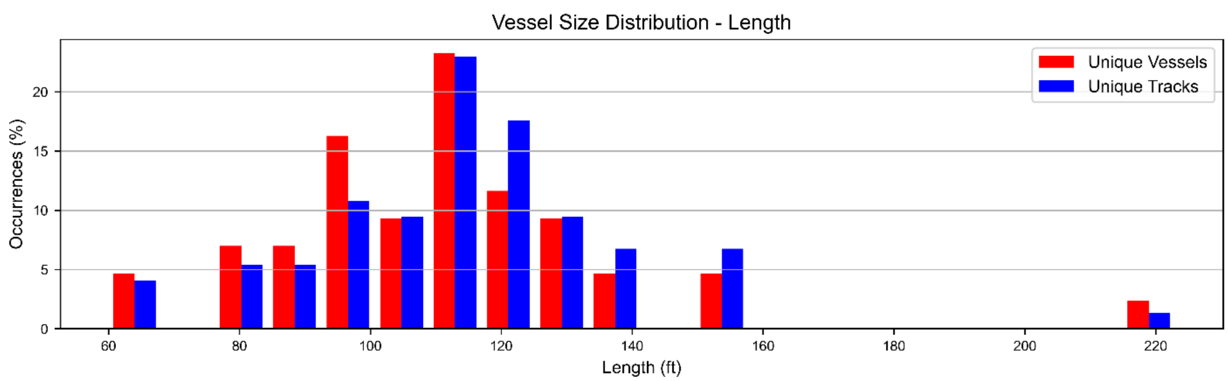

Figure B.12: Histogram of Towing Vessel Size (LOA including Towed Vessel Reported in AIS) Transiting Through the Lease Area

Figure B.13 presents a plot of all tug and towing vessel tracks, and Figure B.14 presents the distribution of courses and speeds of the tug ang towing vessels in the Lease Area. The dominant courses observed are northeast and southwest.

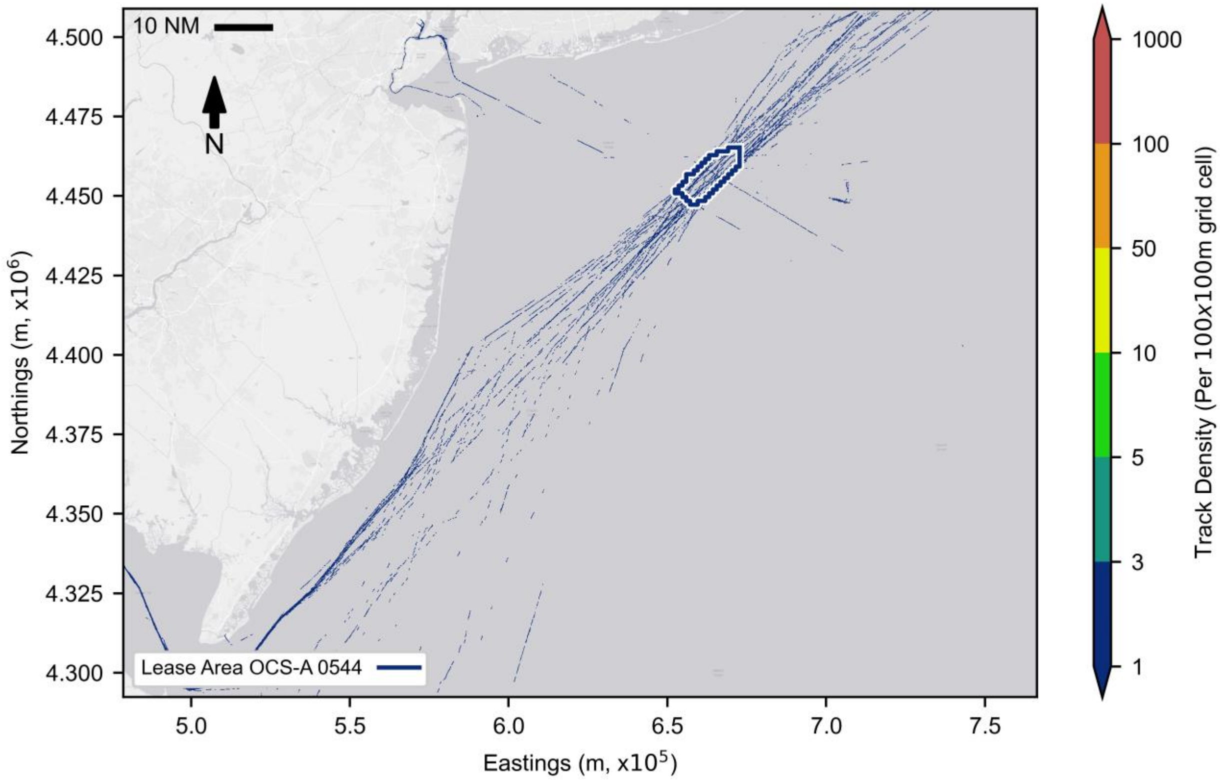

Figure B.13: Total (July 2017- June 2022) Tug/Towing Vessel Tracks Through the Lease Area

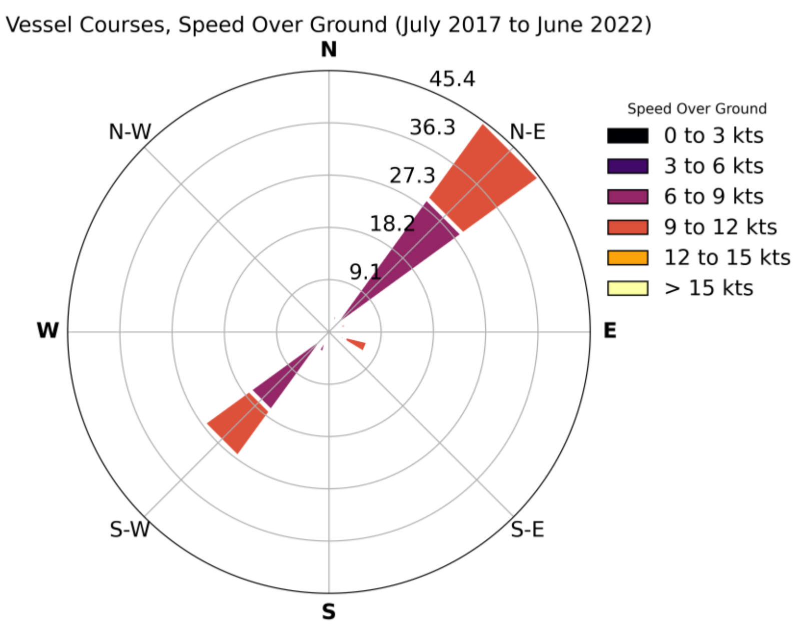

Figure B.14: Tug-towing Vessels' Courses Throughout and Speed Through the Lease Area

B.2.5 Other Vessels

A total of 62 unique vessels of various types not covered by previous non-fishing commercial categories transited through the Lease Area during the 5-year AIS data record. The 62 unique vessels are a range of different types including dredgers and survey vessels. The total number of unique other non-fishing commercial vessel tracks through the Lease Area was 267. Table B.9 summarizes the vessel details for the 10 largest unique (other) commercial vessels that transited through the Lease Area. A histogram of vessel lengths based on AIS data is presented in Figure B.15. The vessel length ranges from 59 to 202 ft (18 to 62 m) LOA.

Table B.9: Vessel Details – 10 Largest Other Vessels Transiting the Lease Area

Vessel Name	AIS Code	MMSI Number	IMO Number	LOA (ft)	LOA (m)	Beam (ft)	Beam (m)
CHARLTON	1018	338902000	9231664	950.0	289.6	105.9	32.3
KENNEDY	1022	338919000	6621662	516.9	157.6	76.0	23.2
USS MITSCHER	90	366996000	-	457.8	139.5	66.4	20.2
DURABLE	90	538001648	9242376	412.3	125.7	68.9	21.0
USS MILWAUKEE	90	369970707	-	353.5	107.0	53.8	16.4
RN WEEKS	1005	303390000	8516079	282.5	86.1	54.0	16.5
GEOQUIP SEEHORN	95	210204000	8406470	272.3	83.0	59.1	18.0
CG CAMPBELL*	1018	367289000	-	270.0	82.3	38.0	11.6
CG FORWARD*	90	367261000	-	269.0	82.0	36.1	11.0
TOISA VIGILANT	90	311963000	9282132	264.1	80.5	58.7	17.9

NOTE: Vessel dimensions updated based on dimensions registered on the Coast Guard database (https://cgmix.uscg.mil/PSIX/PSIXSearch.aspx)
*Vessel dimensions could not be verified through the Coast Guard database

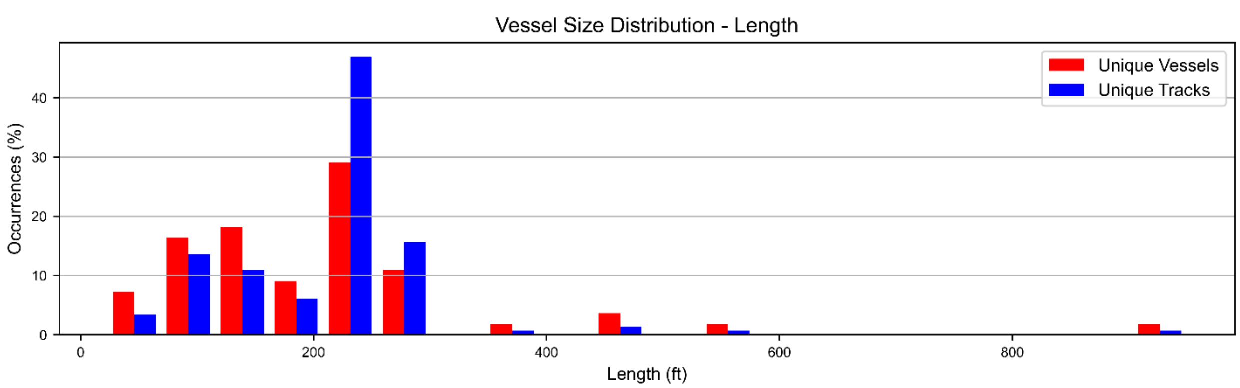

Figure B.15: Histogram of Other Commercial Vessel Size (LOA) Transiting Through the Lease Area

Figure B.16 presents a plot of all other non-fishing commercial vessel tracks, and Figure B.17 presents the distribution of courses and speeds of these vessels in the Lease Area. The dominant courses observed are west-northwest and east-southeast.

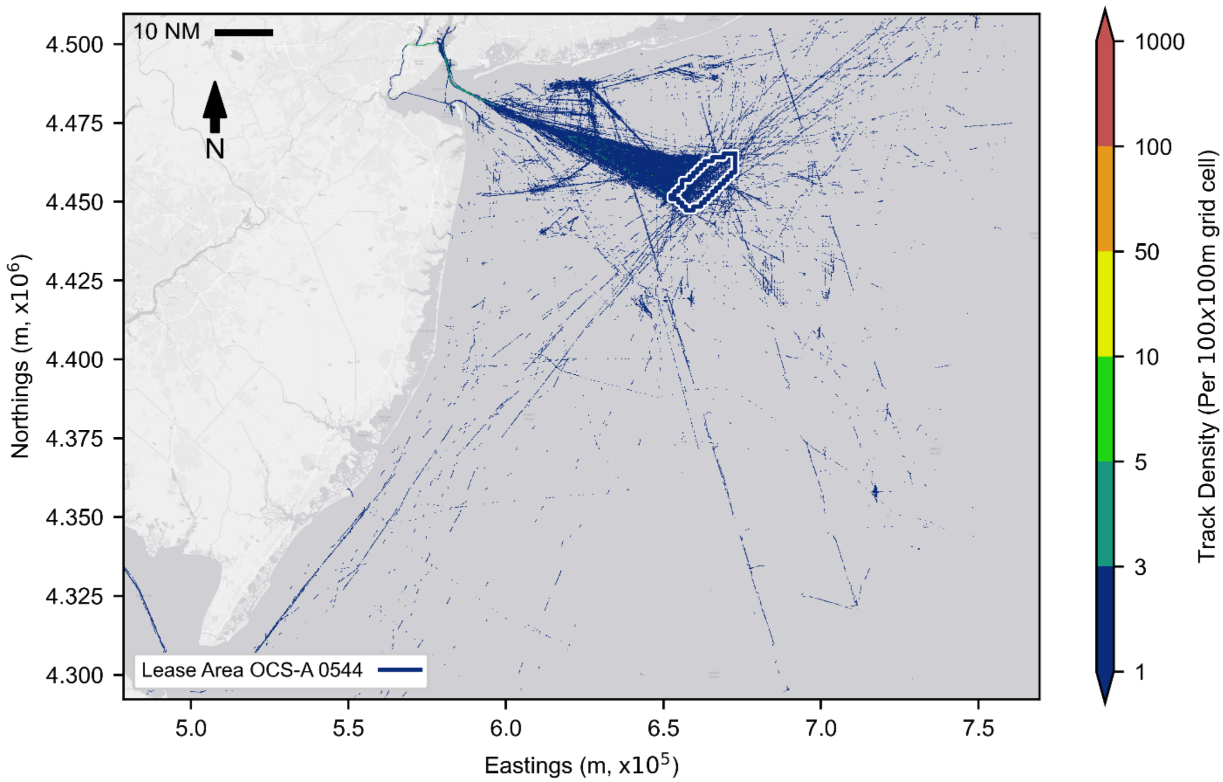

Figure B.16: Total (July 2017 – June 2022) Other Vessel Tracks Through the Lease Area

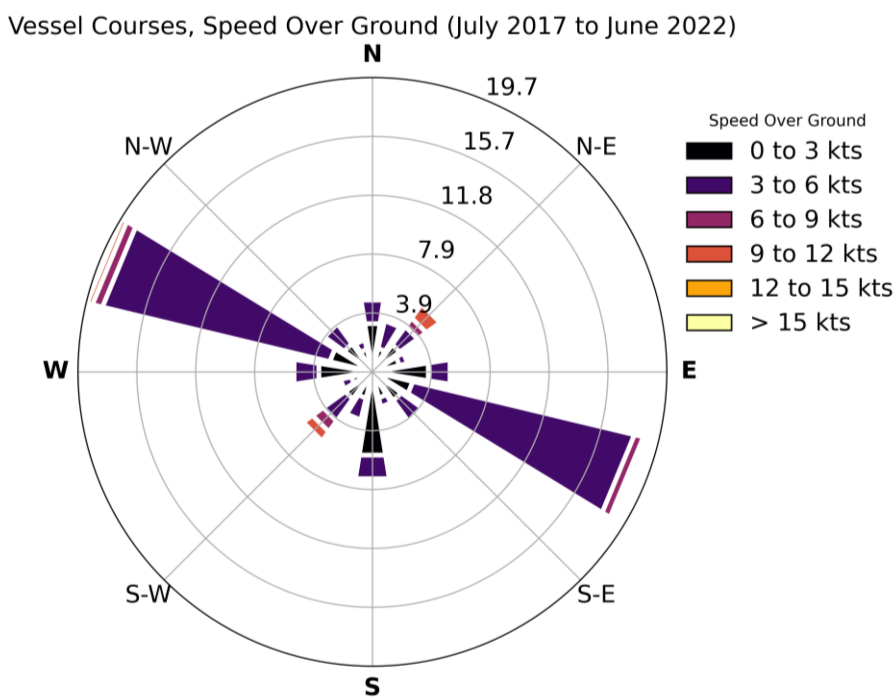

Figure B.17: Other Vessels' Courses Throughout and Speed Through the Lease Area

B.3 Recreational Vessels

A total of 530 unique recreational and sailing vessels of various types transited through the Lease Area during the 5-year AIS data record. These vessels were responsible for 733 unique vessel tracks transiting through the Lease Area. Table B.10 summarizes the vessel details for the 10 largest (LOA) recreational and sailing vessels that transited through the Lease Area. A histogram of vessel length is presented in Figure B.18. The majority of vessels have lengths between approximately 32 to 150 ft (10 to 45 m), and a small number of vessels 150 ft (45 m) LOA or longer.

It is noted that many recreational vessels, particularly smaller vessels, either do not carry AIS transceivers or transmit at lower power levels which may not be captured in the dataset.

Table B.10: Vessel Details – 10 Largest Recreational Vessels Transiting the Lease Area

Vessel Name	AIS Code	MMSI Number	IMO Number	LOA (ft)	LOA (m)	Beam (ft)	Beam (m)
NRP SAGRES*	36	263141000		295.3	90.0	78.7	24.0
CARPE DIEM	37	319025100	9590383	190.3	58.0	32.2	9.8
BROADWATER	37	339876000	1004936	170.6	52.0	30.5	9.3
NITA K II	37	339435000	1007940	170.6	52.0	30.9	9.4
STEP ONE	37	538071074	1010832	154.8	47.2	29.5	9.0
HONEY	1019	338365000	9423401	144.2	44.0	30.5	9.3
REEF CHIEF	37	319002200	9537458	161.0	49.0	26.2	8.0
ROCK STAR	37	319009300	9557692	160.8	49.0	26.2	8.0
JUST COAST*	36	338248925	0000000	160.8	49.0	13.1	4.0
MITSEAAH	1019	319073000	9440655	141.9	43.3	32.6	9.9

NOTE: Vessel dimensions updated based on dimensions registered on USCG Port State Information Exchange system (PSIX)
*Vessel dimensions could not be verified through the Coast Guard database

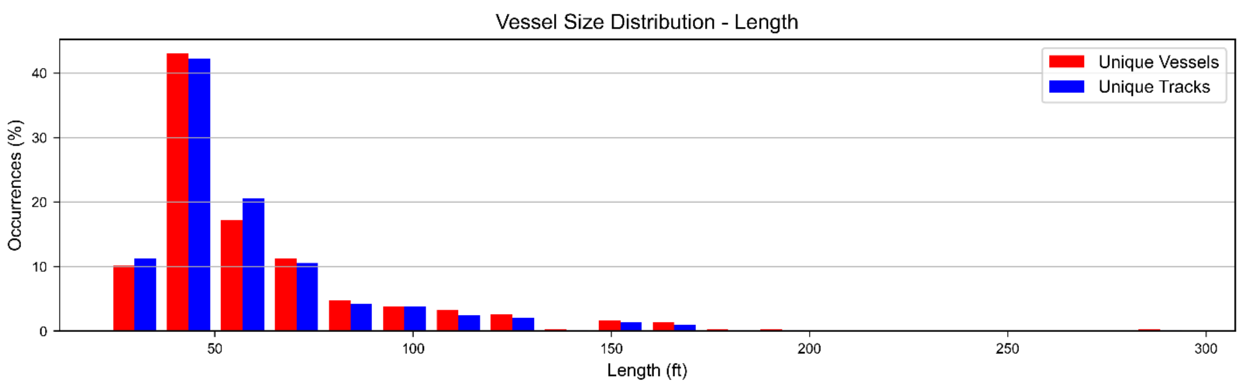

Figure B.18: Histogram of Recreational Vessel Size (LOA) Transiting Through the Lease Area

Vessel transit routes for recreational vessels were investigated based on track density analyzed within the AIS analysis area and the surrounding area. Figure B.19 presents the vessel track density for sailing and recreational vessels that have crossed the Lease Area. The traffic density through the Lease Area is lower than the surrounding region, of which the annual average track density of the regional dataset is presented in Figure B.20. Figure B.21 presents the distribution of courses and speeds of the tracks for recreational vessels transiting through the Lease Area. The dominant courses are northeast and southwest.

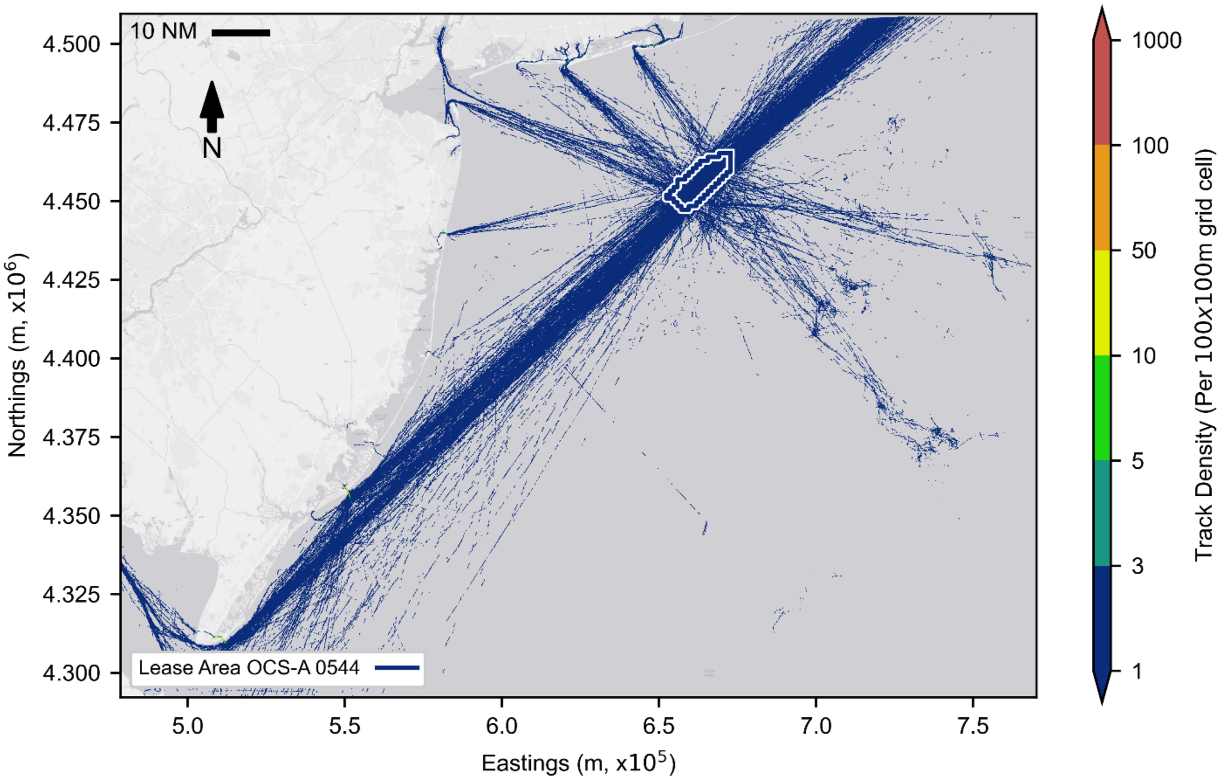

Figure B.19: Total (July 2017-June 2022) Recreational Vessel Tracks Through the Lease Area

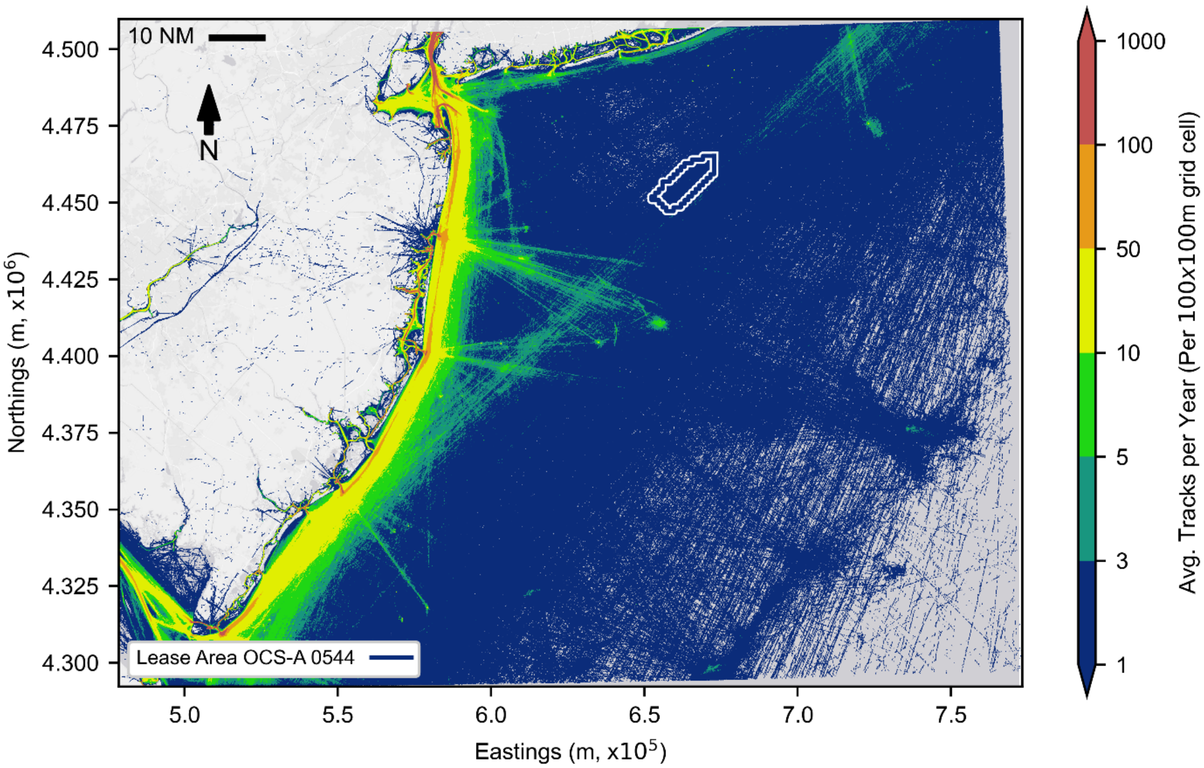

Figure B.20: AIS Vessel Traffic Average Density for Recreational Vessels

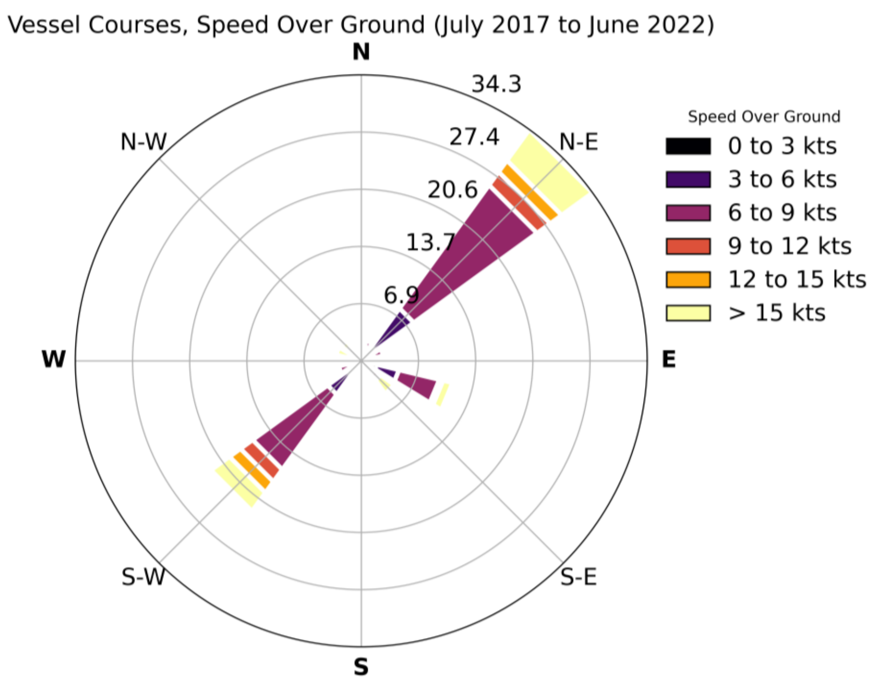

Figure B.21: Recreational Vessels' Courses Throughout and Speed Through the Lease Area

B.4 Fishing Vessels

The analysis of commercial fishing vessel traffic through the AIS analysis area is presented in the following section. Analysis of AIS vessel data include separation of traffic into transiting vessels (greater than 4 kts speed) and vessels that are likely to be fishing which was based on AIS data when vessel speed is less than 4 kts.

