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VINEYARD WIND

Draft Construction and Operations Plan

Volume III Text

Vineyard Wind Project

June 3, 2020

Submitted by
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700 Pleasant Street, Suite 510
New Bedford, Massachusetts 02740

Submitted to
Bureau of Ocean Energy Management
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Sterling, Virginia 20166

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Public Archaeology Laboratory, Inc.
RPS
Saratoga Associates
Swanson Environmental Associates
Wood Thilsted Partners Ltd
WSP

June 3, 2020

Section 7.0

Socioeconomic Resources

7.0 SOCIOECONOMIC RESOURCES

7.1 Demographics and Employment, and Economics

The Project Region is the geographic area that could be affected by Project-related activities. The principal construction and installation activities will be concentrated at New Bedford, Massachusetts in Bristol County and offshore in the Wind Development Area ("WDA"). Ports located elsewhere in Massachusetts and in Rhode Island may potentially serve as staging areas for some Project components (see Section 3.2.5 of Volume I). Onshore construction activities will occur in Barnstable County, Massachusetts. During the operations and maintenance phase, activities are expected to be concentrated in Dukes and Bristol Counties and offshore in the WDA. Thus, for purposes of this analysis, the Project Region consists of the communities in Barnstable County, Bristol County, Dukes County, and Nantucket County, Massachusetts and the communities in Providence County and Washington County, Rhode Island.

Additional details on Project-related activities are provided in Sections 7.1.2.1, 7.1.2.2, and 7.1.2.3.

7.1.1 Description of the Affected Environment

Demographic, employment, and economic baselines, including existing socioeconomic activities and resources in the onshore and coastal environment that may be affected by the Project are described in the sections that follow. It should be noted that many of the coastal and ocean amenities that attract visitors to these regions are free for public access, thereby generating no direct employment, wages, or gross domestic product. Nonetheless, these nonmarket features function as key drivers for many coastal businesses, particularly those within the recreation and tourism sectors.

7.1.1.1 Massachusetts

Population and economic statistics for Barnstable, Bristol, Dukes, Nantucket Counties, and the Commonwealth of Massachusetts are provided in Table 7.1-1, below.

Table 7.1-1 Existing Economic Conditions in the Vicinity of Vineyard Wind

Location	Population (2017)[1]	Population Density[2] (persons per sq. mile)	Per Capita Income (2016)[3]	Annual Total Employment (2017)[4]	Annual Unemployment Rate (2017)[4]
Massachusetts	6,859,819	879.5	$38,069	3,521,482	3.7%
Barnstable County	213,444	542.1	$39,104	107,254	4.7%
Bristol County	561,483	1,015.2	$30,525	278,472	4.7%
Dukes County	17,325	167.8	$40,051	9,007	4.9%
Nantucket County	11,229	249.7	$46,009	6,810	4.4%

[1]US Census Bureau, Population Estimates Program ("PEP"), Updated annually; [2] US Census Bureau, Census of Population and Housing. Land area is based on current information in the TIGER® data base, calculated for use with Census 2010; population from PEP V2017 [3] US Census Bureau, American Community Survey ("ACS") 5-Year Estimates (2016); [4] Quarterly Census of Employment and Wage Program of the Bureau of Labor Statistics, accessed July 2018, not seasonally adjusted.

7.1.1.1.1 Barnstable County

Demographics

Barnstable County consists of the 15 municipalities on the Cape Cod peninsula extending from the southeast coast of Massachusetts (Figure 7.1-1).

The Census Bureau's Population Estimates Program ("PEP") data for 2016 counts 214,276 residents of Barnstable County. The Towns of Barnstable and Falmouth are the largest population centers of the Barnstable County with estimated populations of 44,498 and 31,544, respectively, as estimated in 2016 by the Census Bureau's American Community Survey ("ACS").

Barnstable County's population density, per capita income, total employment, and unemployment rate are provided in Table 7.1-4. Based on ACS estimates for 2016, Barnstable County's median household income is $65,382, which is less than the statewide median of $70,954.

As occurs in certain other coastal communities, towns in Barnstable County experience significant seasonal population growth. The Cape Cod Commission ("CCC") estimates that the average annual seasonal population growth on Cape Cod was equivalent to 68,856 full-time residents in 2010 (CCC, 2012). Seasonal population growth is estimated to occur during the summer months, between June and August. CCC's Regional Policy Plan (2012) notes that seasonal population continues to grow even as the number of Cape Cod's year-round residents decreased by 0.7% since 2010.