B.4.1 AIS Data

A total of 251 unique commercial fishing vessels of various types transited through the Lease Area during the 5-year AIS data record. The total number of commercial fishing vessel tracks through the Lease Area was 1,480, indicating that compared to other commercial vessels presented in previous sections, fishing vessels more regularly transit through the Lease Area. Table B.11 summarizes the vessel details for the 10 largest fishing vessels that transited through the Lease Area. It should be noted that there were some vessels in the AIS data set that were reporting erroneous length and beam data, and those have been excluded from the table. A histogram of vessel length is presented in Figure B.22. The vessel length ranges from approximately 35 to 158 ft (11 to 48 m), with the majority of vessels between approximately 35 and 100 ft (11 and 31 m) LOA.

Figure B.23 presents the vessel track density for all fishing vessels that have crossed the Lease Area.

Table B.11: Vessel Details – 10 Largest Fishing Vessels Transiting and/or Fishing Within Lease Area

Vessel Name	AIS Code	MMSI Number	IMO Number	LOA (ft)	LOA (m)	Beam (ft)	Beam (m)
MELISSA K	1001	366975990	7802562	158.50	48.3	38.1	11.6
DRYSTEN*	1001	367016390	8687983	145.9	44.5	29.9	9.1
ESS PURSUIT	1001	367411970	8983480	145.5	44.3	42.8	13.0
ESS ENDEAVOR	1001	367411920	8988894	145.0	44.2	42.8	13.1
ENTERPRISE	1001	367658950	8411920	117.0	35.7	28.0	8.5
BIG BOB	1001	366867540	8983521	104.4	31.8	30.0	9.1
LADY BRITTANY	1001	366983260	8983533	104.0	31.7	30.0	9.1
PROVIDIAN	1001	368065000	8943052	101.3	30.9	40.0	12.2
PATIENCE	1001	367335510	6727806	101.3	30.9	25.0	7.6
NORDIC EXPLORER	30	367444970	8418021	98.9	30.1	29.5	9.0

NOTE: Vessel dimensions updated based on dimensions registered on USCG Port State Information Exchange system (PSIX)
*Vessel dimensions could not be verified through the Coast Guard database

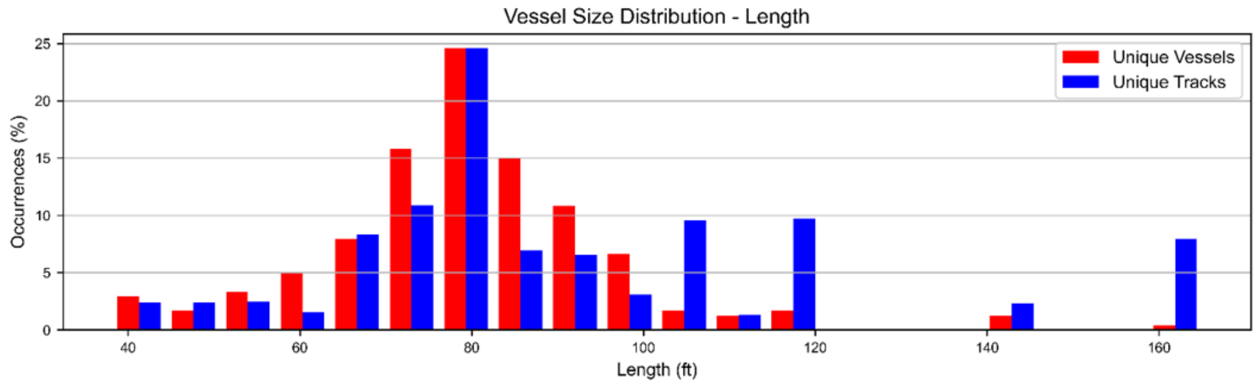

Figure B.22: Histogram of Fishing Vessel Size (LOA) Transiting Through the Lease Area

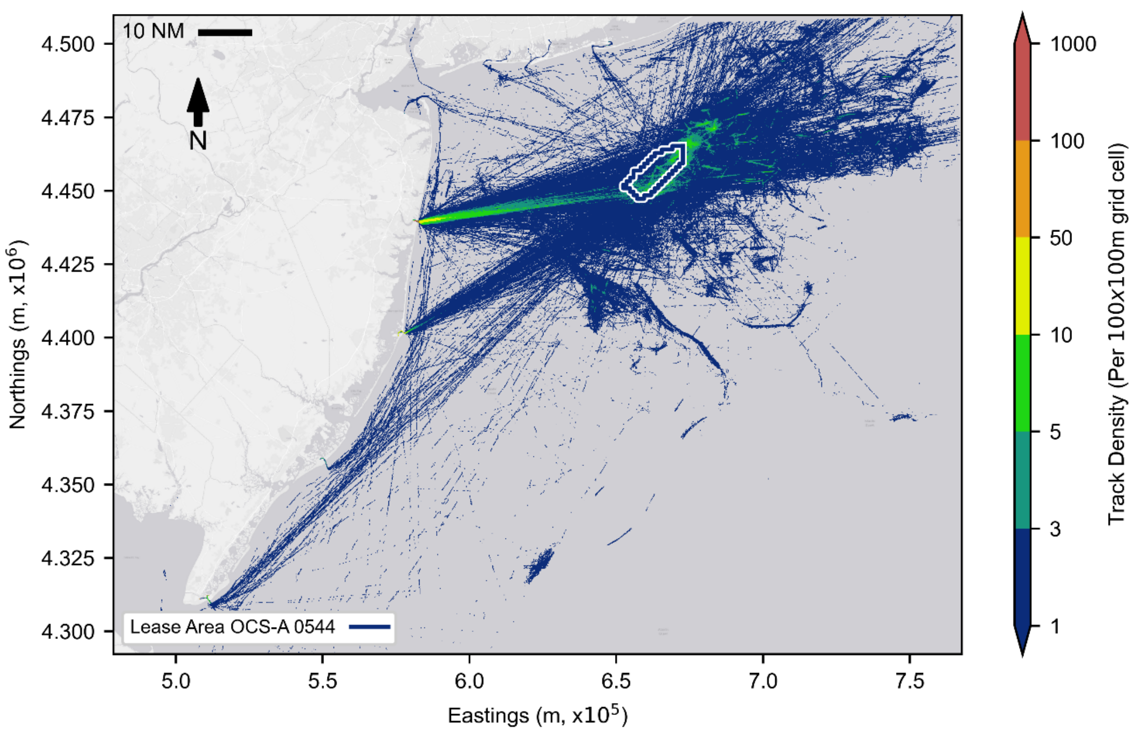

Figure B.23: Total (July 2017-June 2022) Fishing Vessel Tracks Through the Lease Area for All Transit Speeds

Analyses have been completed to separate transiting fishing vessels and fishing vessels that are likely to be fishing. This separation was based a speed threshold of 4 kts (< 4 kts fishing, > 4 kts transiting). Figure B.24 presents the vessel tracks for fishing vessels that transected the Lease Area while fishing. Figure B.25 presents the vessel tracks for fishing vessels that transected the Lease Area during their transit. The tracks of transiting fishing vessels are spread across a range of directions through Lease Area.

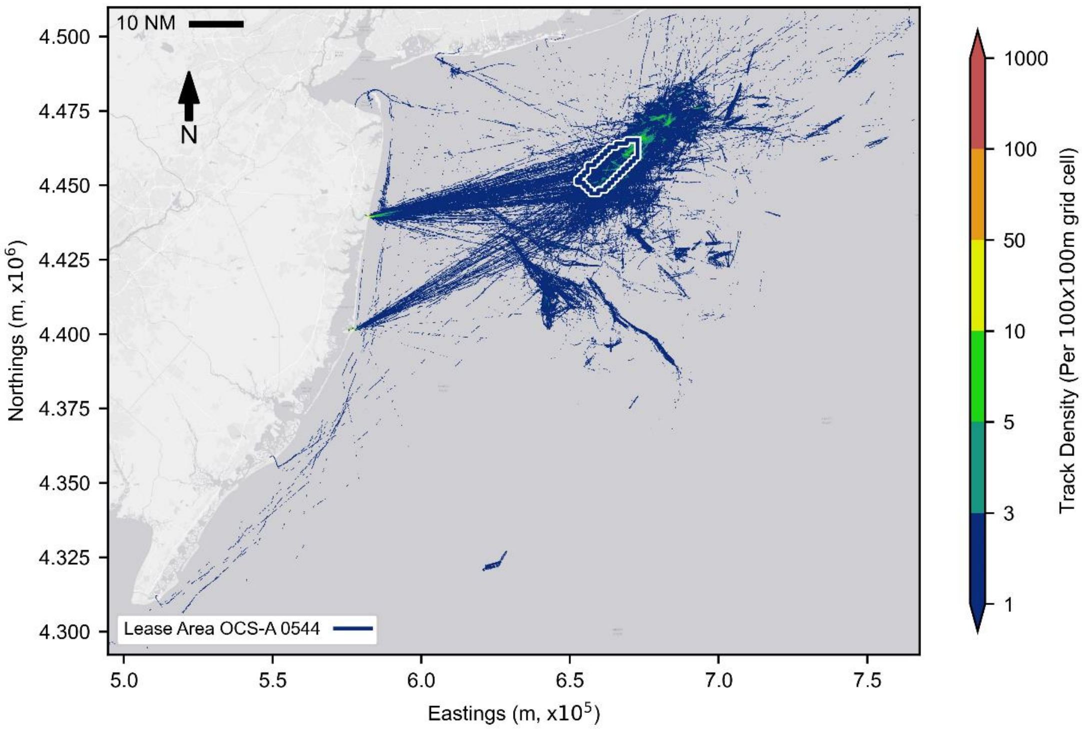

Figure B.24: Total (July 2017-June 2022) Vessel Track Density for Fishing Vessel Tracks in the Lease Area (<4 kts)

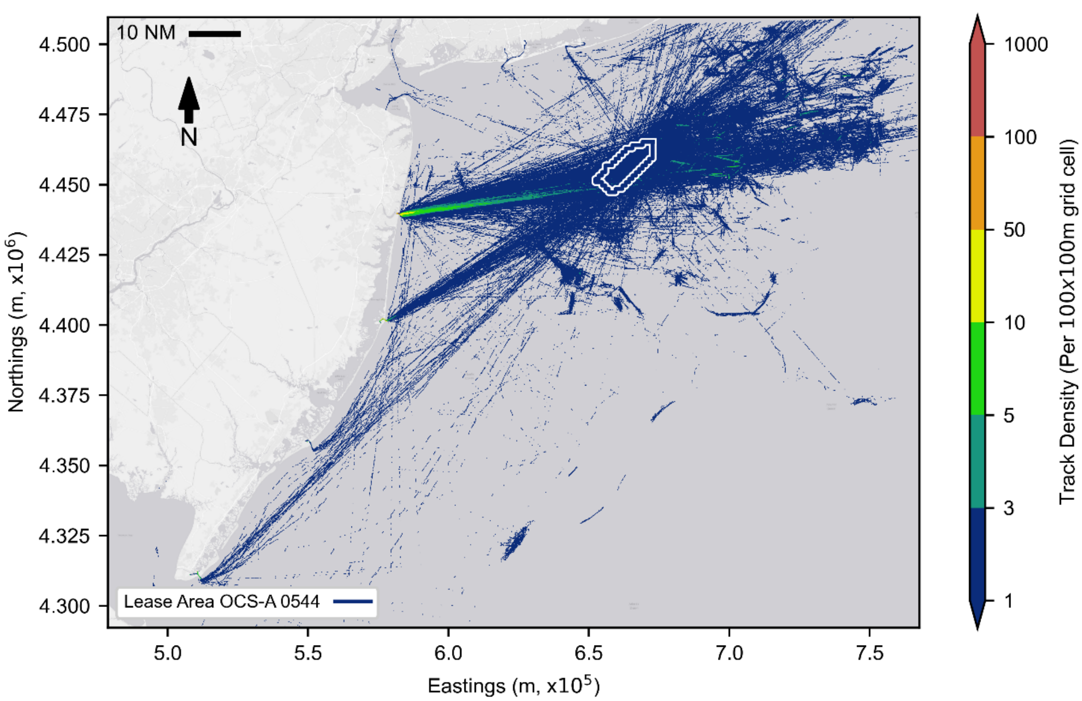

Figure B.25: Total (July 2017-June 2022) Fishing Vessel Tracks Transiting Through the Lease Area (>4 kts)

Figure B.26 and Figure B.27 presents the distribution of courses and speeds for all vessels and actively fishing vessels respectively. The dominant courses in all cases are west to southwest and east to northeast.

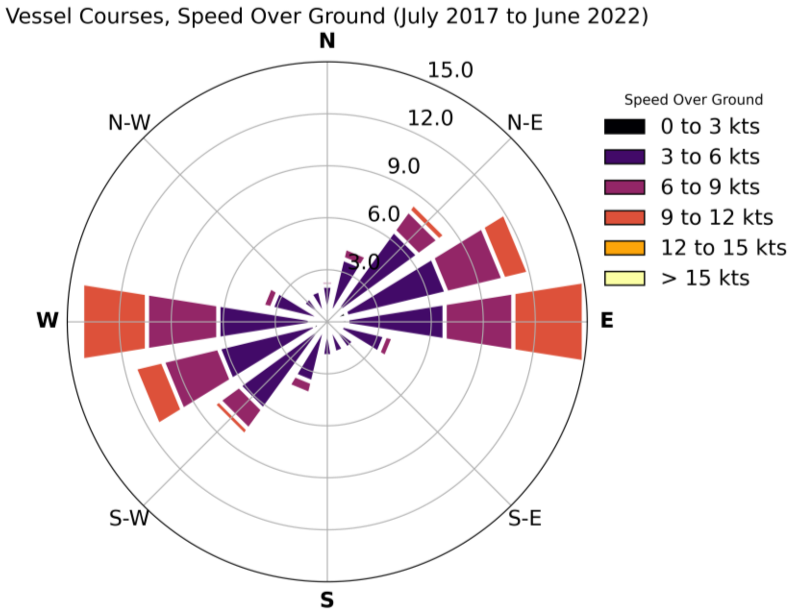

Figure B.26: Fishing Vessels' Courses Throughout and Speed Through the Lease Area

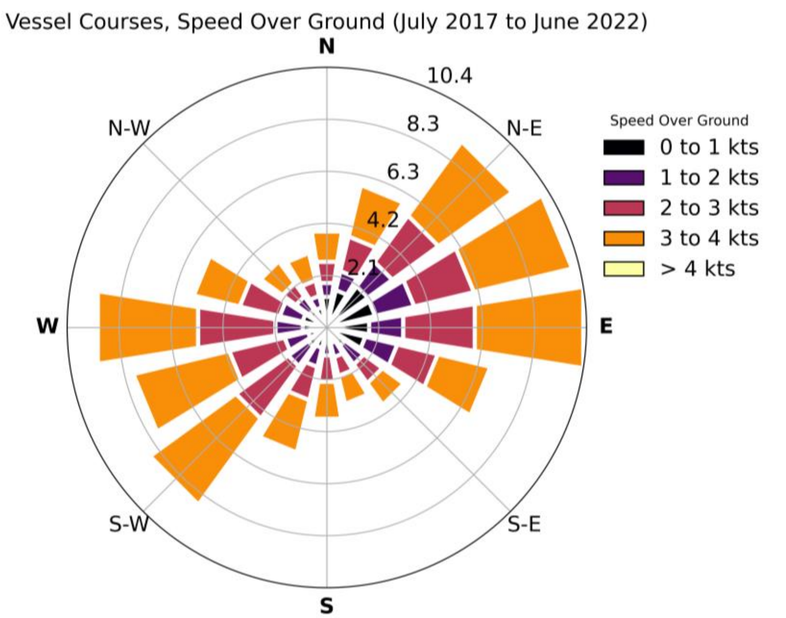

Figure B.27: Actively Fishing Vessels' Courses Throughout and Speed Through the Lease Area

Table B.12 gives a summary by month and year of fishing vessel traffic in the Lease Area. The fishing vessel traffic is highly seasonal, with most traffic occurring in the summer and autumn months. A summary of the monthly AIS fishing vessel traffic averaged across the 5-years of data is presented in Table B.13.

Table B.12: AIS Fishing Vessel Traffic Through the Lease Area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
2017													
Number of Unique Vessels (fishing)	-	-	-	-	-	-	6	3	6	14	2	4	30
Number of Unique Vessel Tracks (fishing)	-	-	-	-	-	-	8	10	6	19	3	6	52
Number of Unique Vessels (transiting)	-	-	-	-	-	-	18	11	12	20	8	8	58
Number of Unique Vessel Tracks (transiting)	-	-	-	-	-	-	41	24	19	30	14	18	146
Number of Unique Vessels (all)	-	-	-	-	-	-	20	11	13	25	9	9	63
Number of Unique Vessel Tracks (all)	-	-	-	-	-	-	48	26	22	42	16	20	174
2018													
Number of Unique Vessels (fishing)	2	2	3	1	1	0	1	5	4	8	2	2	21
Number of Unique Vessel Tracks (fishing)	5	4	3	1	1	0	3	33	7	23	3	7	90
Number of Unique Vessels (transiting)	11	8	6	11	7	5	8	12	11	13	4	5	61
Number of Unique Vessel Tracks (transiting)	27	17	10	13	11	7	20	43	17	36	13	15	229
Number of Unique Vessels (all)	12	9	7	13	8	6	9	14	13	14	4	6	65
Number of Unique Vessel Tracks (all)	29	20	12	17	15	8	23	52	21	40	13	16	266
2019													
Number of Unique Vessels (fishing)	2	2	0	1	1	1	0	0	7	10	4	3	29
Number of Unique Vessel Tracks (fishing)	3	2	0	1	2	1	0	0	16	26	14	3	68
Number of Unique Vessels (transiting)	6	5	11	5	10	10	5	4	17	15	10	6	74
Number of Unique Vessel Tracks (transiting)	12	8	15	8	13	11	9	9	27	39	22	13	186
Number of Unique Vessels (all)	8	7	13	7	10	11	6	5	20	18	11	8	80
Number of Unique Vessel Tracks (all)	15	11	19	11	13	16	11	14	37	45	41	16	249
2020													
Number of Unique Vessels (fishing)	2	6	6	4	3	10	10	12	14	11	5	0	58
Number of Unique Vessel Tracks (fishing)	3	11	11	5	9	20	22	30	20	23	15	0	169

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Number of Unique Vessels (transiting)	11	11	20	8	8	18	28	28	22	20	15	6	123
Number of Unique Vessel Tracks (transiting)	14	25	35	10	16	35	52	62	31	38	26	8	352
Number of Unique Vessels (all)	12	12	27	9	10	19	33	30	25	21	19	8	137
Number of Unique Vessel Tracks (all)	15	30	54	13	23	43	66	70	40	45	46	10	455
2021													
Number of Unique Vessels (fishing)	3	2	7	0	2	2	1	1	3	6	6	1	26
Number of Unique Vessel Tracks (fishing)	3	3	11	0	2	2	1	1	3	7	14	1	48
Number of Unique Vessels (transiting)	9	10	12	9	4	14	11	9	7	9	12	3	67
Number of Unique Vessel Tracks (transiting)	23	17	19	11	9	21	18	18	13	16	19	3	187
Number of Unique Vessels (all)	9	11	14	10	5	15	12	10	9	9	15	4	73
Number of Unique Vessel Tracks (all)	23	18	22	13	12	27	24	19	17	17	26	4	222
2022													
Number of Unique Vessels (fishing)	0	0	0	2	4	4	-	-	-	-	-	-	6
Number of Unique Vessel Tracks (fishing)	0	0	0	3	10	7	-	-	-	-	-	-	20
Number of Unique Vessels (transiting)	1	3	6	9	9	14	-	-	-	-	-	-	22
Number of Unique Vessel Tracks (transiting)	1	4	11	23	38	25	-	-	-	-	-	-	102
Number of Unique Vessels (all)	1	3	6	10	10	16	-	-	-	-	-	-	24
Number of Unique Vessel Tracks (all)	1	4	11	24	39	35	-	-	-	-	-	-	114
Average: 2017-2022													
Number of Unique Vessels (fishing)	1.8	2.4	3.2	1.6	2.2	3.4	3.6	4.2	6.8	9.8	3.8	2.0	34.0
Number of Unique Vessel Tracks (fishing)	2.8	4.0	5.0	2.0	4.8	6.0	6.8	14.8	10.4	19.6	9.8	3.4	89.4
Number of Unique Vessels (transiting)	7.6	7.4	11.0	8.4	7.6	12.2	14.0	12.8	13.8	15.4	9.8	5.6	81.0
Number of Unique Vessel Tracks (transiting)	15.4	14.2	18.0	13.0	17.4	19.8	28.0	31.2	21.4	31.8	18.8	11.4	240.4
Number of Unique Vessels (all)	8.4	8.4	13.4	9.8	8.6	13.4	16.0	14.0	16.0	17.4	11.6	7.0	88.4
Number of Unique Vessel Tracks (all)	16.6	16.6	23.6	15.6	20.4	25.8	34.4	36.2	27.4	37.8	28.4	13.2	296.0

NOTE: Transiting and actively fishing tracks can be doubly counted

Table B.13: Summary of AIS Fishing Vessel Traffic Through the Lease Area

	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Number of Tracks (2017-2022)												
Fishing	17	14	20	25	10	24	30	34	74	52	98	49
Transiting	57	77	71	90	65	87	99	140	156	107	159	94
All Vessels	66	83	83	118	78	102	129	172	181	137	189	142
Average Tracks per Day												
Fishing	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.5	0.3	0.6	0.3
Transiting	0.4	0.5	0.5	0.6	0.4	0.6	0.7	0.9	1.0	0.7	1.0	0.6
All Vessels	0.4	0.5	0.6	0.8	0.5	0.7	0.9	1.1	1.2	0.9	1.2	0.9

Seasonal Average Tracks per Day	Winter	Spring	Summer	Autumn
Fishing	0.1	0.1	0.3	0.4
Transiting	0.5	0.5	0.9	0.8
All Vessels	0.5	0.6	1.0	1.0

NOTE: Transiting and actively fishing tracks can be doubly counted

B.5 Vessel Traffic across the OECC

The OECC connects the Lease Area to the potential landfall sites on the southern shore of Long Island, New York. An AIS data analysis was carried out for the OECC to evaluate the location and frequency of vessel crossings. Table B.14 summarizes the vessels that have crossed the OECC by year and type for the July 2017 to June 2022 period.

Table B.15 further summarize the OECC crossings by month and by season. Average vessel crossings are highest in the summer season.

Table B.14: OECC Vessel Crossings by Vessel Type and Year for July 2017 to June 2022

Vessel Type	2017	2018	2019	2020	2021	2022
Fishing	252	623	502	474	375	143
Passenger	325	478	514	169	137	46
Cargo	801	1,572	1,368	1,253	1,187	566
Tanker	316	632	633	518	713	282
Recreational	209	334	522	472	631	174
Military	-	-	1	-	1	3
Tug-Tow	280	812	673	424	361	199
Other	79	163	196	148	170	61
Total	**2,262**	**4,614**	**4,409**	**3,458**	**3,575**	**1,474**
Average Crossings per Day	**12.3**	**12.6**	**12.1**	**9.5**	**9.8**	**8.1**

Table B.15: OECC Crossings by Month and Season

Vessel Type	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Fishing	108	106	163	177	135	249	444	215	195	278	192	107
Passenger	42	20	14	8	44	86	155	295	275	302	296	132
Cargo	506	512	427	550	545	569	592	632	646	599	603	566
Tanker	194	254	203	231	279	313	246	291	282	318	245	238
Recreational	28	4	2	10	61	215	435	498	374	343	246	126
Military	-	-	1	-	-	2	1	-	-	-	1	-
Tug-Tow	250	236	210	173	213	234	210	259	287	212	233	232
Other	44	50	54	56	44	97	65	113	104	70	51	69
Unspecified	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1,172**	**1,182**	**1,074**	**1,205**	**1,321**	**1,765**	**2,148**	**2,303**	**2,163**	**2,122**	**1,867**	**1,470**
Avg. Crossings per Year	**234.4**	**236.4**	**214.8**	**241.0**	**264.2**	**353**	**429.6**	**460.6**	**432.6**	**424.4**	**373.4**	**294**
Season	Winter			Spring			Summer			Autumn		
Seasonal Average Tracks per Year	228.5			286.1			440.9			363.9		

Figure B.27 shows the average annual tracks crossing the OECC. The average annual tracks exceed 100 vessels (per 100x100m grid cell) in an approximately 0.41 nm (766 m) stretch of the main trunk of the OECC corridor.

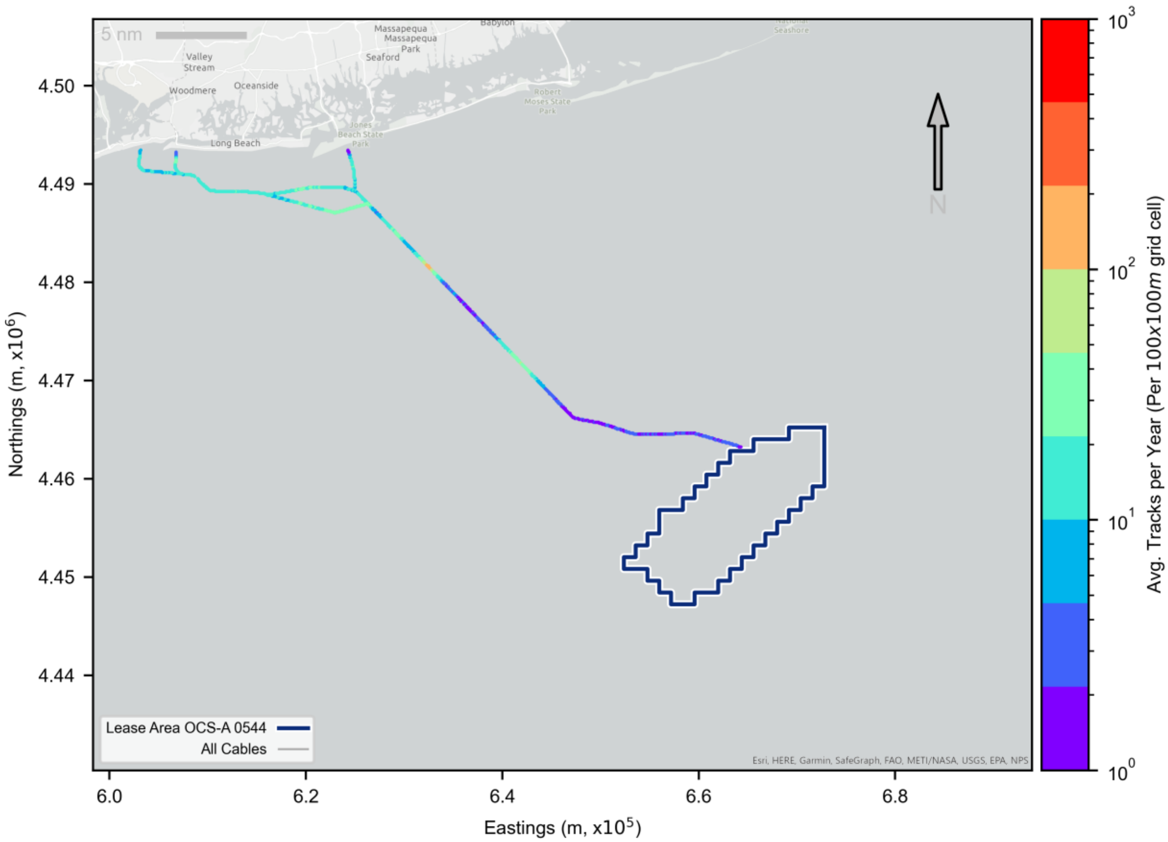

Figure B.28: Vessel Traffic Average Density Map for Vessels Crossing the OECC

Appendix C

VMS and VTR Data Maps

C.1 VMS Fishing Density Maps

The NMFS Office of Law Enforcement Vessel Monitoring System (VMS) data comes from transponders on vessels carrying permits for regulated fisheries. Each transponder allows the fisherman to "declare" which fishery they are currently participating in, declare that they are not participating in a VMS monitored fishery, or indicate that they are powered down at dock. Each transponder will broadcast a position report hourly (excepting when declared for SES/Atlantic Sea Scallop, which are broadcast every 30 minutes). BOEM received VMS raw position reports from NMFS Office of Law Enforcement for the period from January 2015 to December 2019. These data were processed by BOEM to extract the position reports for those vessels that operated within Lease Area OCS-A 0544. The following Appendix subsection will present the Fishing Density plots for Lease Area OCS-A 0544.

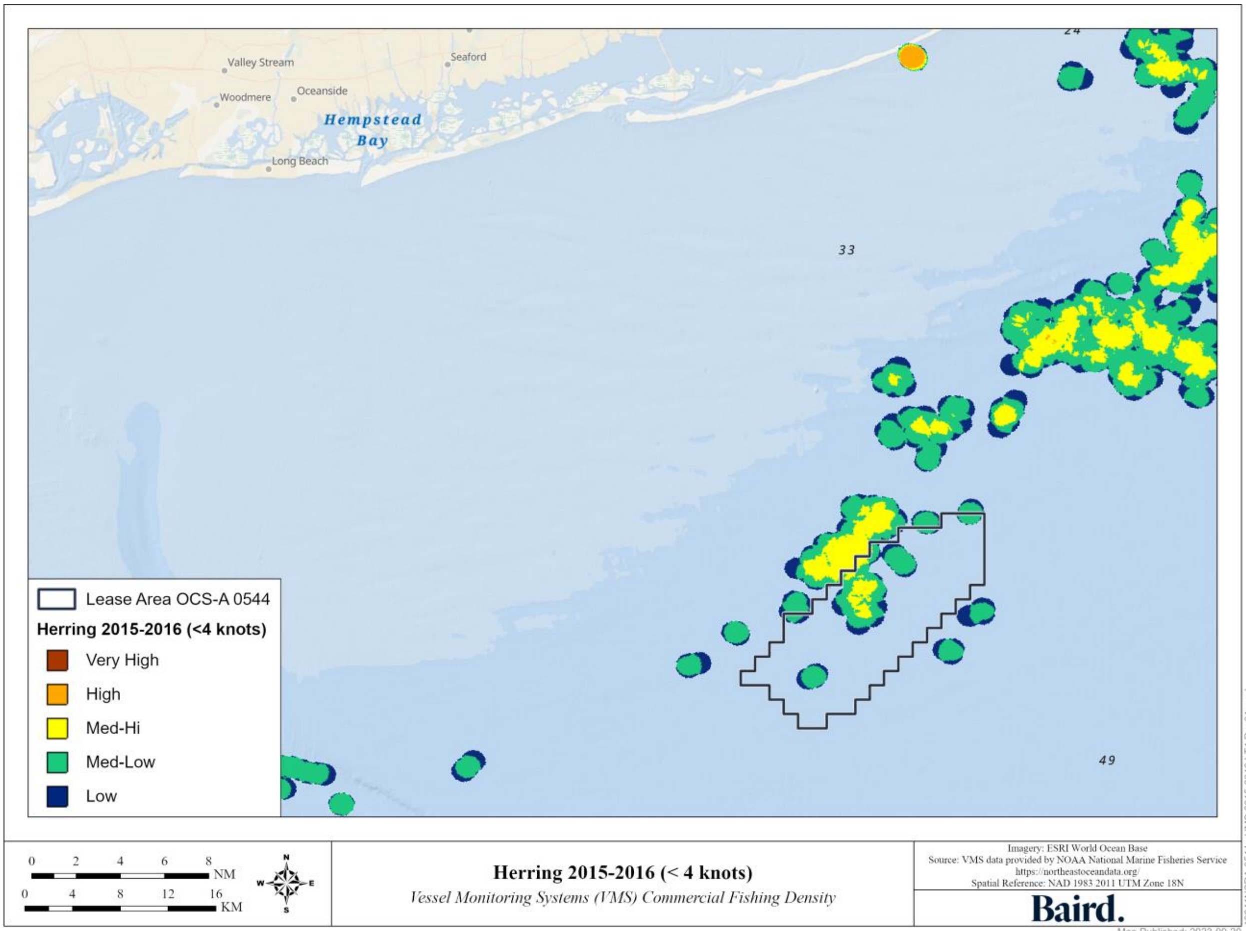

Figure C.1: VMS Commercial Fishing Density for Herring 2015-2016 (<4 kts)

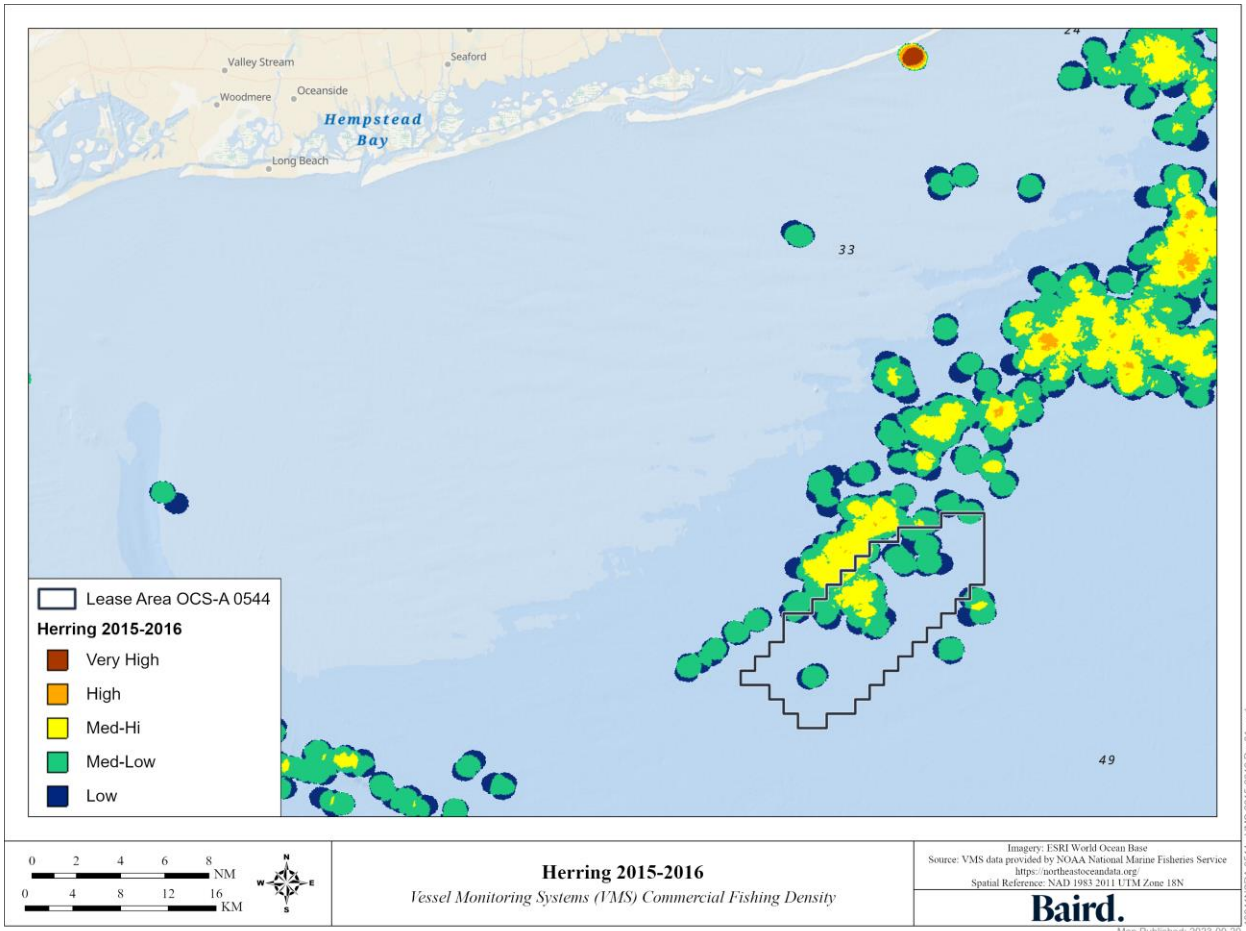

Figure C.2: VMS Commercial Fishing Density for Herring 2015-2016

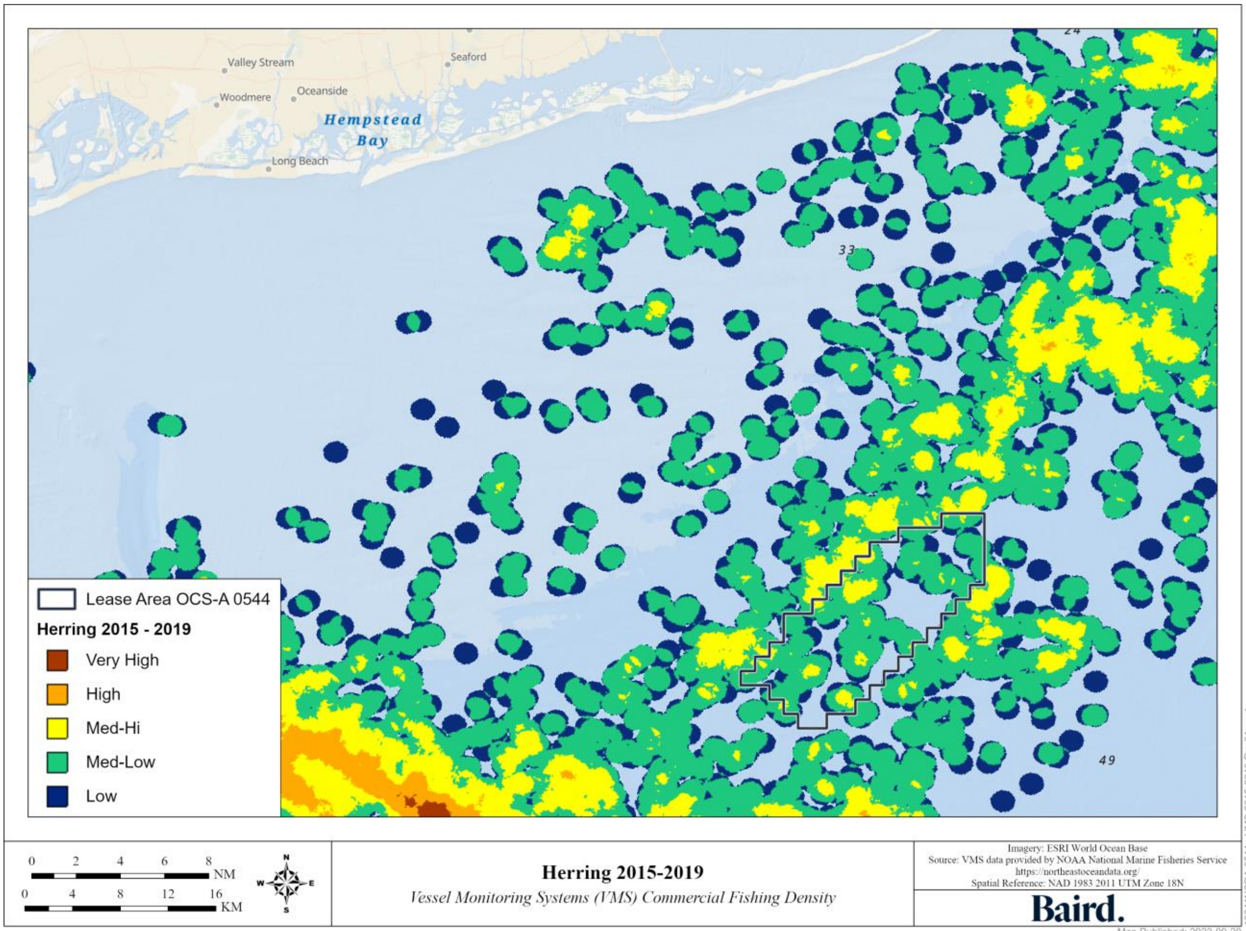

Figure C.3: VMS Commercial Fishing Density for Herring 2015-2019

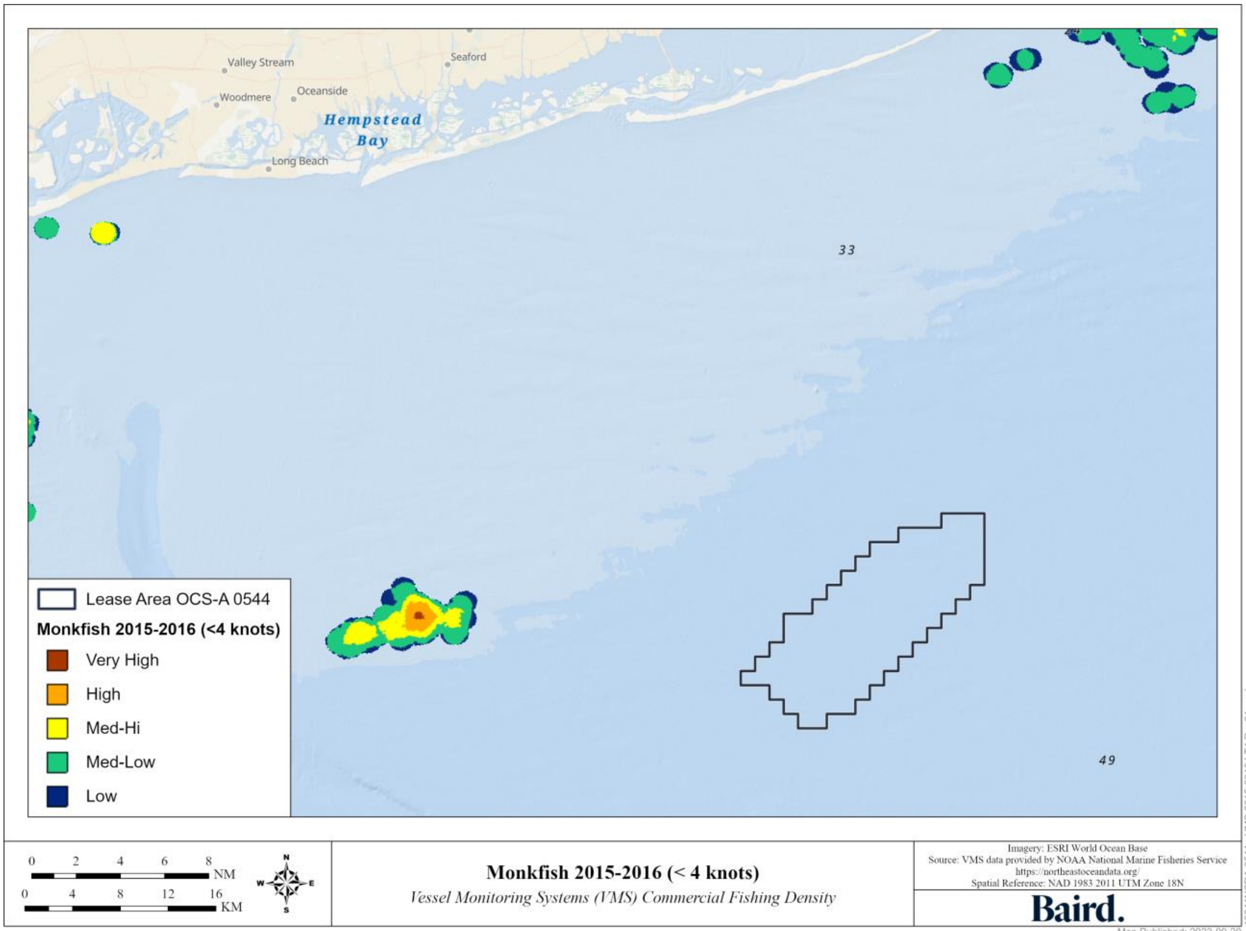

Figure C.4: VMS Commercial Fishing Density for Monksfish 2015-2016 (<4 kts)

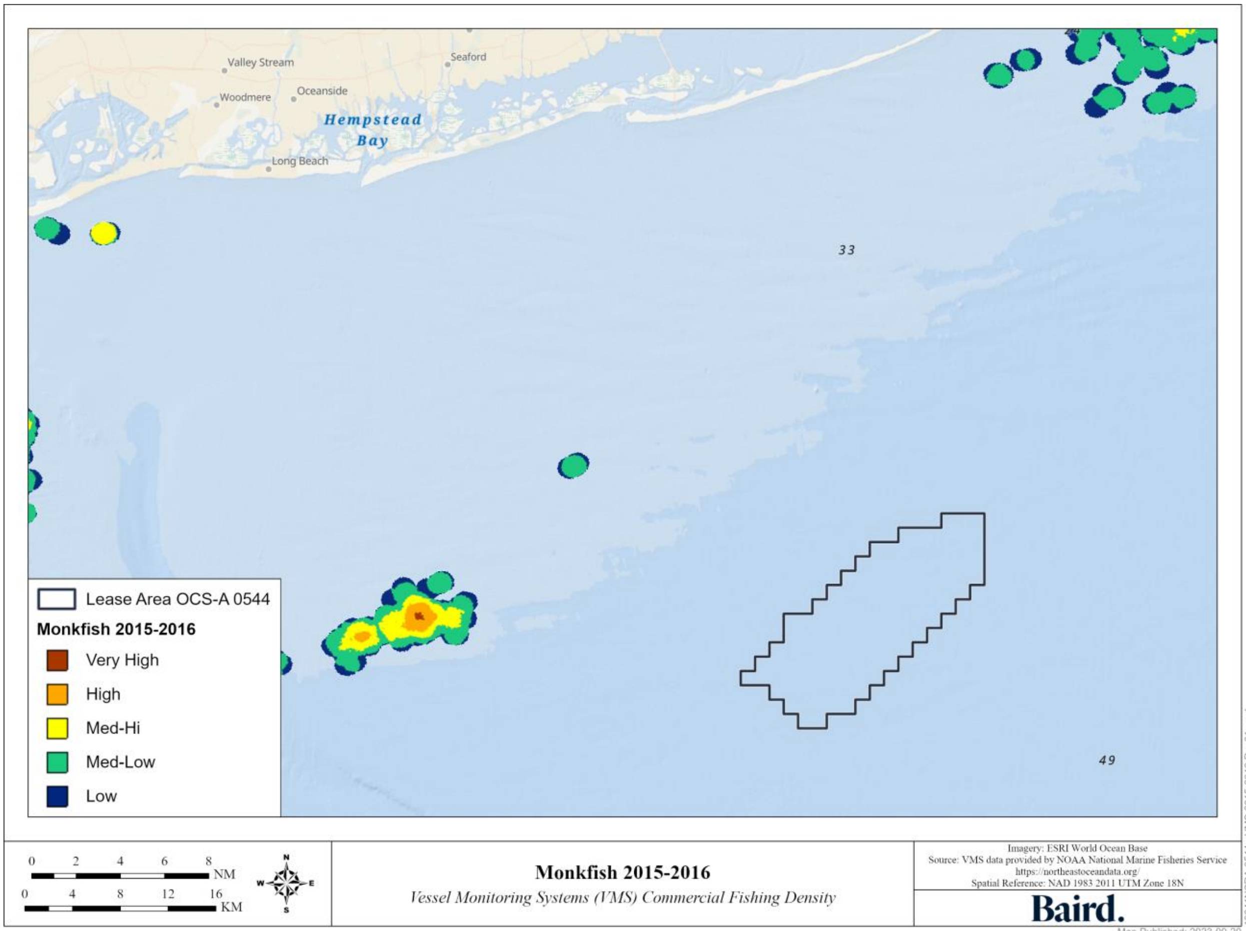

Figure C.5: VMS Commercial Fishing Density for Monkfish 2015-2016

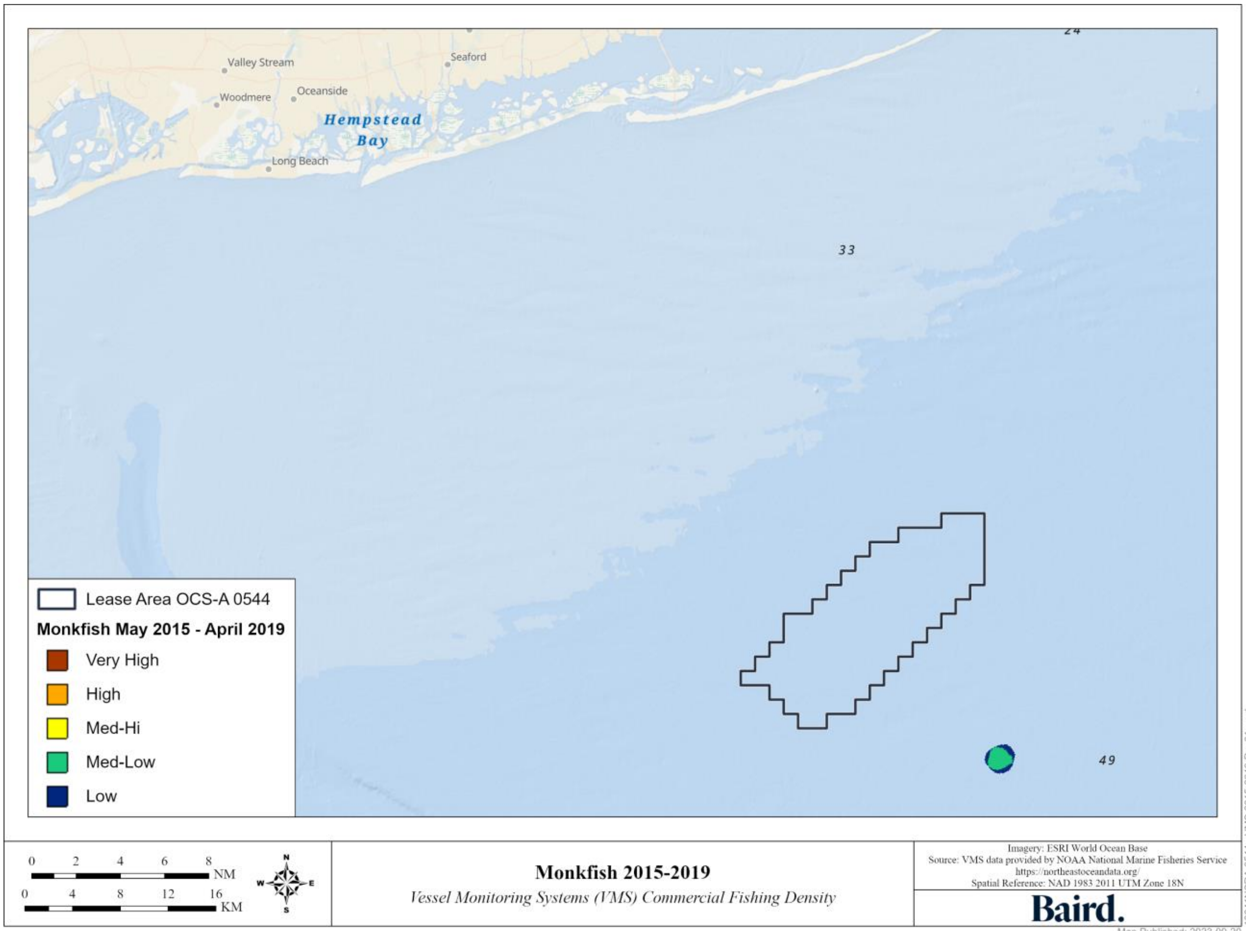

Figure C.6: VMS Commercial Fishing Density for Monkfish 2015-2019

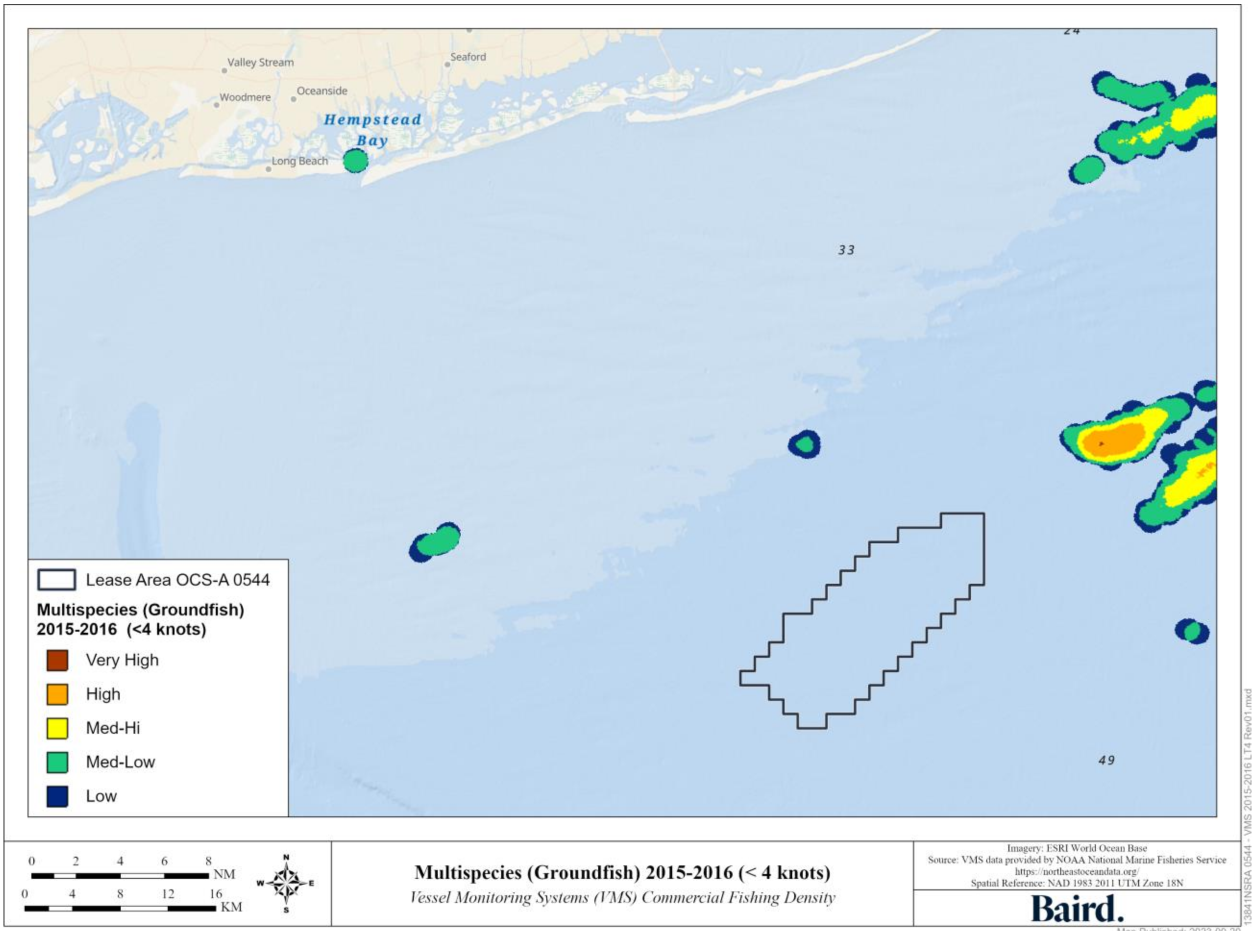

Figure C.7: VMS Commercial Fishing Density for Multispecies 2015-2016 (<4 kts)