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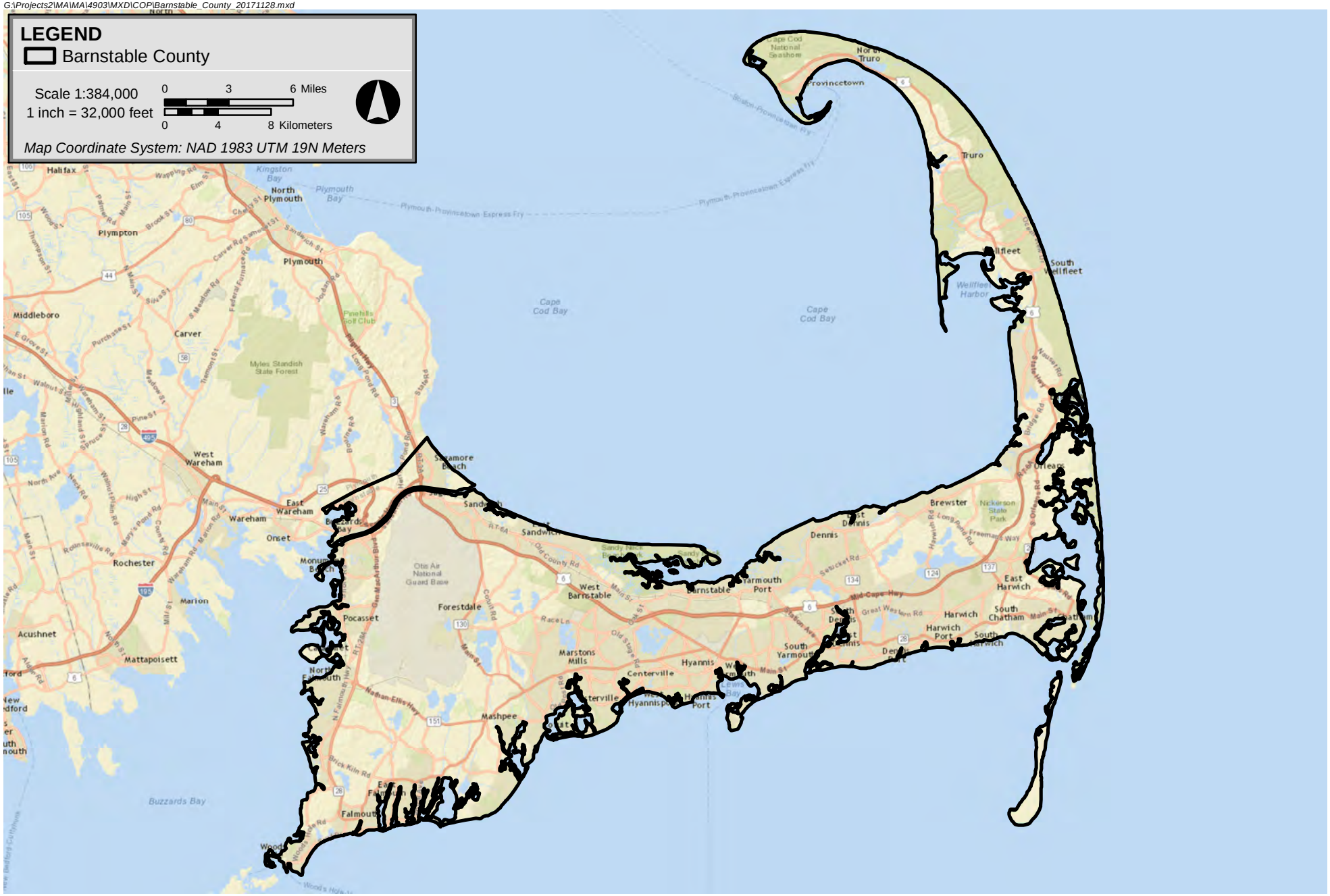

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Figure 7.1-1
Barnstable County

Barnstable County's population density, when calculated with only year-round population, is less than the statewide average. When seasonal residents are included in population density calculations, Barnstable County's population density increases to approximately 719 people per square mile ("people/mi^2").

Economy and Employment

Although Barnstable County's employment opportunities are influenced by its seasonally oriented, visitor-based economy, Barnstable County also hosts substantial health, social service, and professional, management, and administrative employment opportunities.

According to the Bureau of Labor Statistics ("BLS") data, in 2016 Barnstable County's average annual labor force included approximately 110,749 individuals and Barnstable County's unemployment rate was 4.7% in 2016.