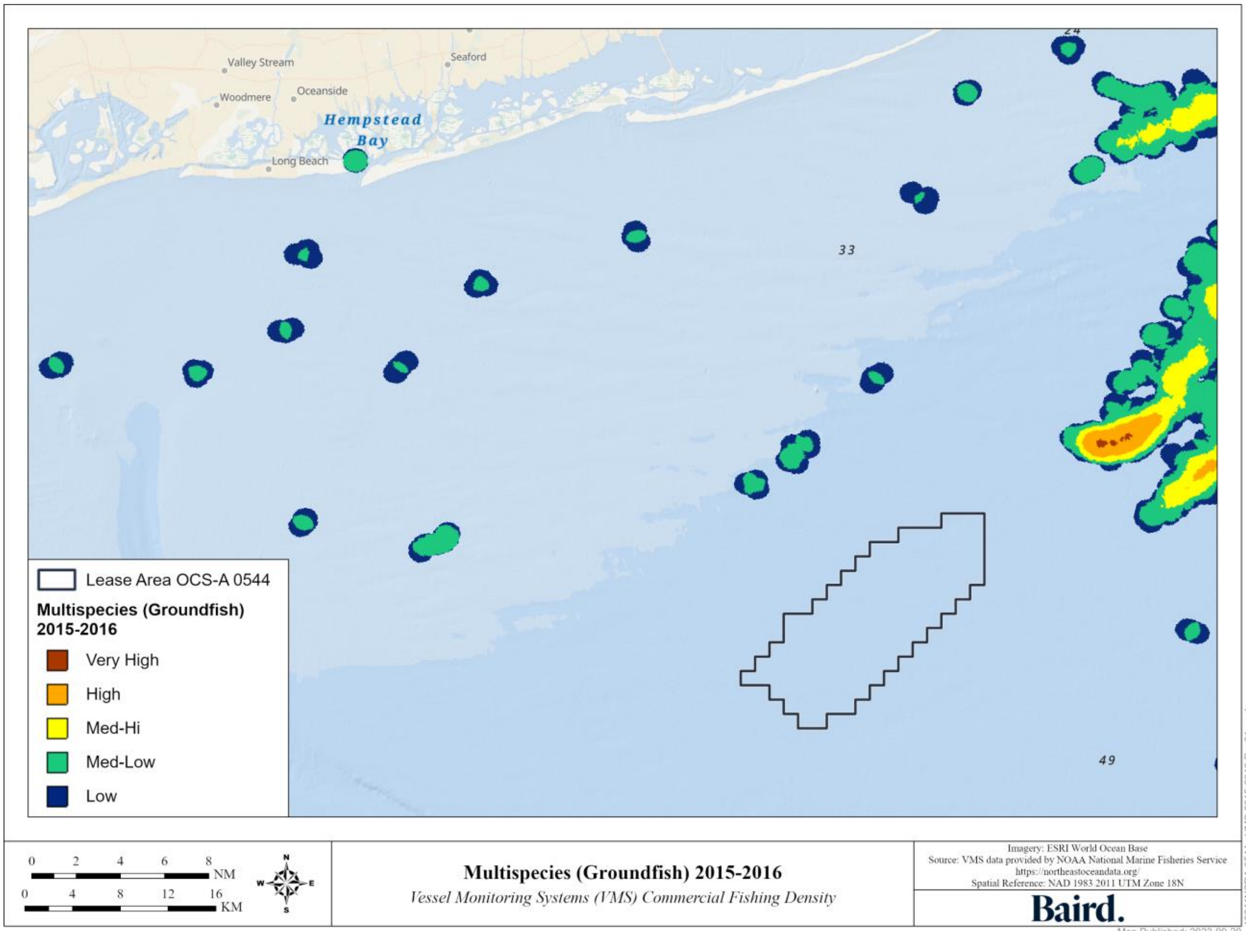

Figure C.8: VMS Commercial Fishing Density for Multispecies 2015-2016

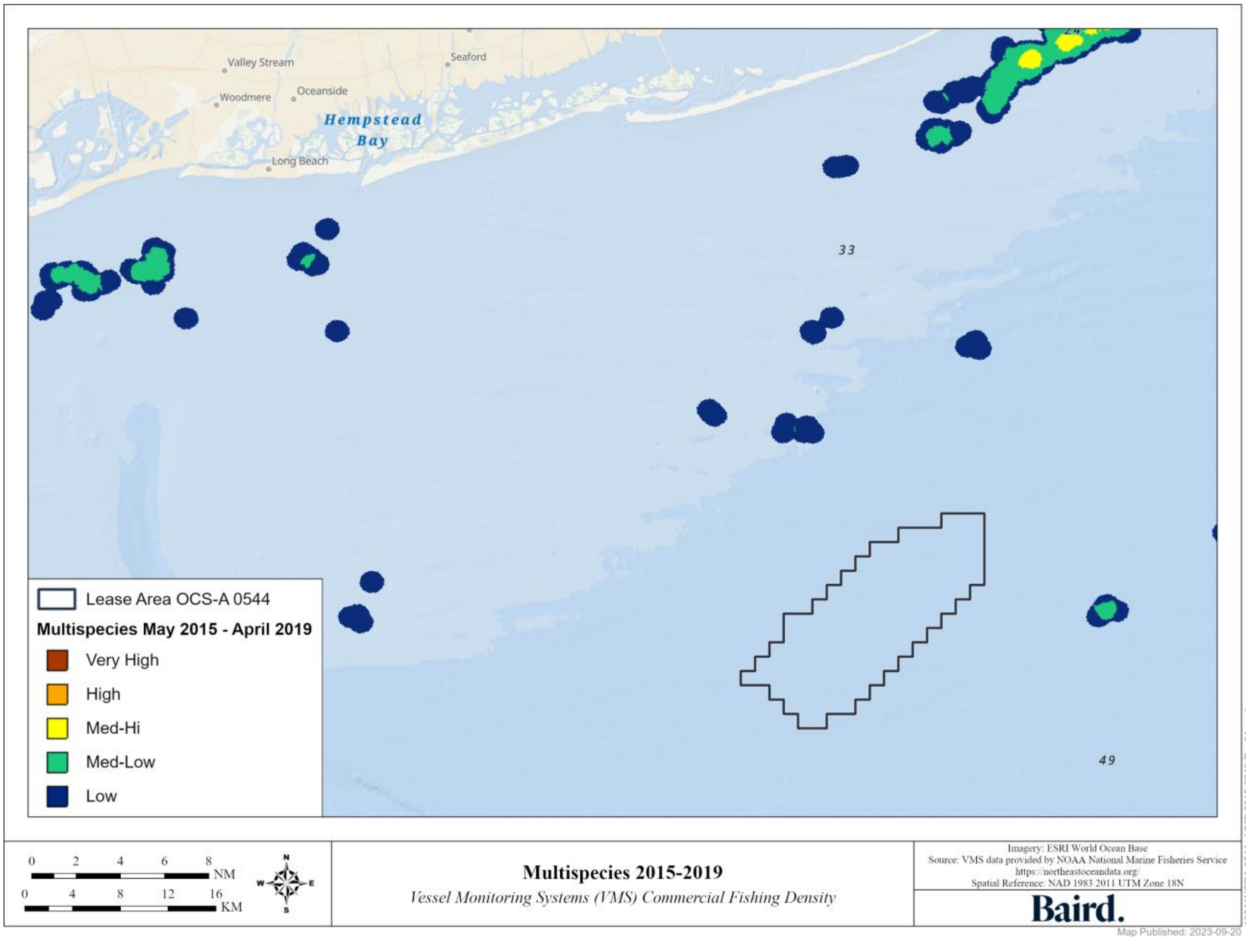

Figure C.9: VMS Commercial Fishing Density for Multispecies 2015-2019

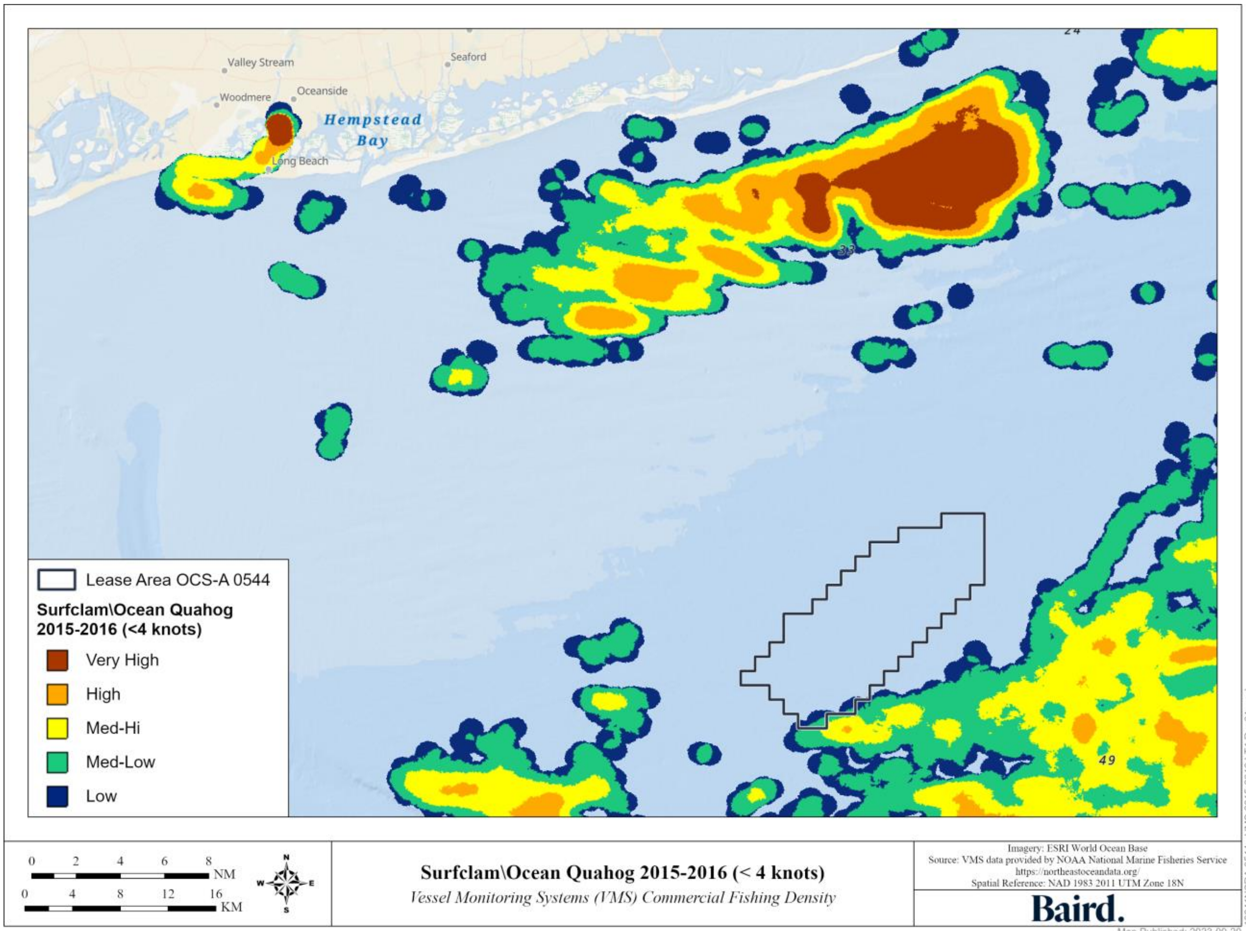

Figure C.10: VMS Commercial Fishing Density for Surfclam/Ocean Quahog 2015-2016 (<4 kts)

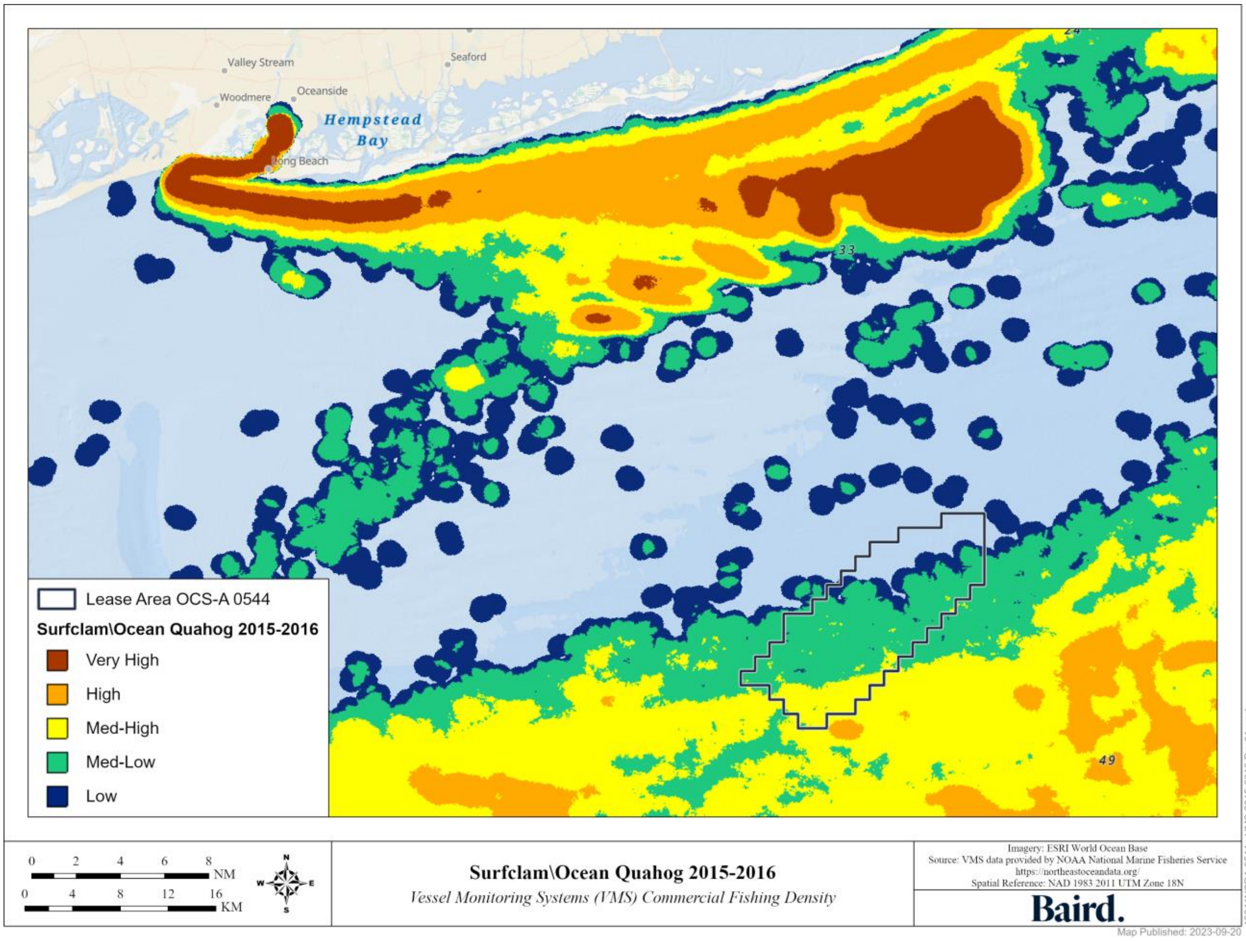

Figure C.11: VMS Commercial Fishing Density for Surfclam/Ocean Quahog 2015-2016

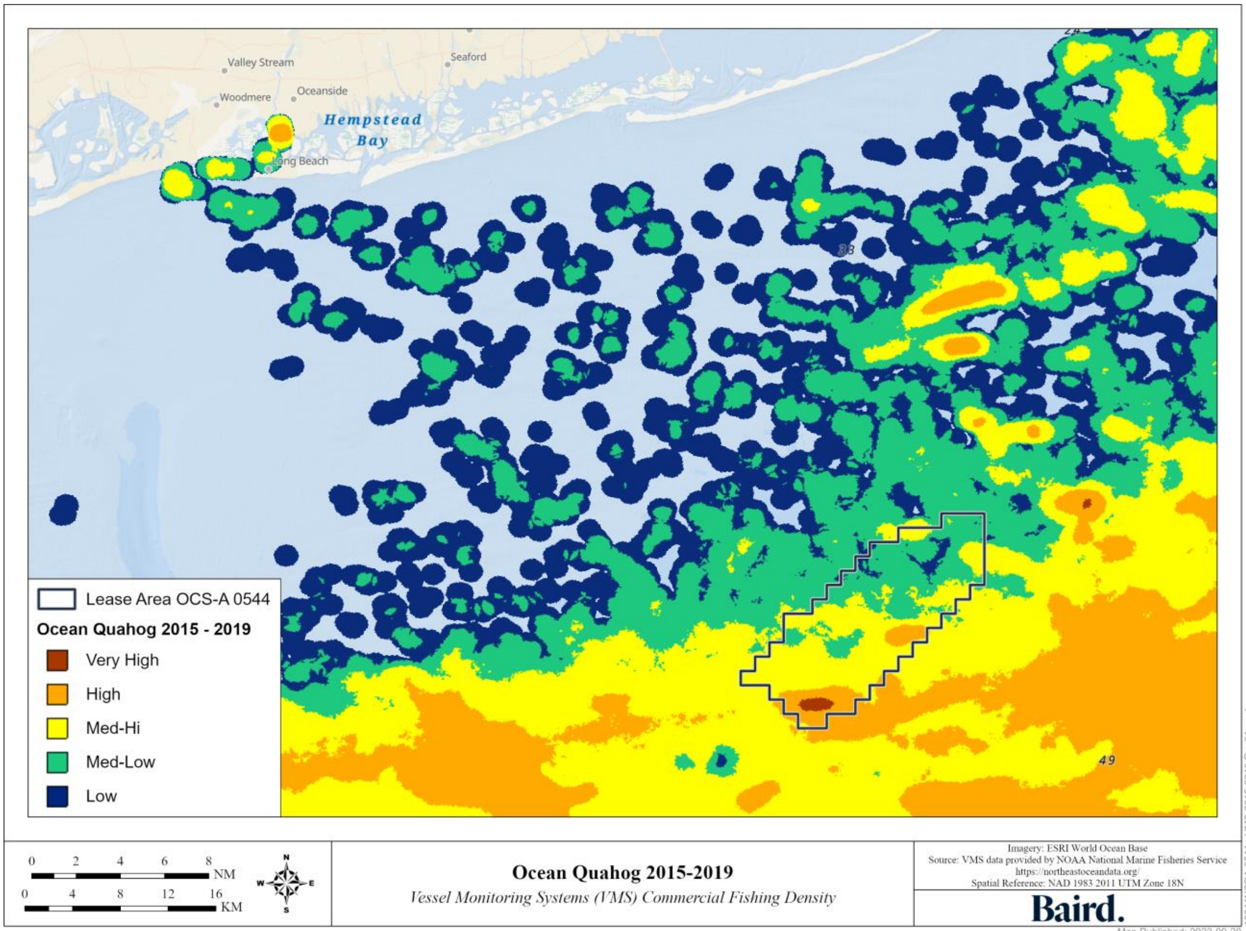

Figure C.12: VMS Commercial Fishing Density for Ocean Quahog 2015-2019

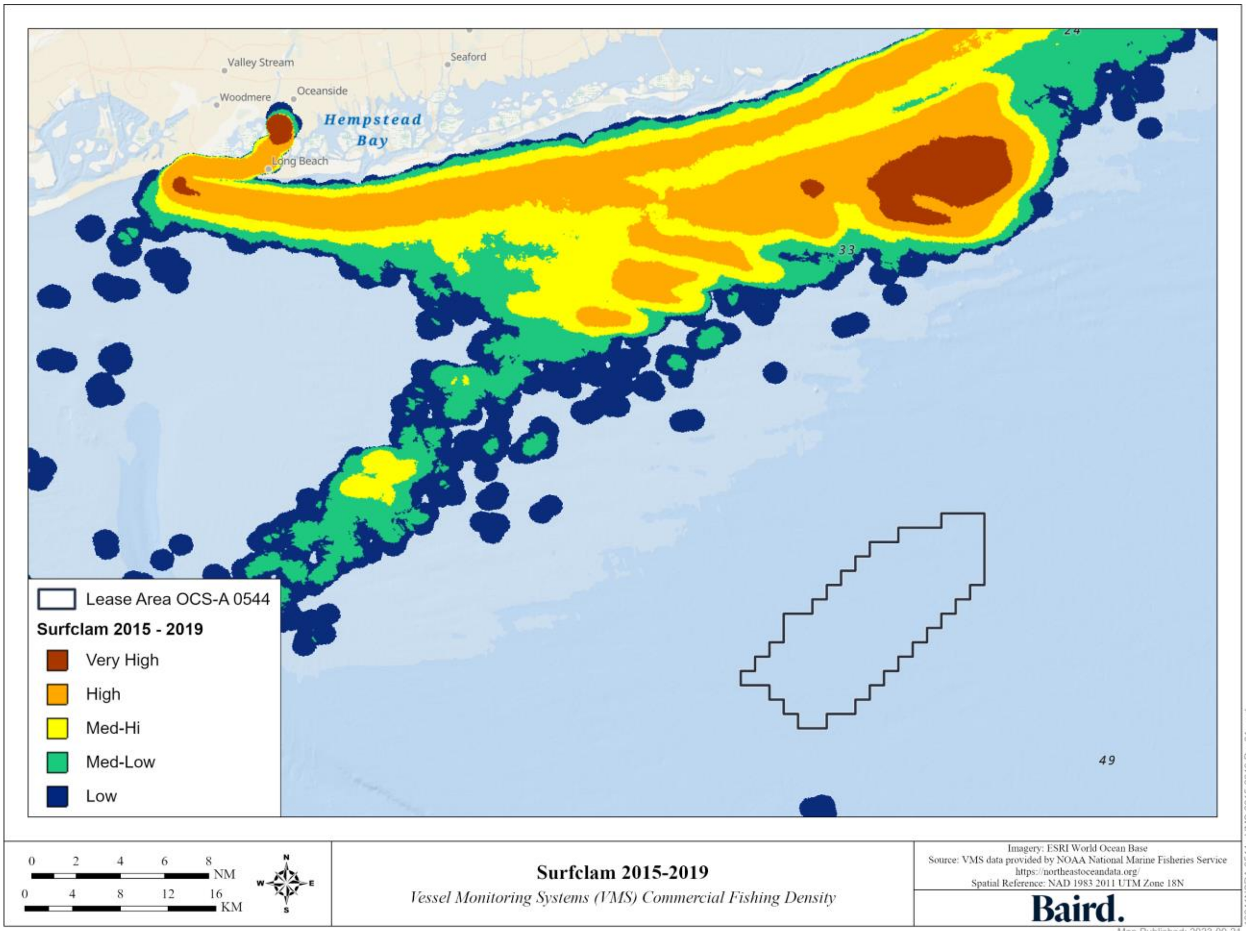

Figure C.13: VMS Commercial Fishing Density for Surfclam 2015-2019

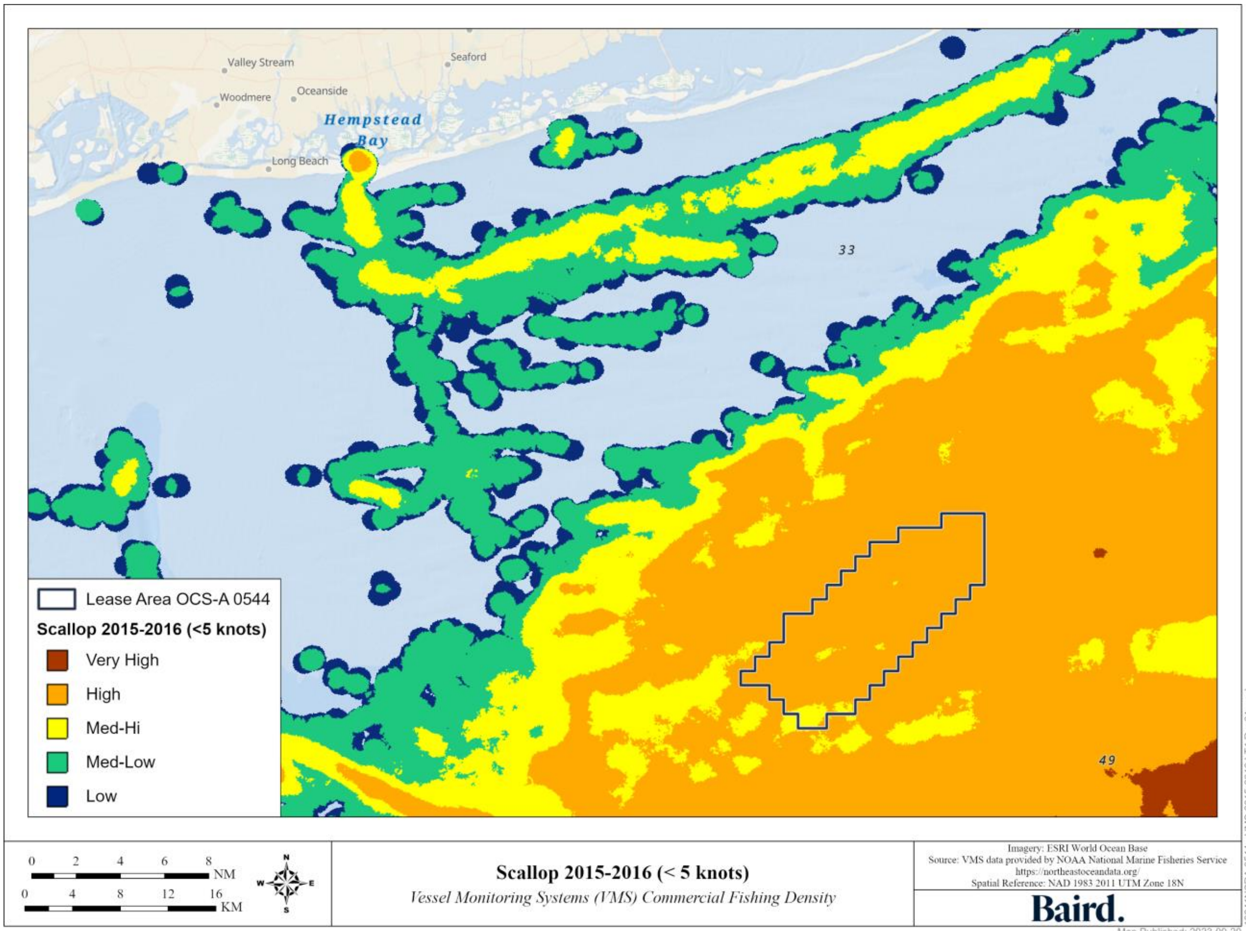

Figure C.14: VMS Commercial Fishing Density for Atlantic Sea Scallop 2015-2016 (<5 kts)

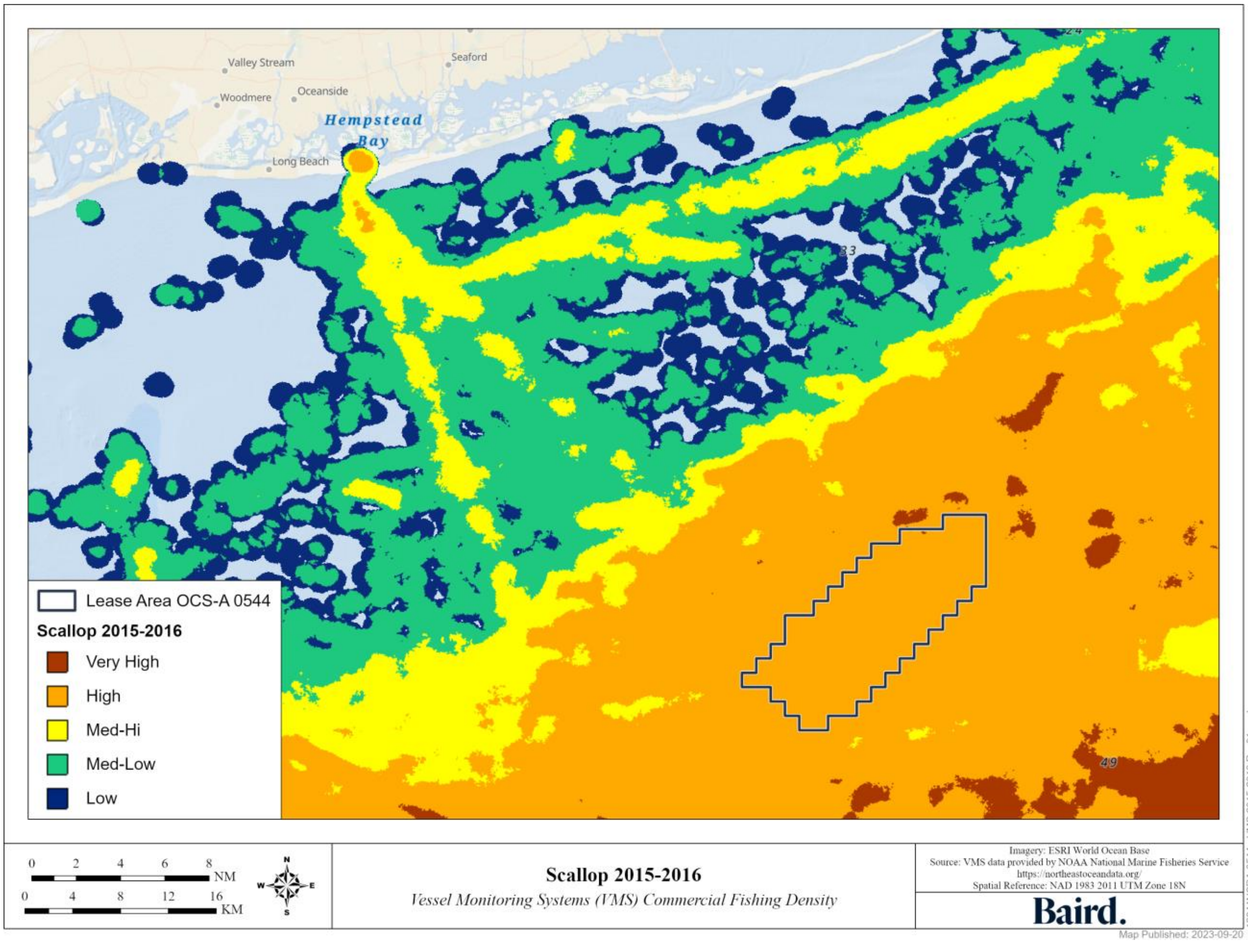

Figure C.15: VMS Commercial Fishing Density for Atlantic Sea Scallop 2015-2016

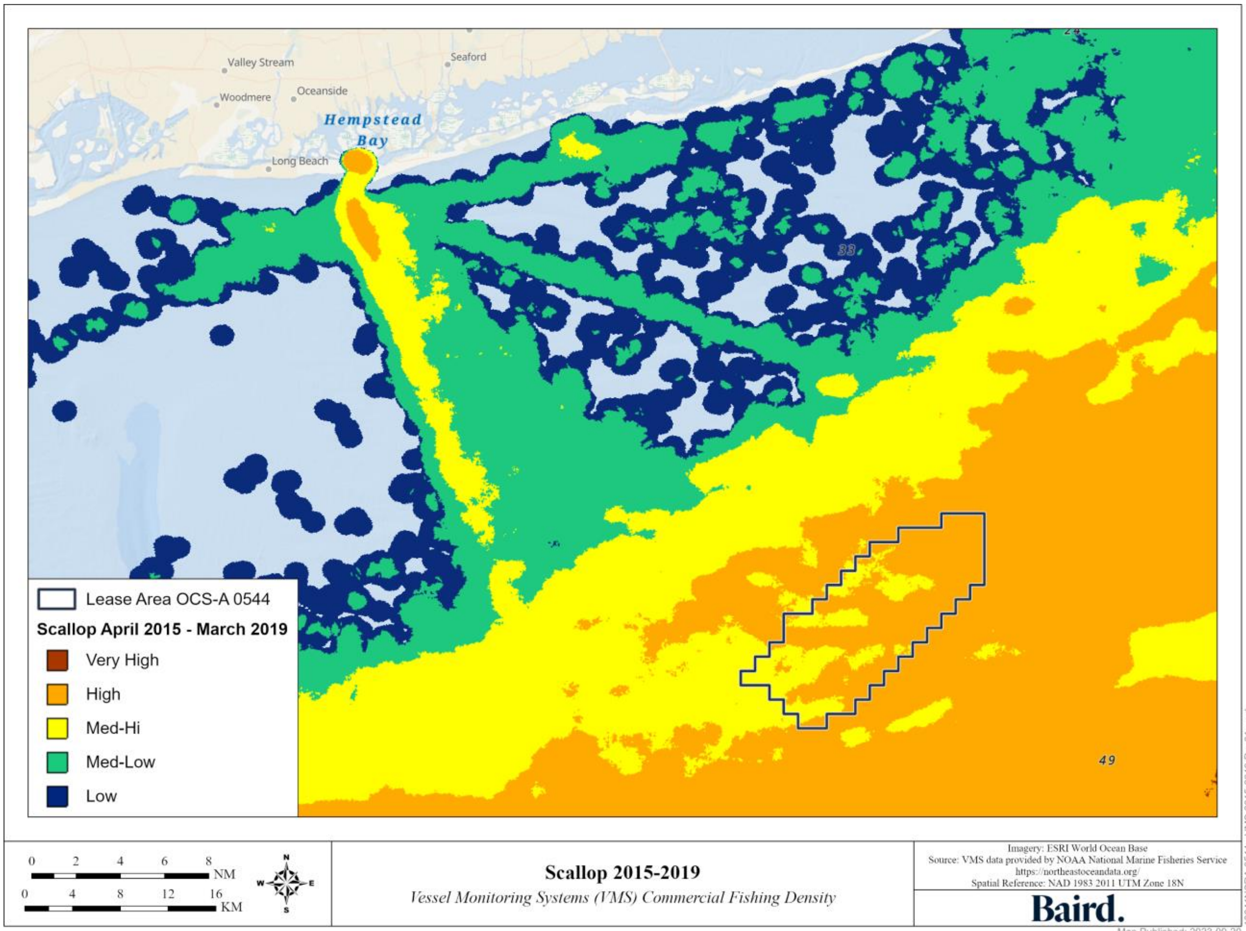

Figure C.16: VMS Commercial Fishing Density for Scallop 2015-2019

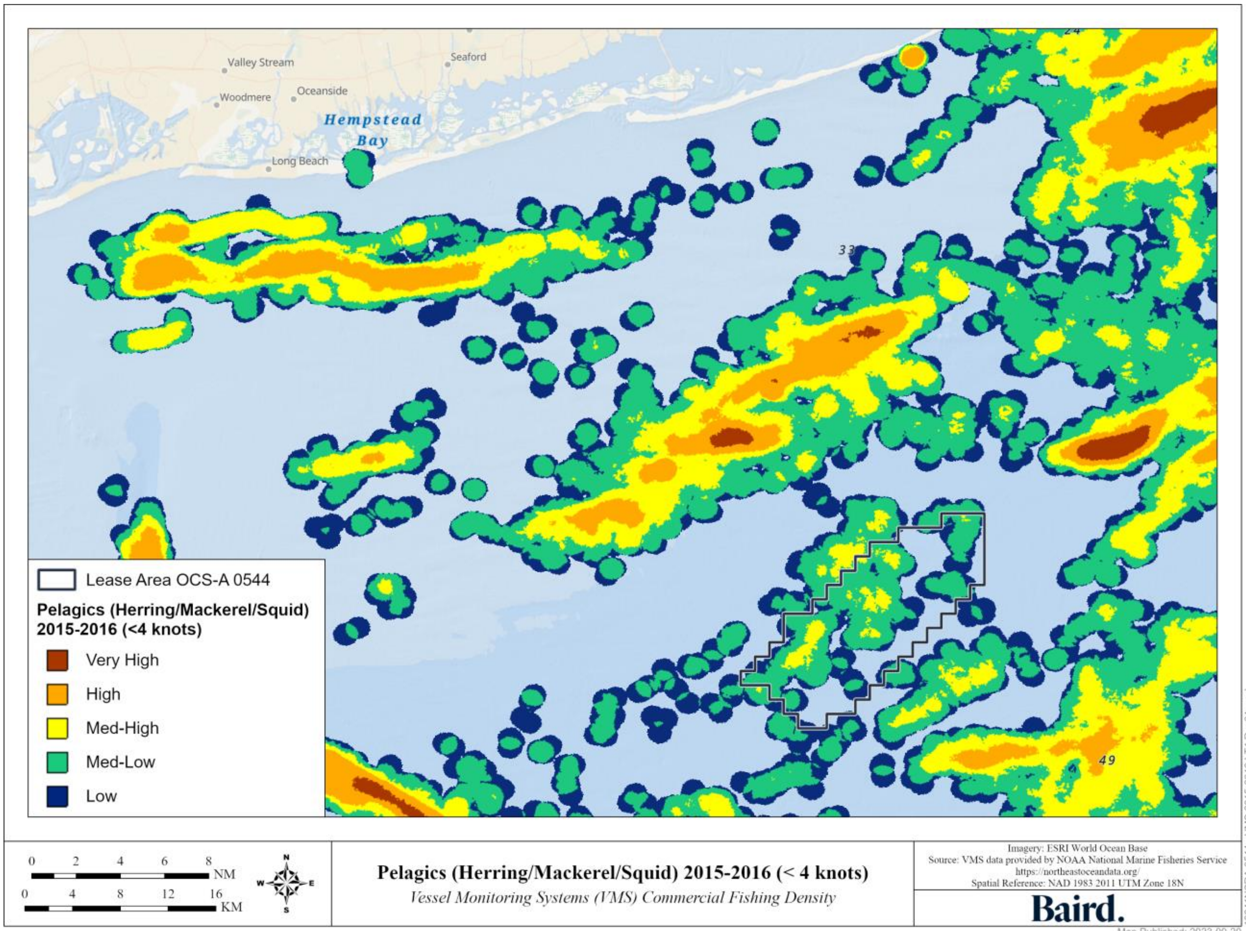

Figure C.17: VMS Commercial Fishing Density for Pelagics 2015-2016 (<4 kts)

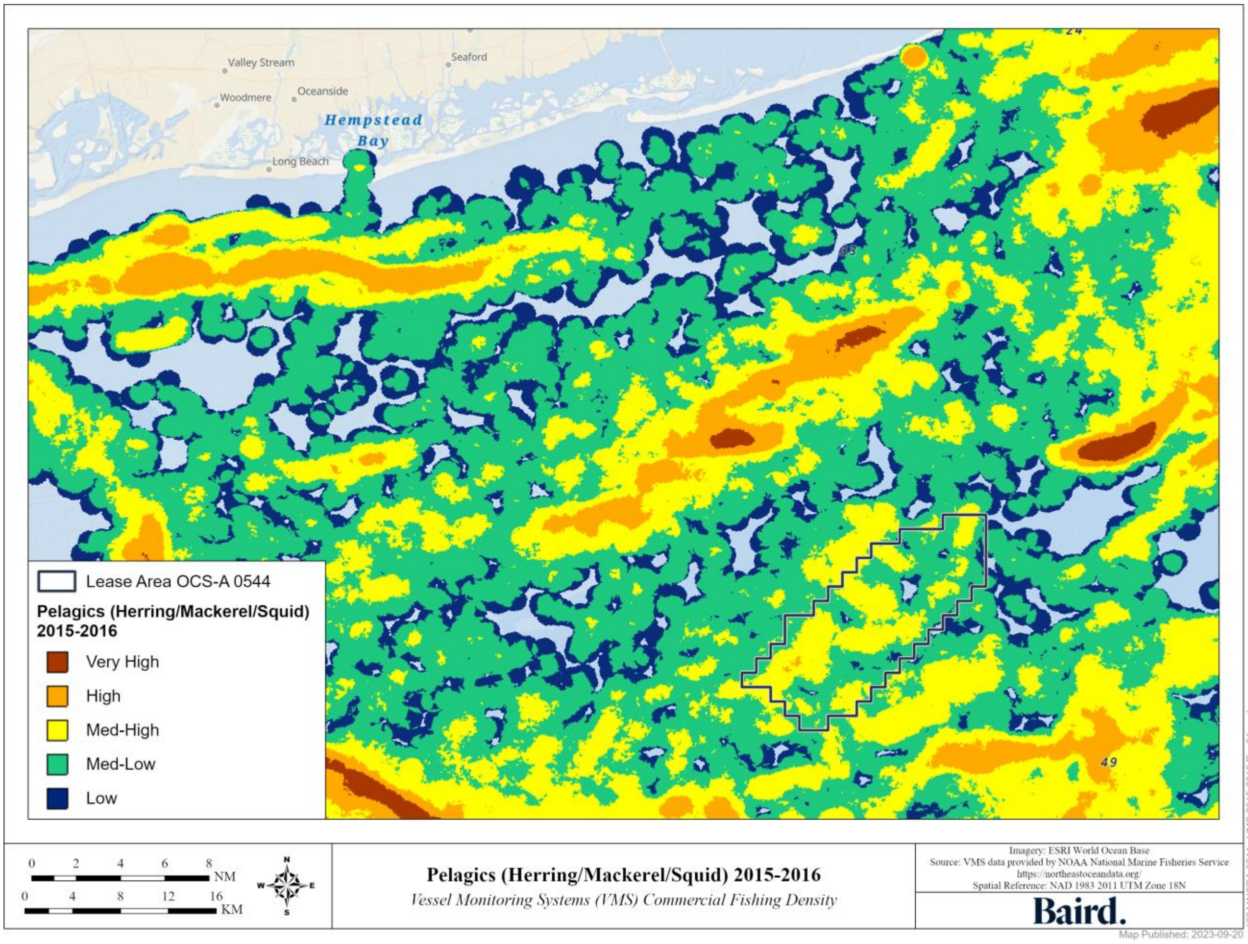

Figure C.18: VMS Commercial Fishing Density for Pelagics 2015-2016

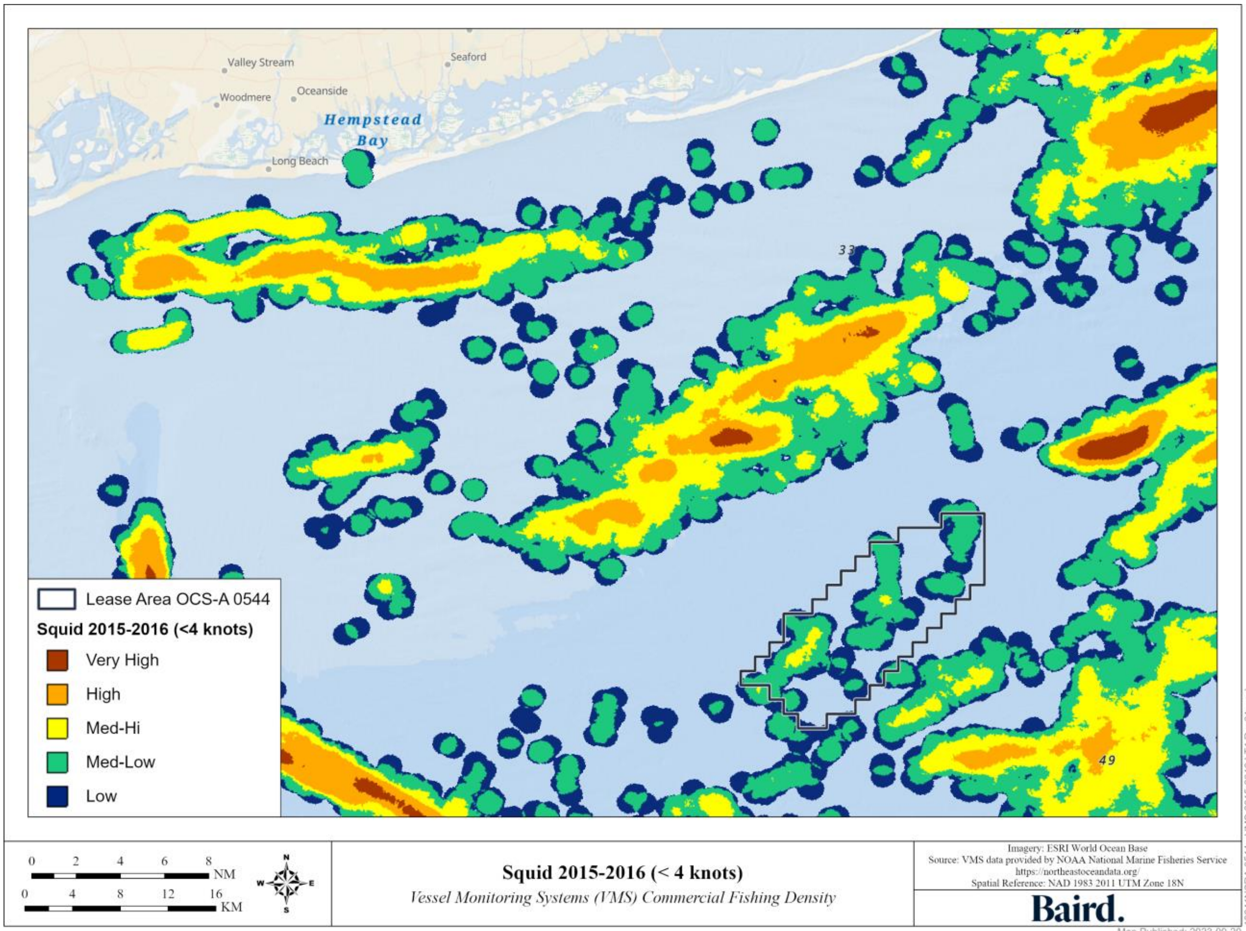

Figure C.19: VMS Commercial Fishing Density for Squid 2015-2016 (<4 kts)

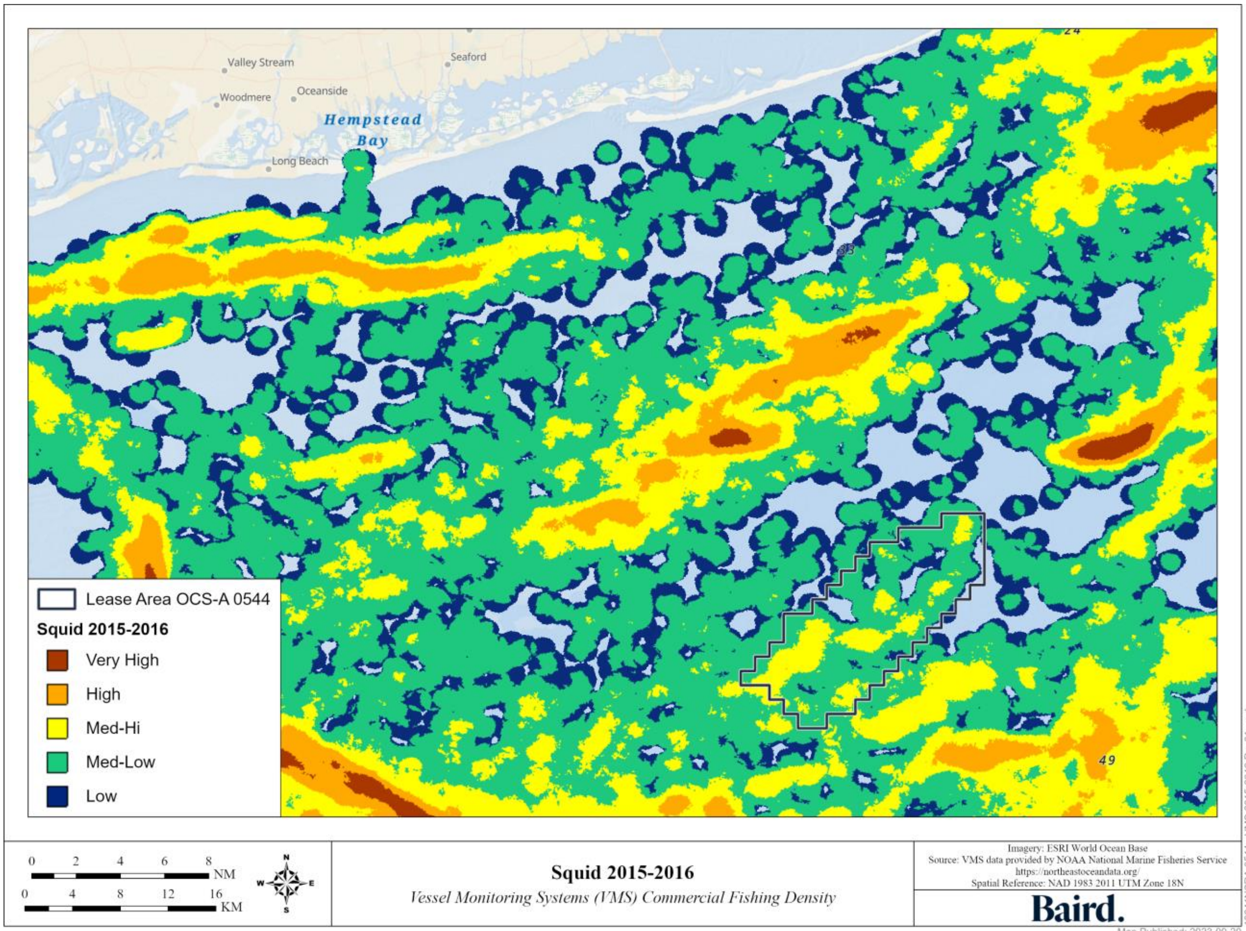

Figure C.20: VMS Commercial Fishing Density for Squid 2015-2016

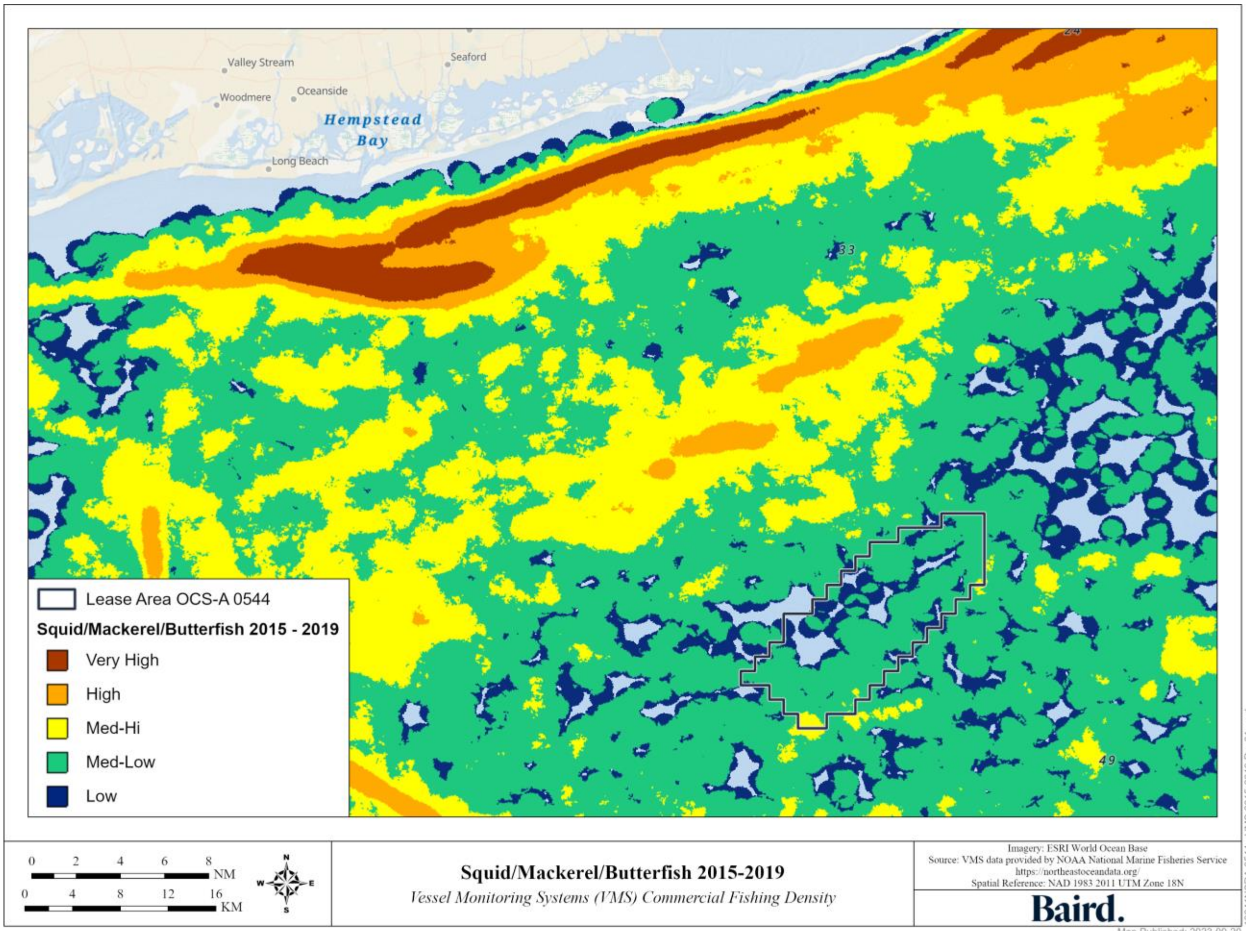

Figure C.21: VMS Commercial Fishing Density for Squid/Mackerel/Butterfish 2015-2019

C.2 Vessel Trip Report (VTR) Maps

NOAA Fisheries collects fishery data by means of Vessel Trip Reports (VTR) in which commercial fishing vessels report the details of each individual trip including vessel details, type of gear used, location, and type of catch. These data have been analyzed and mapped by NOAA Fisheries and are available online as GIS mapping files broken out by type of fishing activity and time period. The following are maps of the most recent data available (2011 to 2015) online.