In 2016, BLS data show Barnstable County's 9,371 private-sector employer establishments, which are each physical locations at which business is conducted or where services or industrial operations are performed, employed 96,271 individuals. In 2016, the most recent year for which data are available, Barnstable County's workforce was comprised of 66.1% of Barnstable County residents and 33.9 % non-residents.

The largest employment sectors by North American Industry Classification System ("NAICS") Sector, according to County Business Patterns ("CBP") data for 2015, are the Health Care and Social Assistance, Retail Trade, and Accommodation and Food Services sectors. According to the Massachusetts Executive Office of Labor and Workforce Development, the five largest employers in Barnstable County are: Cape Cod Hospital, Steamship Authority, Woods Hole Oceanographic Institute, Air National Guard, and Arris Group, Inc. Census Bureau data indicate that Barnstable County's highest concentrations of jobs are in the Falmouth and West Yarmouth communities.

The National Oceanic and Atmospheric Administration's ("NOAA") Office for Coastal Management provides data on "Ocean Economy" activities. These categories of activities are based on NAICS codes that depend on the ocean for input. They include: Living Resources, Marine Construction and Marine Transportation, Offshore Mineral Resources, Ship and Boat Building, and Tourism and Recreation. In 2014, the most recent year for which data is available, the Ocean Economy accounted for 10.3% of Barnstable County's total Gross Domestic Product ("GDP"), and Ocean Economy activities employed approximately 16,554 individuals, including self-employed individuals. Ocean Economy jobs include fishing, seafood processing, marine passenger transportation, boat dealers, and tourism and recreation, amongst other jobs.

Over the preceding ten-year period, as a percentage of GDP, Barnstable County's Ocean Economy expanded by 1.7% and added approximately 1,048 jobs. In 2014, the largest Ocean Economy sector by dollar value was recreation and tourism, which accounts for 88.8% of the total Ocean Economy; 1.4% of the Barnstable County's Ocean Economy is attributed to commercial fishing, aquaculture, and seafood processing.

Housing

Housing data for Barnstable County are presented in Table 7.1-2, below.

Table 7.1-2 Barnstable County Housing[1]

Location	Housing Units	Vacant Units	Median Value of Owner-Occupied Units	Median Gross Rent
Barnstable County	161,632	41.6%	$367,300	$1,137

[1] US Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

Census Bureau data for 2015 counts 161,311 total housing units in Barnstable County, of which 66,894 (41.5%) are categorized as vacant. Of the County's 94,417 occupied housing units, 78.8% are owner-occupied. The high vacancy rate reflects the intensity of seasonal use and seasonal population growth noted above. In 2010, the most recent year housing vacancy status is categorized as "seasonal, recreational, or occasional," 88.1% of those vacant units were for seasonal, recreational, or occasional uses.

It is estimated that Barnstable County is the county most heavily influenced by seasonal tourism within the Project Region, suggesting that Project-related housing impacts during the peak tourism season, if any, would be most acute in Barnstable County. Hotel room occupancy statistics made available by the Cape Cod Chamber of Commerce indicate that between 2010 and 2017, the peak hotel room occupancy rate in Barnstable County was 85%, which occurred in August of 2013. As noted in Section 7.5.1.2, Barnstable County's recreation and tourism sectors are supported by an estimated 274 facilities offering accommodations. During winter months, the lodging demand in Barnstable County declines by 50,000 to 100,000 rooms per month. (Barrow, et al., 2000). When lodging demand declines, the Project may provide additional economic benefits to the local communities. The small number of personnel that may relocate to the Project Region, particularly within Barnstable County, are not anticipated to affect the availability of accommodations at any point of a given year.

7.1.1.1.2 Bristol County

Demographics

Bristol County consists of 20 cities and towns located in the southeast coastal region of Massachusetts (Figure 7.1-2). The Census Bureau's PEP data for 2016 counts 558,324 residents of Bristol County. The estimated population of Bristol County's largest cities, New Bedford and Fall River, is 95,032 and 89,220 residents, respectively.

Bristol County's population density, per capita income, total employment, and unemployment rate are shown in Table 7.1-1. Bristol County is more densely population than the statewide average. At $59,343, median household income in Bristol County in 2016 falls below the statewide median of $70,954, while the unemployment rate is higher than the statewide average.