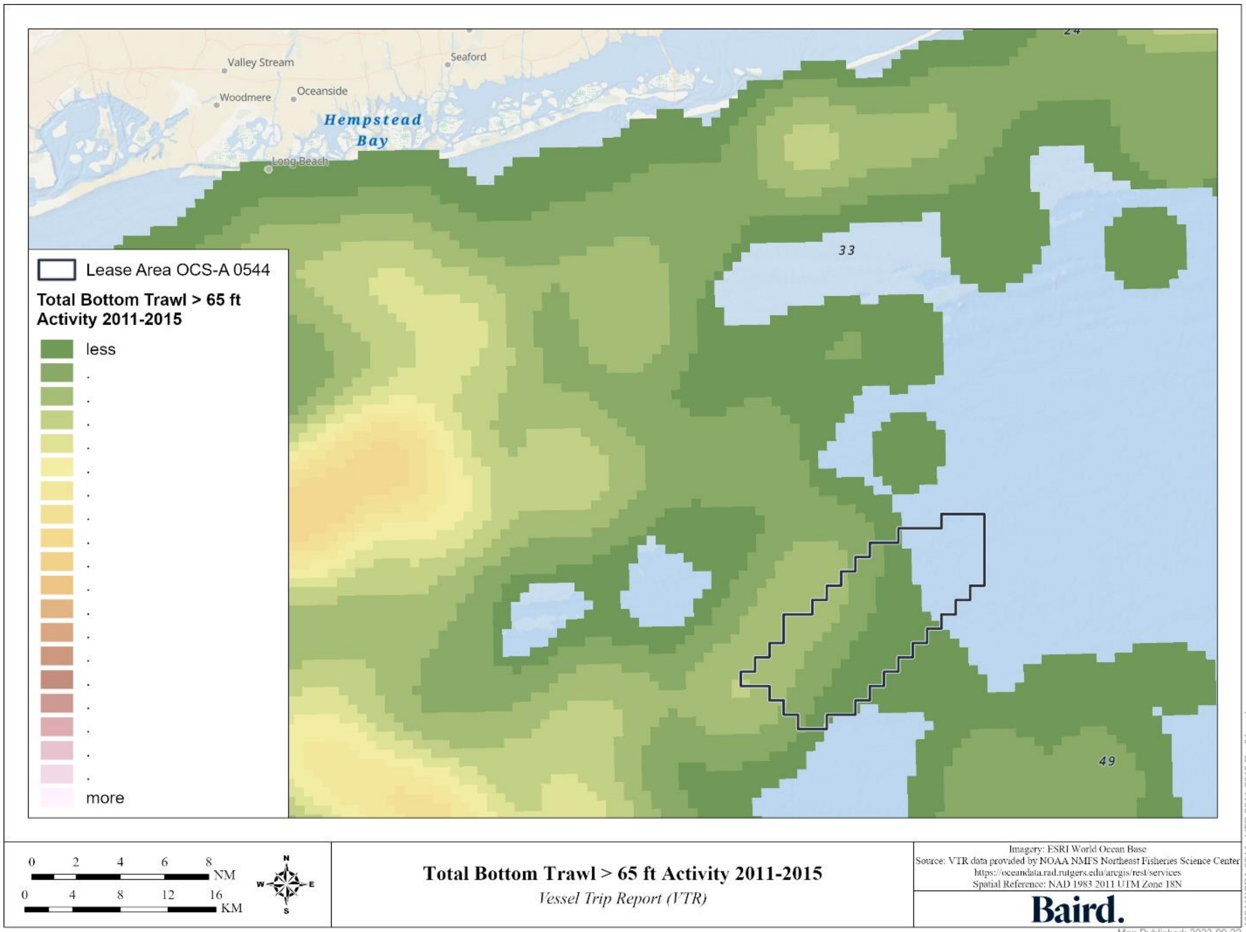

Figure C.22: Vessel Trip Report for Total Bottom Trawl Activity for Vessels Greater than 65 ft (2011-2015)

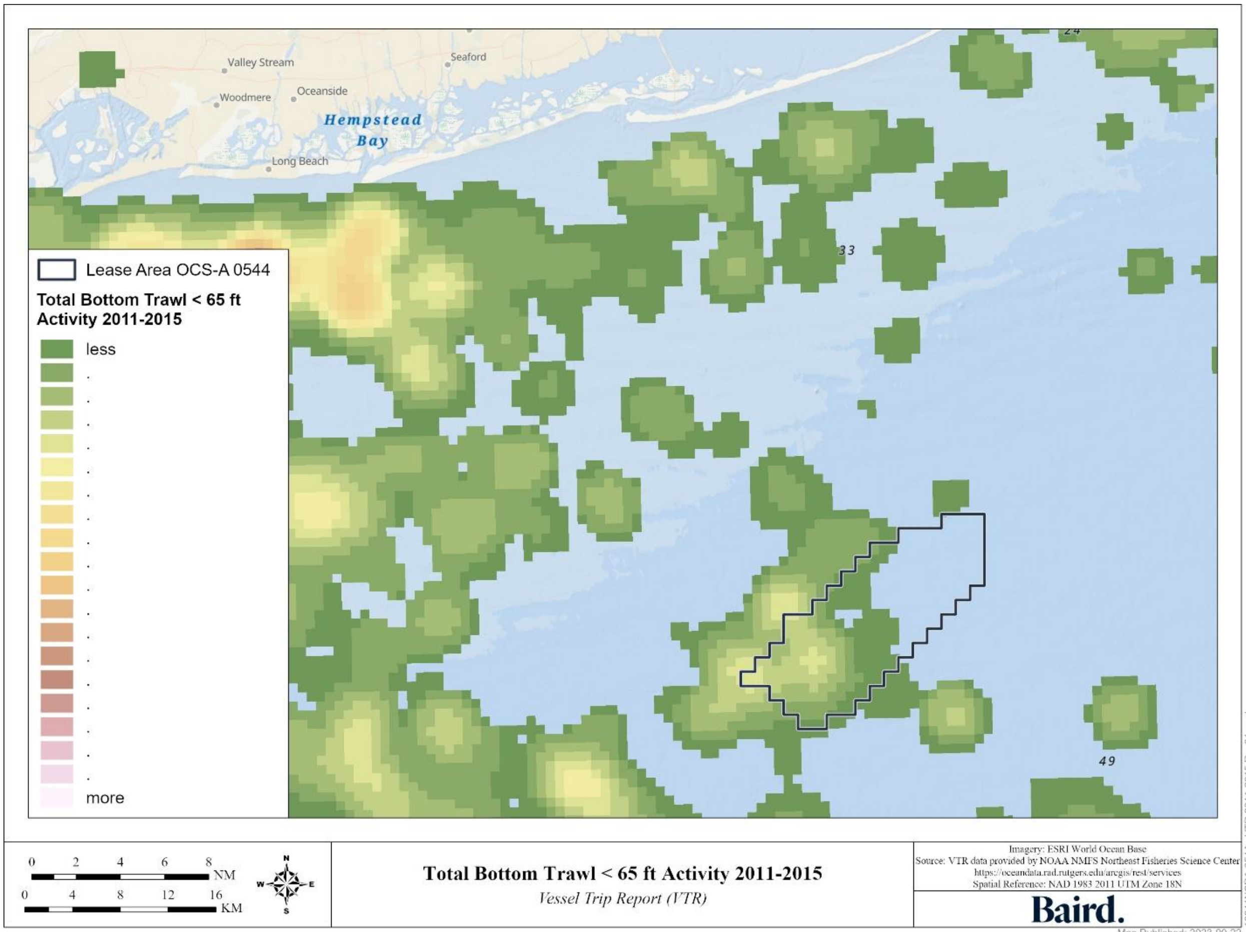

Figure C.23: Vessel Trip Report for Total Bottom Trawl Activity for Vessels Less than 65 ft (2011-2015)

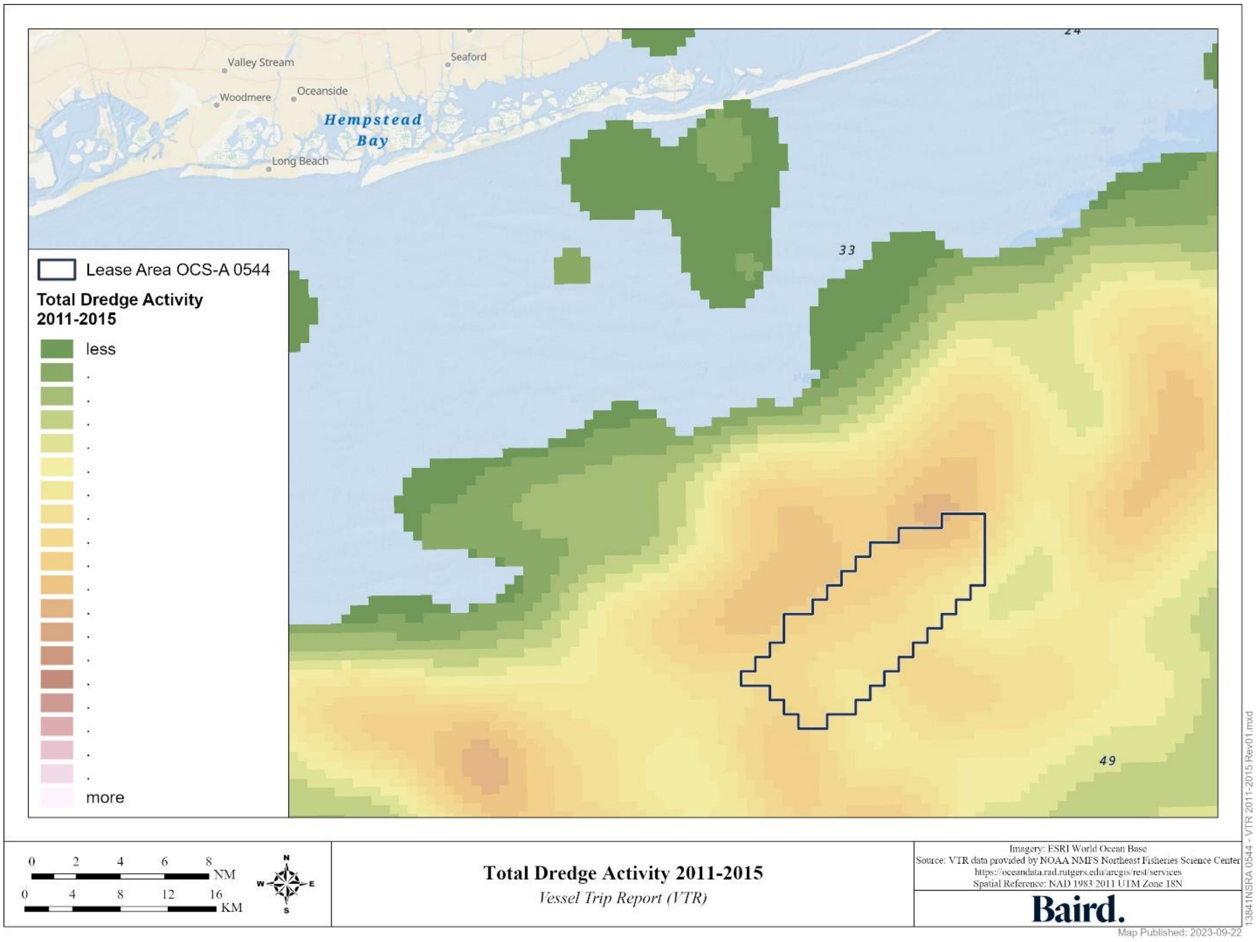

Figure C.24: Vessel Trip Report for Total Dredge Activity (2011-2015)

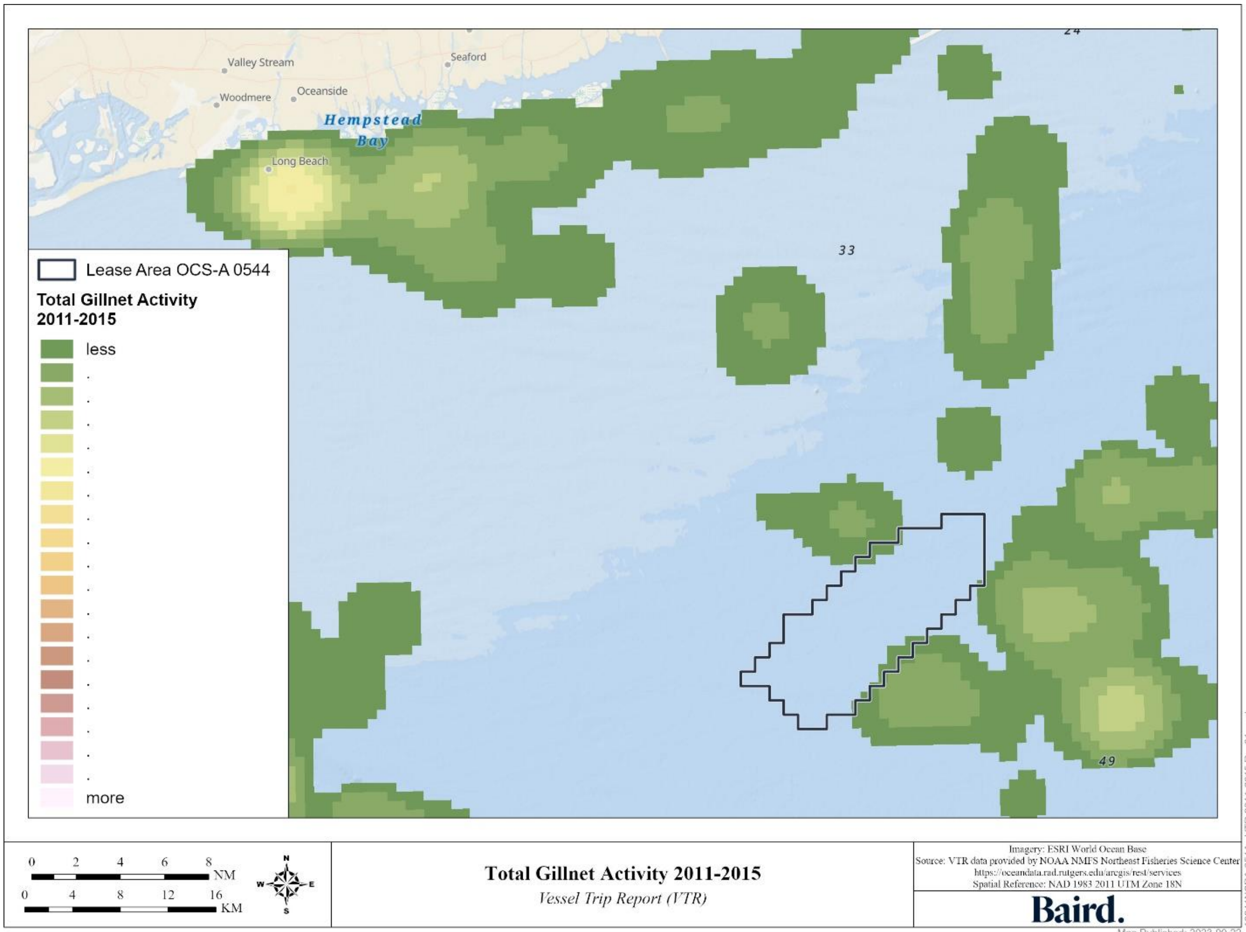

Figure C.25: Vessel Trip Report for Total Gillnet Activity (2011-2015)

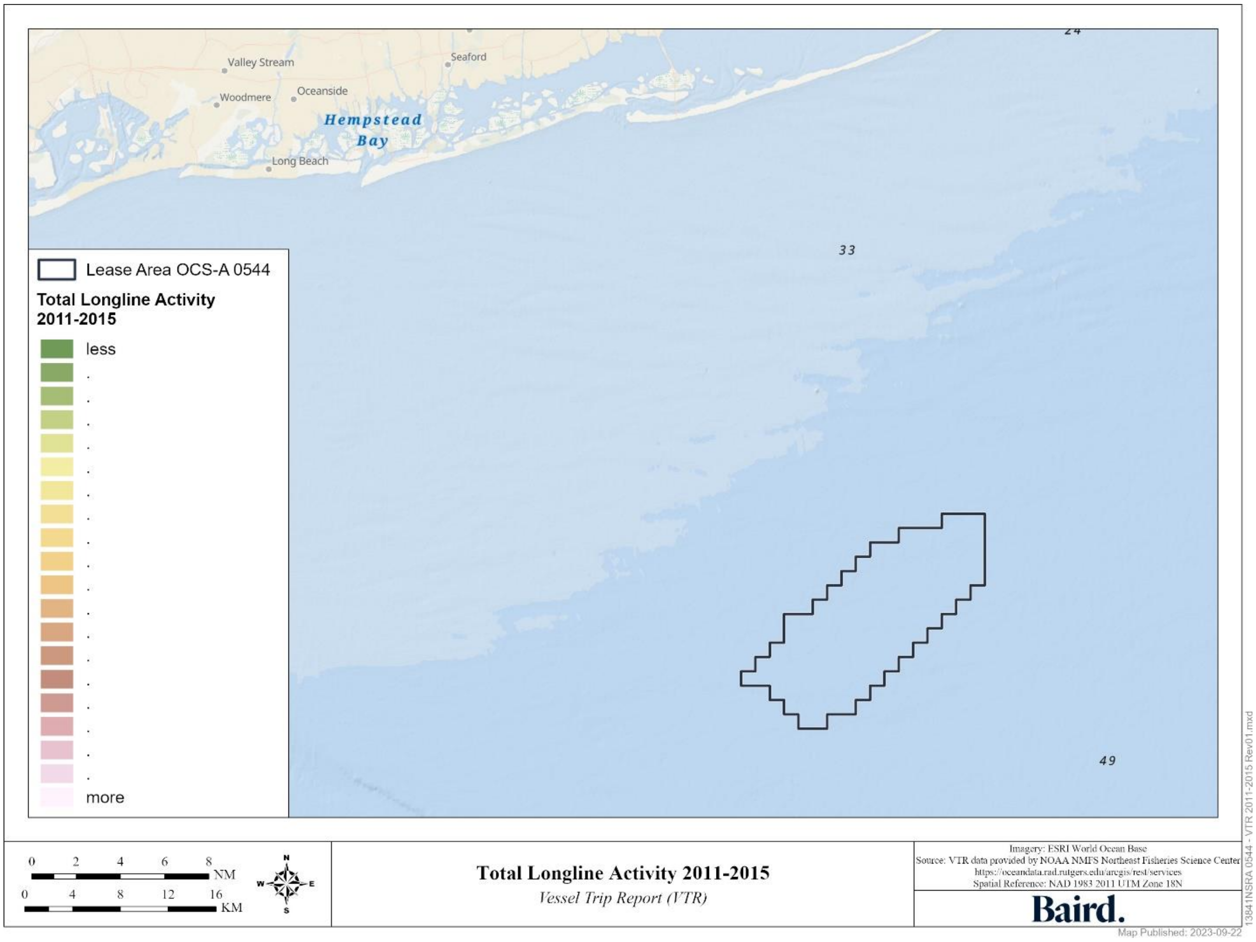

Figure C.26: Vessel Trip Report for Total Longline Activity (2011-2015)

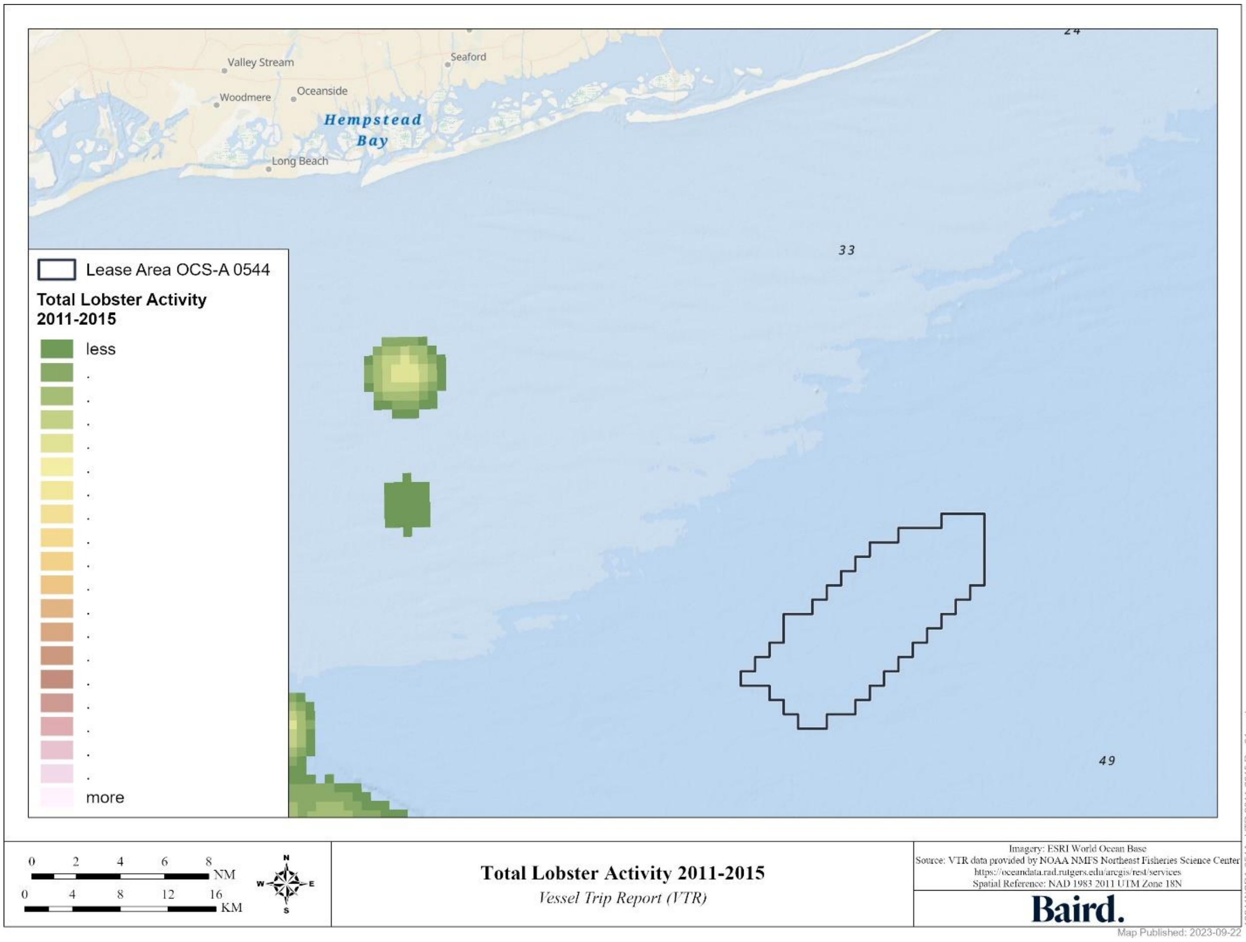

Figure C.27: Vessel Trip Report for Total Lobster Activity (2011-2015)

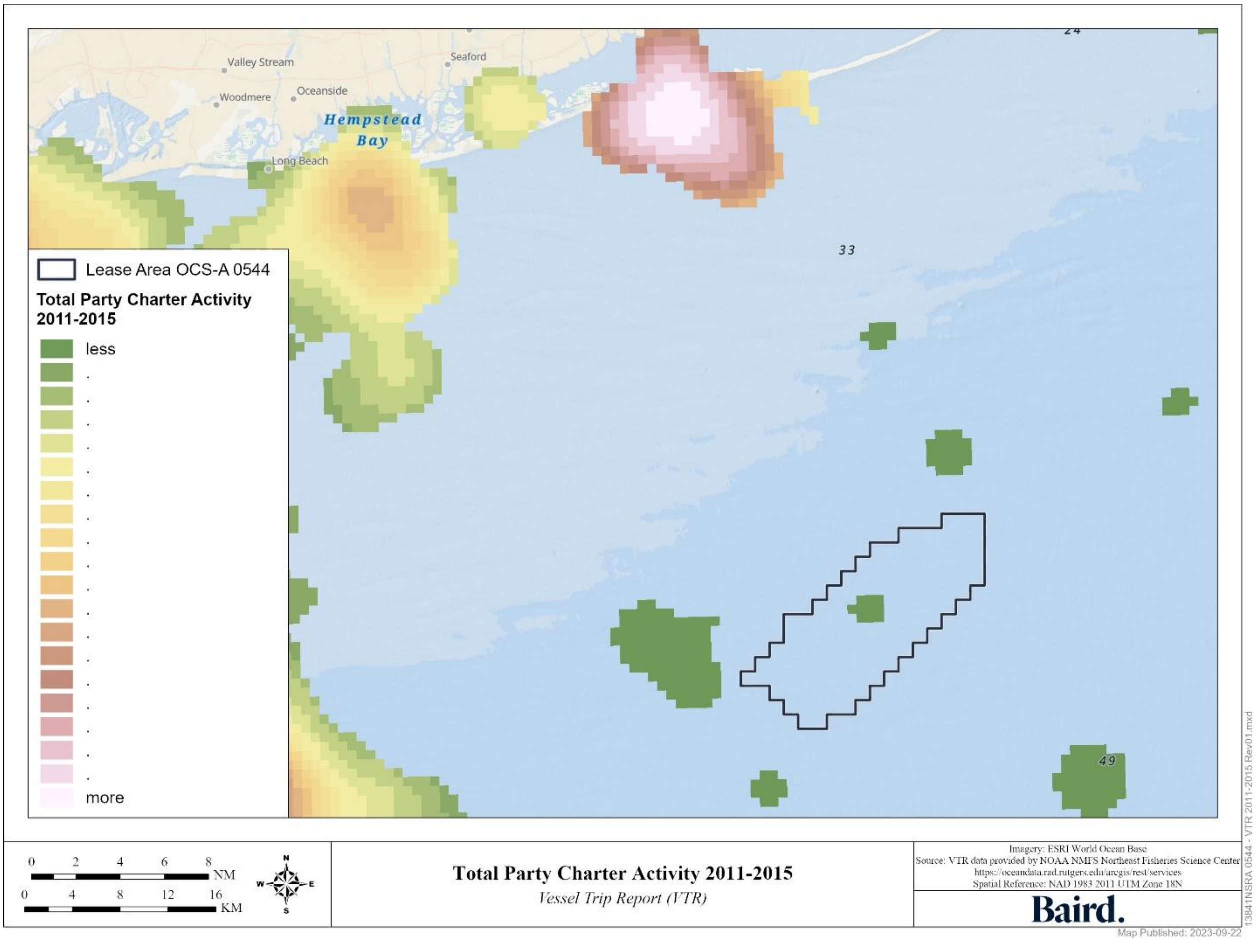

Figure C.28: Vessel Trip Report for Total Party Charter Activity (2011-2015)

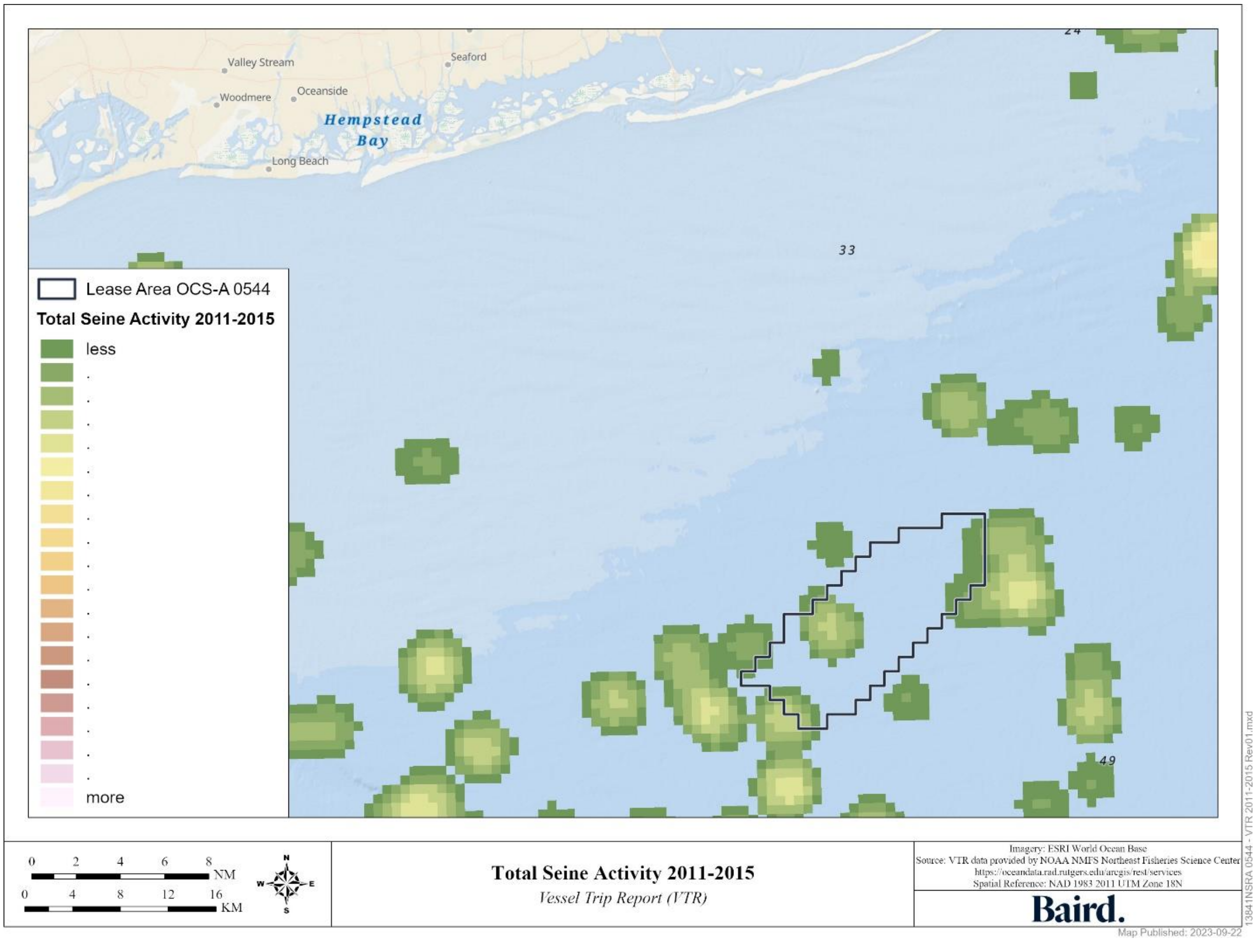

Figure C.29: Vessel Trip Report for Total Seine Activity (2011-2015)

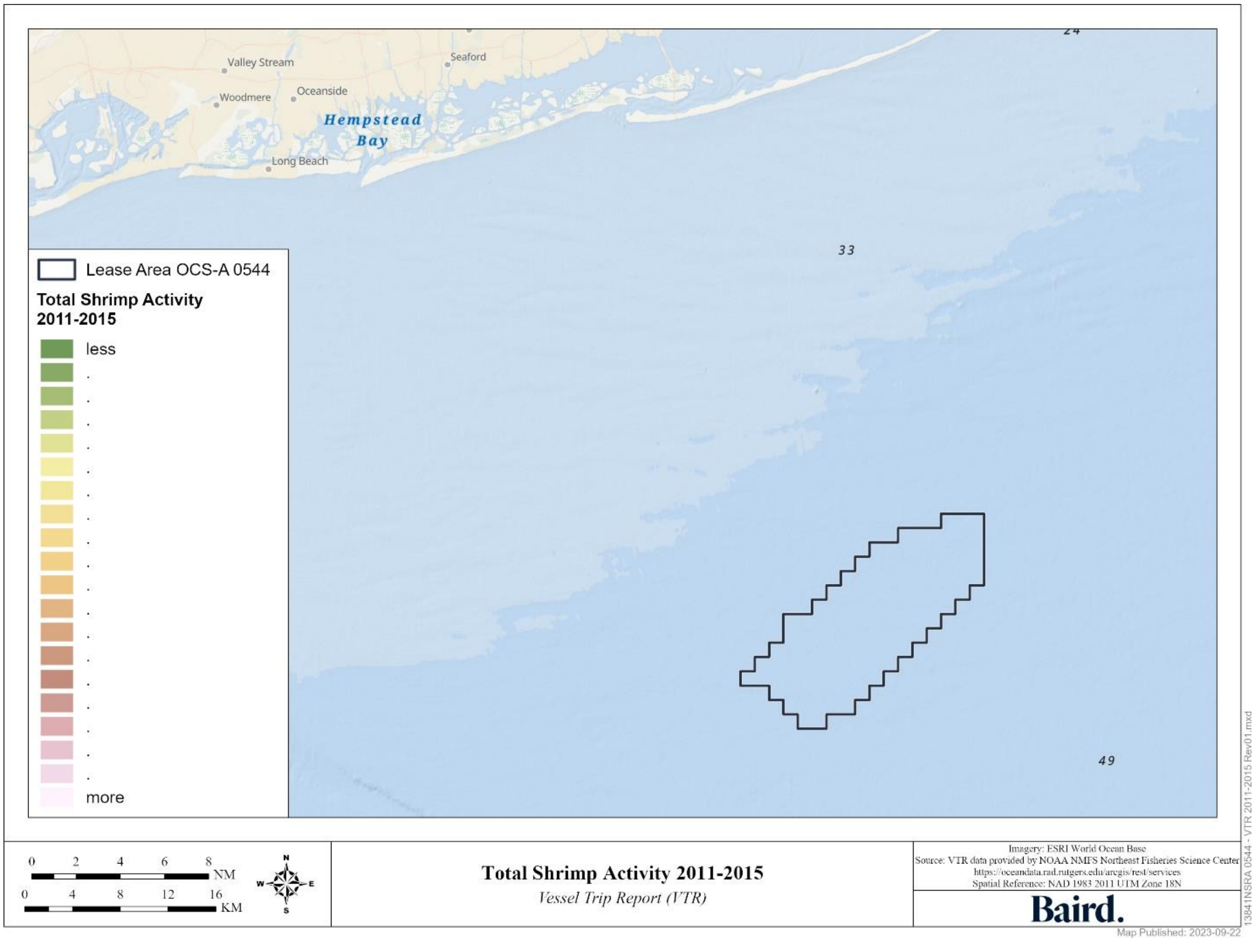

Figure C.30: Vessel Trip Report for Total Shrimp Activity (2011-2015)

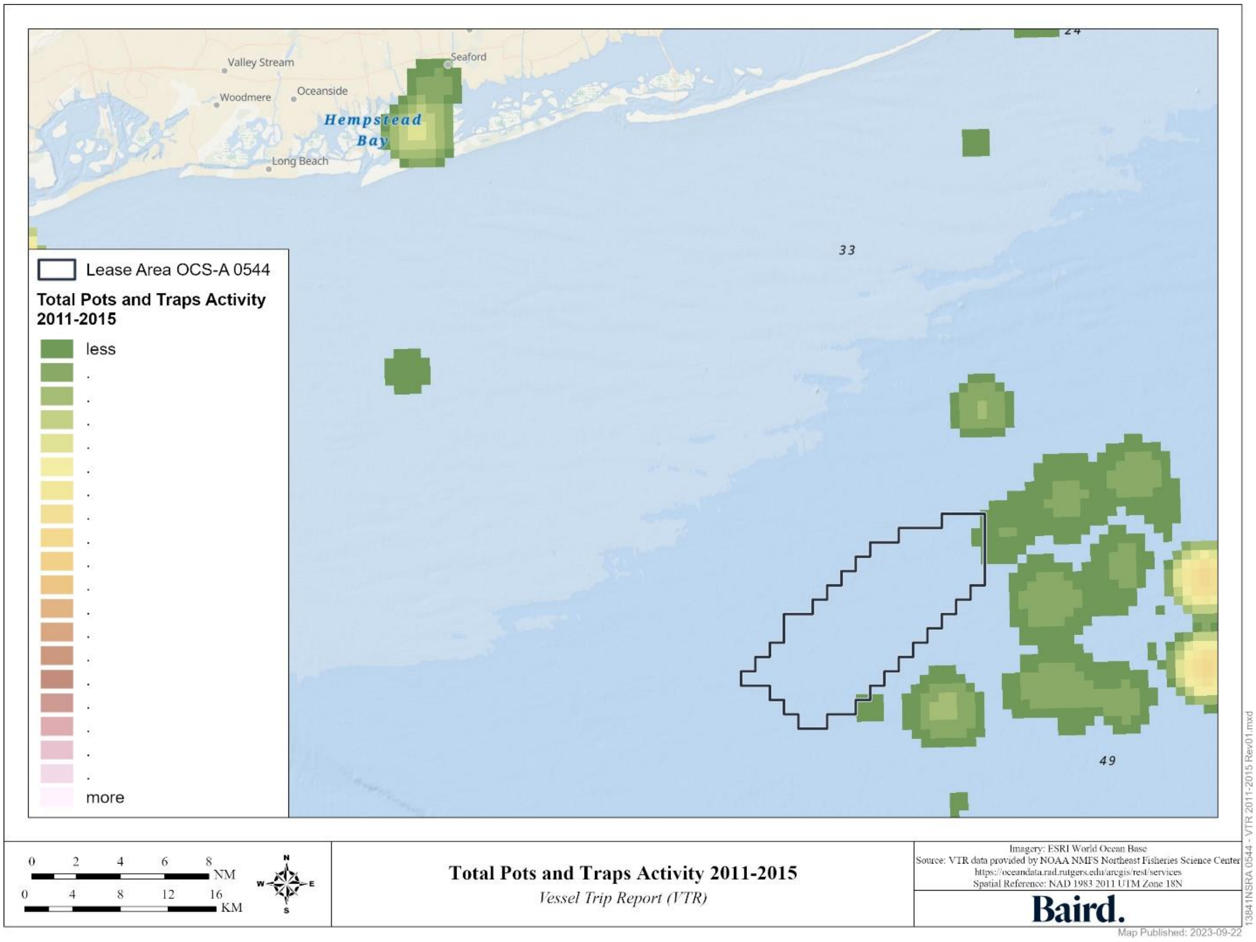

Figure C.31: Vessel Trip Report for Pots and Traps Activity (2011-2015)

Appendix D

NORM Model Summary

D.1 NORM Model Summary

Navigational and Operational Risk Model (NORM) is a model developed by Baird to assess and quantify navigational risk for both open-water and defined waterway conditions. NORM is capable of calculating navigational risk in both situations and is mainly geared towards quantifying the change in risk due to potential installations, or changes in waterway conditions. NORM is written in Python and is a statistical based navigational risk model that uses a theoretical framework derived from well-established literature as its base. NORM uses raw AIS traffic inputs, navigational charts, metocean conditions, and fixed structure information to calculate the risk of various accident scenarios. NORM can calculate the occurrence frequency of head-on collisions, overtaking collisions, crossing collisions, powered allisions, and drifting allisions. These calculations can be performed for intra-class, inter-class, and overall traffic risk analyses.

NORM consists of three main steps, as outlined in Figure D.1. These include an input step (where all relevant input data in collected), a pre-processing step (where the input data is processed into meaningful inputs for the risk calculations), and the actual risk calculation step.

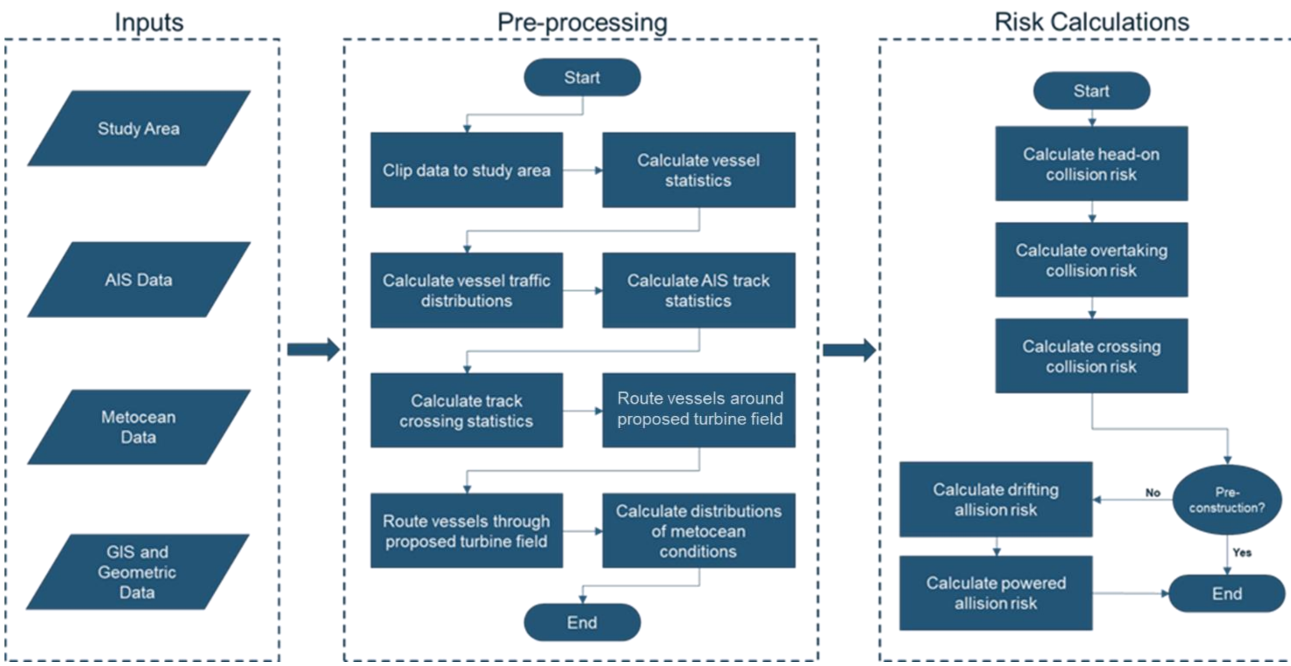

Figure D.1: Overview of NORM Modeling Procedure

D.1.2 Inputs

D.1.2.1 Study Area

The study area for the navigational safety risk assessment must be carefully selected to only contain the traffic that may be appreciably affected by the project of interest. If too large an area is chosen, it may contain a considerable amount of traffic that may never actually experience any impacts due to an offshore installation resulting in an underestimation of the relative change in navigational risk. If too small an area is chosen, the changes to regional traffic patterns may potentially be under-estimated. This study area is used to clip all AIS data (often retrieved for a larger area) to contain the analysis only to the study area.

D.1.2.2 AIS Data

NORM uses raw AIS data as inputs into the model, mainly for the pre-processing steps outlined in Section D.1.3. Multi-year datasets can be used by NORM to understand the distribution of vessel characteristics that are common to the study area and for determination of design vessel characteristics used in the risk calculations. This data is also used for various analyses to determine traffic characteristics such as heading distributions, crossing angle distributions, proximity frequencies, etc.

D.1.2.3 Metocean Data

Wind and/or current conditions local to the chosen study area are used as a model input for NORM. NORM considers long-term historical or hindcast datasets to understand the conditions local to the chosen study area. The wind and current conditions are specifically used for the drifting allision risk calculations, whereby the direction and speed of the drifting vessel is directly correlated with the speed and direction of the winds acting on it as well as oceanographic and/or tidal current.

For North America, NORM has the ability to search multiple databases to identify datasets with information on visibility conditions in the chosen study area. Outside of North America visibility data may be manually input. Visibility is a critical component that affects mariner's ability to safely travel, and is used by NORM to modify the various causation factors as outlined in Section D.1.4.1.

D.1.2.4 GIS and Geometric Inputs

NORM has the capability to incorporate arbitrarily shaped and positioned objects in the form of GIS shapefiles. These can be used to represent turbine locations, offshore oil rigs, or any other offshore installation, and their respective geometry. These inputs are mainly used to calculate collisions with fixed offshore objects, i.e., allisions. When using NORM to calculate navigational risk in the presence of a turbine field, the layout of the grid dictates the geometric characteristics of the navigation paths that can be safely transited, and relative positioning of turbines with respect to transiting vessels. NORM uses the GIS and geometric inputs to automatically determine the appropriate navigation path geometry and assumed traffic distribution through these navigation paths in the presence of a turbine field or other fixed objects.

D.1.3 Pre-processing

NORM includes a pre-processing step, whereby all the raw inputs are processed to obtain meaningful relationships and inputs for the risk calculations. This includes pre-processing of the raw AIS data, metocean data, and GIS/geometric data. As part of this pre-processing step, NORM calculates the following:

Vessel characteristics and traffic statistics

- Distribution of vessel LOA, beam, speed, annual/seasonal volume for each vessel class

Vessel traffic distributions and interactions

- Spatial distribution of traffic concentration (Figure D.2)
- Spatial distribution of vessels with respect to one another in concentrated areas, done on an inter-class and intra-class basis (Figure D.3)

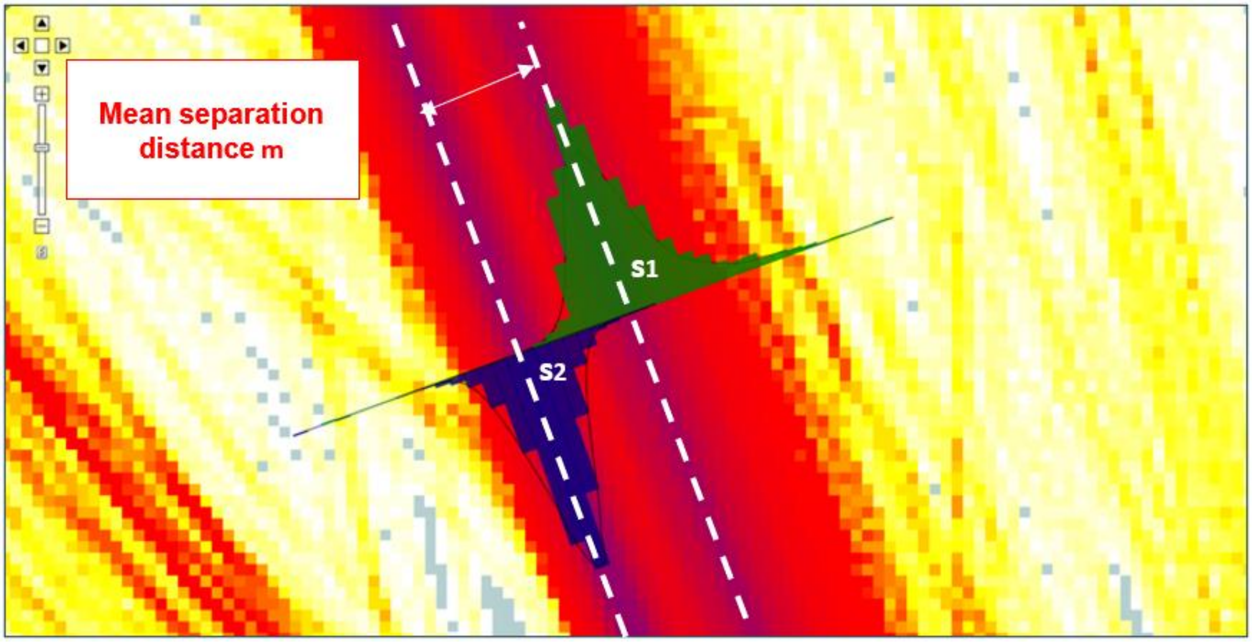

Figure D.2: Spatial Distribution of Traffic Concentration and Vessel Traffic Distribution

AIS track statistics

- AIS ping data used to make AIS tracks
- Individual tracks analyzed to get track length and heading distributions, done on an inter-class and intra-class basis (Figure D.3)

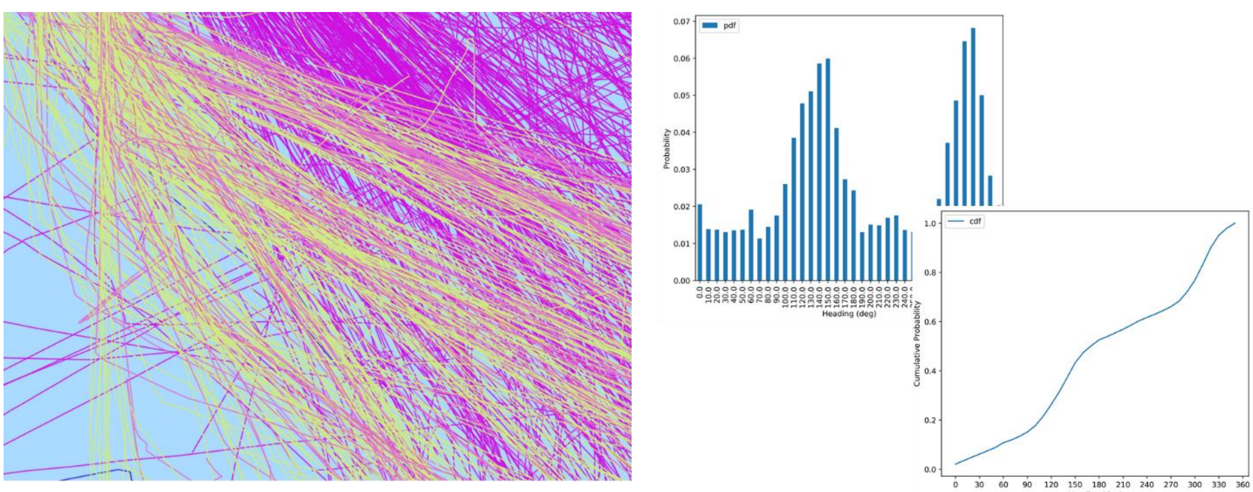

Figure D.3: AIS Tracks, and Track Length and Heading Distributions

Route vessels through/around turbine(s)

- NORM utilizes an algorithm (based on existing traffic patterns, turbine field footprint, and turbine placement) to route traffic down future navigation paths between turbine rows, establishing future traffic conditions within the study area used for risk calculations (Figure D.4).