In recent years, Bristol County and surrounding areas in the southeast coastal region of Massachusetts have experienced population gain because of international migration. These gains, however, are offset by domestic out-migration, notably among the college-age population (Renski, 2015).

Economy and Employment

In 2016, according to the BLS, Bristol County's average annual labor force included approximately 287,648 individuals and the unemployment rate was 4.7%.

In 2016, Bristol County's 17,322 private-sector employer establishments, employed 223,466 individuals (BLS, 2017). In 2015, the most recent year for which data are available, Barnstable County's workforce was comprised of 57.7% of County residents and 42.3% non-residents, with the largest concentration of jobs in the Attleboro, Fall River, New Bedford, and Taunton communities. According to BLS data, in 2016, the largest employers by NAICS, are Health Care and Social Assistance, Retail Trade, and Manufacturing sectors. The five largest employers in Bristol County are: Bristol County Community College, DePuy Spine, Inc., General Dynamics, Hormel Foods, and Medtronic, Inc. (EOLWD, 2017).

According to NOAA, Ocean Economy activities accounted for 2.1% of Bristol County's total GDP in 2014 and employed approximately 6,096 individuals, including self-employed individuals. The largest Ocean Economy sectors by dollar value were commercial fishing, aquaculture, and seafood processing, which accounted for 58% of Bristol County's total Ocean Economy value.

Bristol County's Port of New Bedford is a full service port with well-established fishing and cargo handling industries. The Port of New Bedford's operations and facilities include warehouses, ice houses, boatyards and ship repair yards, construction, engineering, tug

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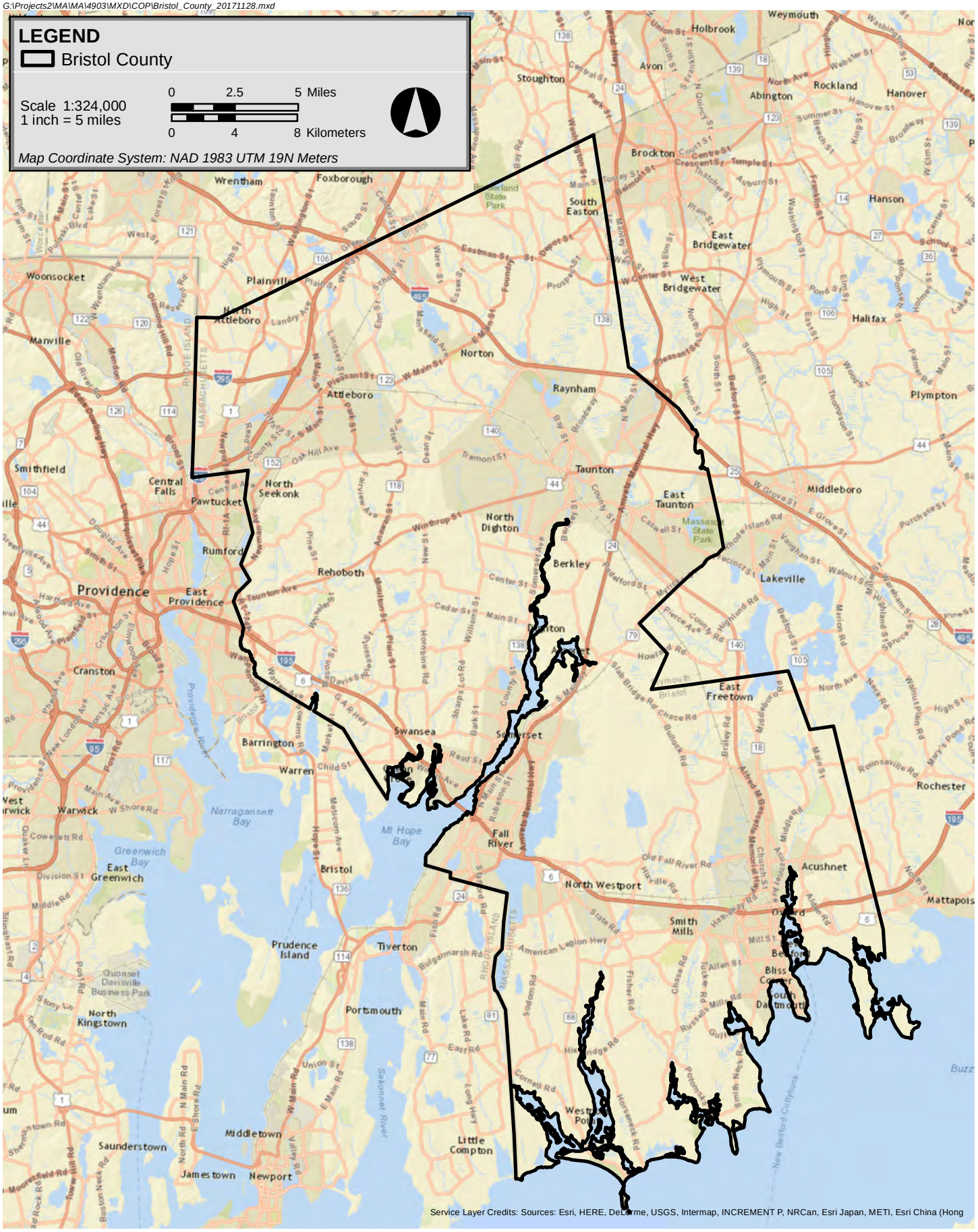