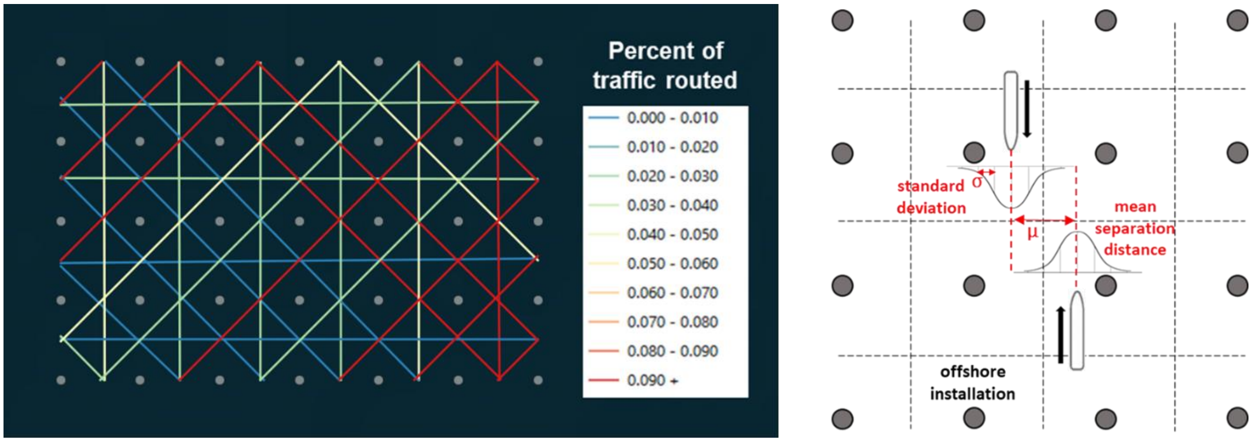

Figure D.4: Traffic Routed Through Turbine Field (left), Assumed Future Traffic (right)

D.1.4 Risk Calculations

NORM employs a widely adopted and accepted methodology for calculating navigational risk for various collision/allision scenarios that is described in the below equation:

$$N_a = P_a * n = P_g * P_c * n$$

Where N_a is the number of accidents occurring over a given time period (typically one year), P_a is the probability of an accident occurring, n is the number of vessels over a given time period, P_g is the geometric probability of an accident occurring, and P_c is the causation probability. The causation probability is the probability that a potential accident will in fact occur once on a potential collision/allision course.

The number of vessels considered (n) is obtained from AIS data. Methodology outlined in Zhang et al. (2019) is employed to calculate the geometric probability (P_g); this methodology stems from original work outlined in Pedersen (2010). NORM also employs causation factors (P_c) developed by Fuji and Mizuki (1998).

D.1.4.1 Causation Factors

Causation factors are defined as the probability that an accident will in fact occur, given that one (or more) vessel(s) is on a potential collision/allision course. It is the factor meant to capture human error in the collision or allision process, whereby it acts as a reduction factor for all the possible collisions/allisions that could occur under blind navigation conditions.

Causation factors have historically been computed using fault tree analysis, Bayesian networks, or derived from historical accident data. In general, they are dependent on human and vessel response, environmental conditions, use of navigational and communication equipment (i.e., AIS, VTS), etc. NORM utilizes the causation factors developed by Fuji and Mizuki (1998), rooted in historical observations. These causation factors have been widely applied in the industry and have been used as default factors for navigational risk models as such IWRAP (IALA, n.d.); the causation factors are summarized in Table D.1.

Table D.1: Accident Causation Factors Used in NORM

Accident Scenario	Causation Factor
Head-on Collision	0.5E-04
Overtaking Collision	1.1E-04
Crossing Collision	1.3E-04
Powered Allision	1.86E-04

Adverse visibility conditions in potential accident scenarios can reduce vessel reaction and response time and lead to increased navigational risk. According to Fujii and Mizuki (1998), the causation factors they generated were obtained from historical data where visibility was less than 1 km approximately 3% of the year. They also state that the causation probability (and thus navigational risk) is approximately inversely proportional to the visibility. Suggestions are then provided to scale the causation factors by a factor of two if the frequency of visibility less than 1 km is between 3% to 10%, and by a factor eight if it is between 10 to 30%. NORM makes this adjustment based on visibility conditions.

D.1.4.2 Collision Scenarios

Collisions are defined as the event of one vessel striking or contacting another vessel. NORM considers three different collision scenarios as part of the navigational safety risk assessment procedure: head-on, overtaking, and crossing. These collision scenarios are depicted in Figure D.5.

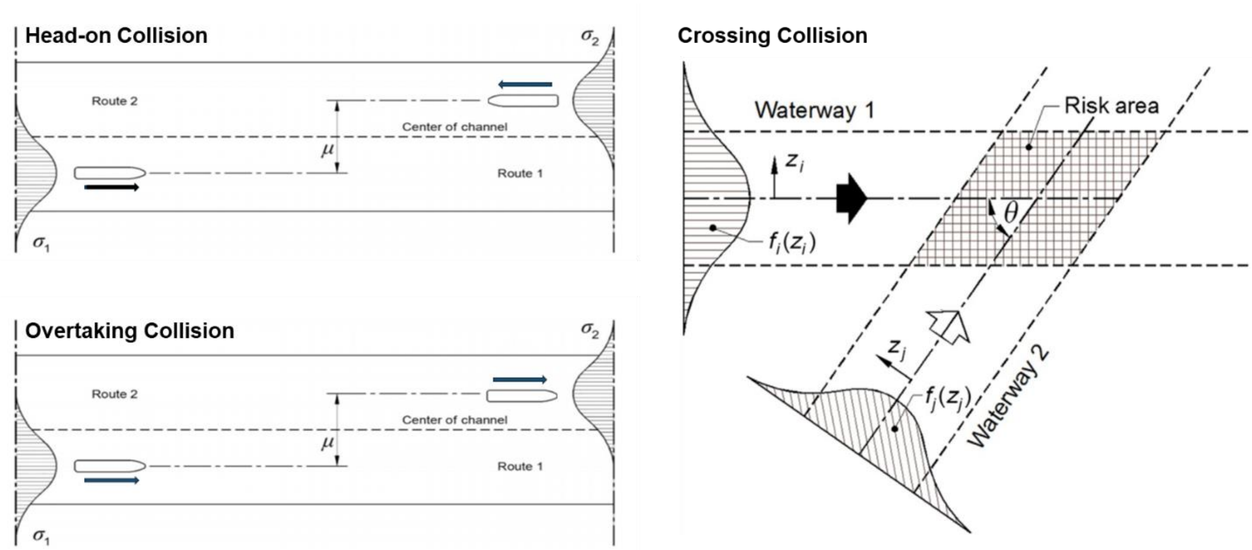

Figure D.5: Collision Scenarios Considered by NORM (Images Adopted from Zhang et al., 2019)

Head-on collisions occur when vessels are approaching from parallel but opposite directions. Overtaking collisions are similar to head-on collisions but occur when two vessels are traveling in the same direction at different speeds. Crossing collisions can occur when two vessel tracks intersect at a significantly non-parallel angle (assumed >10 degrees in the NORM model). NORM utilizes the applicable methodology (from Zhang et al. [2019]) to calculate the navigational risk for each of these scenarios, with outputs from the pre-processing step used as the inputs for the risk calculations. In particular, NORM utilizes the full distribution of vessel track headings, and the observed probabilities of vessels approaching head-on, overtaking or at a crossing angle within the study area.

Navigational risk for each of the collision scenarios is highly dependent on the vessel characteristics, track characteristics, and traffic distributions calculated during the pre-processing step. NORM has the capability to use the full range of vessel and track characteristics for risk calculations, or single statistical values i.e., mean/median vessel LOA, beam, speed, etc. Collision risk due to head-on, overtaking, and crossing collisions is calculated by NORM for all inter-class and intra-class combinations, as well as overall traffic for all vessel classes.

As the methodology outlined in Zhang et al. (2019) is mainly geared towards defined navigational channels, for open-water conditions NORM considers the true level of interaction of vessels (through the frequency-proximity pre-processing analysis) as part of the calculation to overcome inherent limitations in the formulation for this type of application.

D.1.4.3 Allision Scenarios

Allisions are defined as the event of a vessel striking or contacting a fixed structure. NORM considers both powered and drifting allisions as part of the navigational safety risk assessment procedure. Powered allisions occur when there is still power to the vessel and operable steering, whereas drifting allisions occur after a vessel experiences either loss of propulsion or rudder failure, a combination of the two, or some other form of damage that renders the vessel inoperable. Both powered and drifting allisions are depicted in Figure D.6.

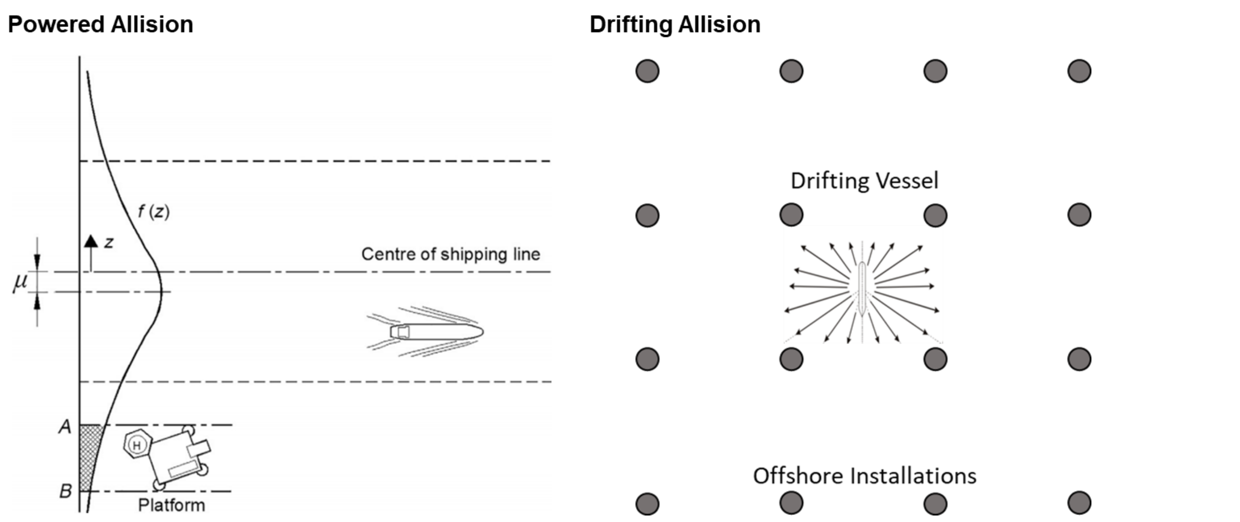

Figure D.6: Allision Scenarios Considered by NORM (Powered Allision Image Adopted from Zhang et al., 2019)

Powered allisions are similar to head-on collisions in that they generally depend on the same factors, but the second vessel, or fixed structure in this case, has a speed of zero and a fixed location. As such, a similar procedure to head-on collisions is followed for the calculation of powered allision risk, in that the outputs from the pre-processing step are used as inputs for the applicable methodology as outlined in Zhang et al. (2019). NORM augments this methodology slightly to make it account for multiple turbines along a given navigation path between turbine rows (as opposed to a single fixed object).

For powered allision risk calculations within a turbine field, the amount of traffic going down a particular navigation path is dependent on the results of the routing pre-processing step (Figure D.6 left), while the traffic distributions are dependent on the geometric constraints of the turbines and their placement (GIS and geometric inputs, Figure D.6 right).

Drifting collisions are much more random and difficult to quantify. NORM assumes rates of vessel breakdown that are commonly used in literature and other navigational risk models which are outlined in Zhang et al. (2019) and Rasmussen et al. (2012):

Table D.2: Rates of Vessel Breakdown Used in NORM

Factor	Frequency (per vessel and hour)
Loss of propulsion	1.3E-04
Rudder failure	6.3E-05
Loss of propulsion and rudder failure	1.5E-05

Furthermore, a drift-repair function is assumed to model the probability that a vessel is still drifting at a certain time after breakdown. This drift-repair function is often modeled with a Weibull function with an assumed cut-off time. NORM assumes a 10-hour cut-off time. That is to say, it is assumed that after 10 hours, all vessels will have been repaired or rescued. This repair function is illustrated in Figure D.7.

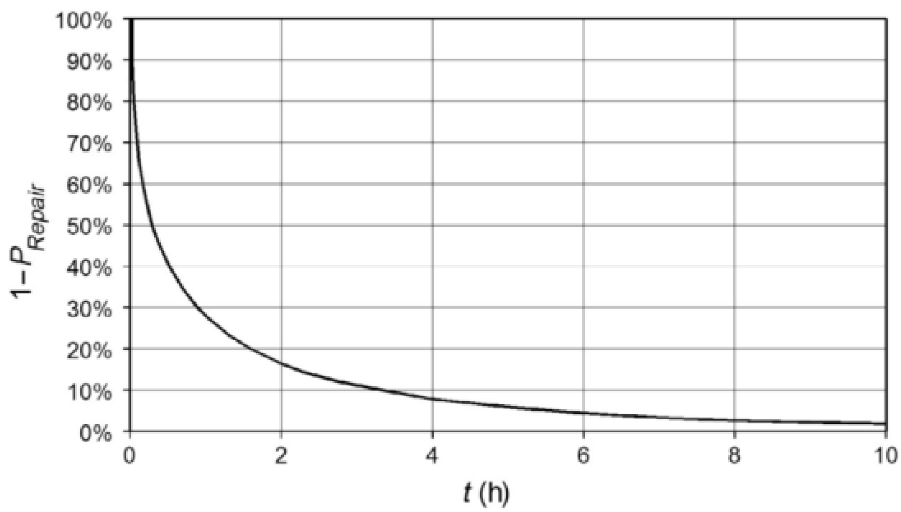

Figure D.7: Drift-repair Function Used in NORM (Image Adopted from Zhang et al., 2019)

For the purposes of drifting allision risk calculations, NORM assumes a drift speed of 2 kts (literature suggests typical is 1-6 kts) with the same directional distribution as the local wind conditions. Alternately, NORM can use a drift velocity and directional distribution equal to local oceanographic and/or tidal currents. NORM then determines all of the turbines within the vessels potential drift radius and calculates drifting allision risk for each turbine individually based on an initial starting position and sums them up. NORM's formulation for calculation drifting allision risk accounts for probability of vessel breakdown, probability of vessel drift-repair, turbine field placement, influence of metocean conditions on drift direction, and vessel characteristics.

Appendix E

Wind Turbine Generator and Electrical Service Platform Coordinates

E.1 Wind Turbine Generator and Electrical Service Platform Coordinates

Coordinates and water depths for Vineyard Mid-Atlantic's wind turbine generator (WTG) and electrical service platform (ESP) positions are provided in Table E.1 below. All WTG/ESP positions are within Lease Area OCS-A 0544. Six WTG/ESP positions along the northwestern boundary of Lease Area OCS-A 0544 are contingent upon the final layout of the neighboring Empire Wind 2 project; Vineyard Mid-Atlantic will not develop these "contingent WTG/ESP positions" if the final Empire Wind 2 layout includes WTGs at immediately adjacent positions within Lease Area OCS-A 0512. Coordinates provided are referenced to Universal Transverse Mercator (UTM) Zone 18 North in meters, NAD 1983 (2011) datum.

Table E.1: Structures Coordinates

Identifier	Name	Position Type	Easting (m)	Northing (m)	Longitude (degrees)	Latitude (degrees)	Water Depth (m)
1	E08	WTG/ESP	663,622	4,461,726	-73.0750	40.2900	-41.2
2	E07	WTG/ESP	664,843	4,461,439	-73.0608	40.2872	-41.0
3	E06	WTG/ESP	666,064	4,461,151	-73.0465	40.2844	-42.7
4	E05	WTG/ESP	667,285	4,460,864	-73.0322	40.2815	-43.0
5	E04	WTG/ESP	668,505	4,460,576	-73.0179	40.2787	-42.4
6	E03	WTG/ESP	669,726	4,460,289	-73.0036	40.2759	-43.3
7	E02	WTG/ESP	670,947	4,460,001	-72.9894	40.2730	-43.6
8	E01	WTG/ESP	672,168	4,459,714	-72.9751	40.2702	-43.4
9	L10	WTG/ESP	661,181	4,453,522	-73.1058	40.2166	-42.8
10	M10	WTG/ESP	661,181	4,452,268	-73.1061	40.2053	-42.6
11	N10	WTG/ESP	661,181	4,451,014	-73.1064	40.1940	-42.7
12	O10	WTG/ESP	661,181	4,449,760	-73.1067	40.1828	-44.3
13	P10	WTG/ESP	661,181	4,448,506	-73.1071	40.1715	-44.4
14	H06	WTG/ESP	666,064	4,457,389	-73.0474	40.2505	-42.5
15	K14	WTG/ESP	656,298	4,455,926	-73.1626	40.2392	-41.3
16	I06	WTG/ESP	666,064	4,456,135	-73.0478	40.2392	-43.8
17	L14	WTG/ESP	656,298	4,454,672	-73.1629	40.2279	-40.9
18	J06	WTG/ESP	666,064	4,454,880	-73.0481	40.2279	-45.4
19	M14	WTG/ESP	656,298	4,453,418	-73.1632	40.2166	-41.6
20	K06	WTG/ESP	666,064	4,453,626	-73.0484	40.2166	-43.9
21	N14	WTG/ESP	656,298	4,452,164	-73.1635	40.2053	-41.9
22	O14	WTG/ESP	656,298	4,450,909	-73.1638	40.1940	-41.3
23	G10	WTG/ESP	661,181	4,459,793	-73.1042	40.2731	-40.5
24	H10	WTG/ESP	661,181	4,458,539	-73.1045	40.2618	-40.7

Identifier	Name	Position Type	Easting (m)	Northing (m)	Longitude (degrees)	Latitude (degrees)	Water Depth (m)
25	F02	WTG/ESP	670,947	4,458,747	-72.9897	40.2617	-43.4
26	I10	WTG/ESP	661,181	4,457,284	-73.1049	40.2505	-42.2
27	J10	WTG/ESP	661,181	4,456,030	-73.1052	40.2392	-41.9
28	K10	WTG/ESP	661,181	4,454,776	-73.1055	40.2279	-43.7
29	F06	WTG/ESP	666,064	4,459,897	-73.0468	40.2731	-42.4
30	G06	WTG/ESP	666,064	4,458,643	-73.0471	40.2618	-42.3
31	O15	WTG/ESP	655,077	4,451,197	-73.1781	40.1968	-41.1
32	P15	WTG/ESP	655,077	4,449,943	-73.1784	40.1855	-42.9
33	K11	WTG/ESP	659,960	4,455,064	-73.1198	40.2307	-42.9
34	L11	WTG/ESP	659,960	4,453,809	-73.1201	40.2195	-42.5
35	M11	WTG/ESP	659,960	4,452,555	-73.1204	40.2082	-42.2
36	N11	WTG/ESP	659,960	4,451,301	-73.1207	40.1969	-42.4
37	O11	WTG/ESP	659,960	4,450,047	-73.1210	40.1856	-43.4
38	P11	WTG/ESP	659,960	4,448,793	-73.1213	40.1743	-44.9
39	G07	WTG/ESP	664,843	4,458,930	-73.0614	40.2646	-41.4
40	H07	WTG/ESP	664,843	4,457,676	-73.0617	40.2533	-43.6
41	I07	WTG/ESP	664,843	4,456,422	-73.0620	40.2420	-43.4
42	J07	WTG/ESP	664,843	4,455,168	-73.0624	40.2307	-44.1
43	M15	Contingent WTG/ESP	655,077	4,453,705	-73.1775	40.2194	-41.2
44	K07	WTG/ESP	664,843	4,453,914	-73.0627	40.2194	-43.6
45	N15	WTG/ESP	655,077	4,452,451	-73.1778	40.2081	-41.3
46	L07	WTG/ESP	664,843	4,452,660	-73.0630	40.2082	-43.4
47	H11	Contingent WTG/ESP	659,960	4,458,826	-73.1188	40.2646	-40.2
48	F03	WTG/ESP	669,726	4,459,035	-73.0040	40.2646	-43.1
49	I11	WTG/ESP	659,960	4,457,572	-73.1191	40.2533	-41.5
50	G03	WTG/ESP	669,726	4,457,781	-73.0043	40.2533	-42.5
51	J11	WTG/ESP	659,960	4,456,318	-73.1194	40.2420	-41.7
52	F07	WTG/ESP	664,843	4,460,184	-73.0611	40.2759	-42.0
53	N16	Contingent WTG/ESP	653,857	4,452,738	-73.1920	40.2109	-41.0
54	O16	WTG/ESP	653,857	4,451,484	-73.1923	40.1997	-40.5
55	J12	WTG/ESP	658,739	4,456,605	-73.1337	40.2449	-41.4
56	K12	WTG/ESP	658,739	4,455,351	-73.1340	40.2336	-42.4
57	L12	WTG/ESP	658,739	4,454,097	-73.1343	40.2223	-41.8
58	M12	WTG/ESP	658,739	4,452,843	-73.1346	40.2110	-42.6

Identifier	Name	Position Type	Easting (m)	Northing (m)	Longitude (degrees)	Latitude (degrees)	Water Depth (m)
59	N12	WTG/ESP	658,739	4,451,589	-73.1350	40.1997	-42.0
60	F08	WTG/ESP	663,622	4,460,472	-73.0754	40.2787	-41.6
61	O12	WTG/ESP	658,739	4,450,335	-73.1353	40.1884	-42.5
62	G08	WTG/ESP	663,622	4,459,218	-73.0757	40.2674	-41.5
63	P12	WTG/ESP	658,739	4,449,080	-73.1356	40.1771	-44.3
64	H08	WTG/ESP	663,622	4,457,964	-73.0760	40.2561	-42.3
65	Q12	WTG/ESP	658,739	4,447,826	-73.1359	40.1658	-42.5
66	I08	WTG/ESP	663,622	4,456,709	-73.0763	40.2449	-42.8
67	J08	WTG/ESP	663,622	4,455,455	-73.0766	40.2336	-42.9
68	K08	WTG/ESP	663,622	4,454,201	-73.0770	40.2223	-43.7
69	L08	WTG/ESP	663,622	4,452,947	-73.0773	40.2110	-43.4
70	M08	WTG/ESP	663,622	4,451,693	-73.0776	40.1997	-43.5
71	F04	WTG/ESP	668,505	4,459,322	-73.0183	40.2674	-42.4
72	I12	Contingent WTG/ESP	658,739	4,457,859	-73.1334	40.2562	-40.2
73	G04	WTG/ESP	668,505	4,458,068	-73.0186	40.2561	-42.2
74	H04	WTG/ESP	668,505	4,456,814	-73.0189	40.2448	-43.2
75	Q13	WTG/ESP	657,519	4,448,114	-73.1501	40.1686	-42.6
76	M09	WTG/ESP	662,402	4,451,980	-73.0919	40.2025	-42.8
77	O17	Contingent WTG/ESP	652,636	4,451,772	-73.2066	40.2025	-40.7
78	N09	WTG/ESP	662,402	4,450,726	-73.0922	40.1912	-43.2
79	K13	WTG/ESP	657,519	4,455,638	-73.1483	40.2364	-42.2
80	I05	WTG/ESP	667,285	4,455,847	-73.0335	40.2364	-43.6
81	L13	WTG/ESP	657,519	4,454,384	-73.1486	40.2251	-41.4
82	J05	WTG/ESP	667,285	4,454,593	-73.0338	40.2251	-44.3
83	M13	WTG/ESP	657,519	4,453,130	-73.1489	40.2138	-42.0
84	N13	WTG/ESP	657,519	4,451,876	-73.1492	40.2025	-42.0
85	F09	WTG/ESP	662,402	4,460,759	-73.0896	40.2816	-40.4
86	O13	WTG/ESP	657,519	4,450,622	-73.1495	40.1912	-42.2
87	G09	WTG/ESP	662,402	4,459,505	-73.0900	40.2703	-41.0
88	P13	WTG/ESP	657,519	4,449,368	-73.1498	40.1799	-45.3
89	H09	WTG/ESP	662,402	4,458,251	-73.0903	40.2590	-41.2
90	I09	WTG/ESP	662,402	4,456,997	-73.0906	40.2477	-42.7
91	J09	WTG/ESP	662,402	4,455,743	-73.0909	40.2364	-42.5
92	K09	WTG/ESP	662,402	4,454,489	-73.0912	40.2251	-43.3

Identifier	Name	Position Type	Easting (m)	Northing (m)	Longitude (degrees)	Latitude (degrees)	Water Depth (m)
93	L09	WTG/ESP	662,402	4,453,235	-73.0915	40.2138	-42.9
94	F05	WTG/ESP	667,285	4,459,610	-73.0325	40.2702	-42.2
95	G05	WTG/ESP	667,285	4,458,355	-73.0329	40.2590	-43.0
96	H05	WTG/ESP	667,285	4,457,101	-73.0332	40.2477	-43.5
97	P14	WTG/ESP	656,298	4,449,655	-73.1641	40.1827	-43.2
98	Q14	WTG/ESP	656,298	4,448,451	-73.1644	40.1719	-43.5
99	D05	WTG/ESP	667,285	4,462,118	-73.0319	40.2928	-40.1
100	C05	WTG/ESP	667,285	4,463,372	-73.0315	40.3041	-43.4
101	D07	WTG/ESP	664,843	4,462,693	-73.0604	40.2985	-41.5
102	D04	WTG/ESP	668,505	4,461,830	-73.0176	40.2900	-42.1
103	C04	WTG/ESP	668,505	4,463,084	-73.0173	40.3013	-40.3
104	D01	WTG/ESP	672,168	4,460,968	-72.9748	40.2815	-43.9
105	C01	WTG/ESP	672,168	4,462,222	-72.9744	40.2928	-44.5
106	B01	WTG/ESP	672,168	4,463,476	-72.9741	40.3041	-41.9
107	A01	WTG/ESP	672,168	4,464,730	-72.9738	40.3154	-42.2
108	D02	WTG/ESP	670,947	4,461,255	-72.9890	40.2843	-44.2
109	C02	WTG/ESP	670,947	4,462,510	-72.9887	40.2956	-42.8
110	B02	WTG/ESP	670,947	4,463,764	-72.9884	40.3069	-41.7
111	A02	WTG/ESP	670,947	4,465,018	-72.9880	40.3182	-42.8
112	D06	WTG/ESP	666,064	4,462,405	-73.0461	40.2957	-40.8
113	C06	WTG/ESP	666,064	4,463,659	-73.0458	40.3070	-42.6
114	D03	WTG/ESP	669,726	4,461,543	-73.0033	40.2872	-42.9
115	C03	WTG/ESP	669,726	4,462,797	-73.0030	40.2985	-40.1
116	B03	WTG/ESP	669,726	4,464,051	-73.0026	40.3097	-44.8
117	I04	WTG/ESP	668,505	4,455,658	-73.0192	40.2344	-44.0
118	A03	WTG/ESP	669,726	4,465,153	-73.0024	40.3197	-40.2

Notes:
1. Grid coordinates referenced to UTM Zone 18 north in meters, NAD 1983 (2011) datum.
2. Lease Area bathymetry is derived from a digital terrain model (DTM) of multibeam echosounder (MBES) survey data. Depth measurements are listed in meters relative to Mean Lower Low Water (MLLW).
3. The final alphanumeric identification scheme will be determined in consultation with the United States Coast Guard (USCG).