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Figure 7.1-2
Bristol County

assists, pilots and other maritime services (NBHDC, 2016). In 2015, 36,578 jobs were generated by Port of New Bedford activities (NBHDC, 2016). Recreational boating facilities are also located within and surrounding the Port.

Brayton Point, located on the Taunton River in Somerset, Massachusetts, is the site of the former Brayton Point Power Plant. The power plant was shutdown in 2017 and is being decommissioned. The Commonwealth of Massachusetts' Clean Energy Center ("CEC") has identified Brayton Point, with its existing port facilities, as a potential site for marine industrial and other uses, including offshore wind energy projects. Vineyard Wind is evaluating the potential of Brayton Point to host construction and installation activities. Additionally, Brayton Point's recent history of industrial uses suggests a skilled workforce consistent with Project needs is located in proximity to the site.

The former Montaup Power Plant site, also located on the Taunton River in Somerset, Massachusetts, is the former site of a coal-fired electric generation facility which ceased operation on January 1, 2010. The Montaup Power Plant site has working quayside facilities with deep water access and a large turning basin. The CEC has evaluated several redevelopment scenarios in which the site could host marine industrial uses consistent with Vineyard Wind's requirements for staging construction and installation activities.

Housing

Housing data for Bristol County are presented in Table 7.1-3, below.

Table 7.1-3 Bristol County Housing[1]

Location	Housing Units	Vacant Units	Median Value of Owner-Occupied Units	Median Gross Rent
Bristol County	231,247	7.9%	$273,700	$829

[1] US Census Bureau, 2012-2016 American Community Survey 5-Year Estimates.

Census Bureau data for 2016 counts 231,247 total housing units in Bristol County, of which 18,314 are categorized as vacant. Of the County's 212,993, occupied housing units, 62.1% are owner-occupied. In 2010, the most recent year vacancy status is categorized as "seasonal, recreational, or occasional," 15.2% of those vacant units were for seasonal, recreational, or occasional uses.

7.1.1.1.3 Dukes County

Demographics

Dukes County consists of 11 islands off the southeast coast of Massachusetts, including Martha's Vineyard, Dukes County's largest and most populous island (Figure 7.1-3). Dukes County's population, according to the Census Bureau's PEP, is 17,246 year-round residents. Dukes County's population density, per capita income, total employment, and unemployment rate are shown in Table 7.1-1. The Towns of Oak Bluffs and Edgartown are the largest population centers of Dukes County with 4,647 and 4,247 residents, respectively.

The Martha's Vineyard Commission (2004) estimates that seasonal residents account for more than a tripling of the Martha Vineyard's population during the in-season months of June, July, and August, suggesting approximately 60,000 seasonal residents locate to the Martha's Vineyard. Such significant population fluctuations dramatically alter Dukes County characteristics, including population density which, when not including seasonal residents, remains well below the statewide average of 839.4 people/m2. Estimated seasonal population growth increases density to approximately 639.2 people/m2. Dukes County's estimated median household income for 2016 is $63,534, below the statewide median of $70,954.

Economy and Employment

According to BLS data, in 2016 Dukes County's average annual labor force included approximately 9,350 individuals. Dukes County's unemployment rate in 2016 was 5.0%. Unemployment rates, not seasonally adjusted, speak to the influence of recreation and tourism on the County's employment patterns. The unemployment rate during July of 2016 was 3.5% but during the offseason, in January of 2017, it had risen to 8.3%.

The economy of Dukes County is dominated by seasonal activities related to recreation and tourism. With the exception of the commercial fishing industry, which employs a limited number of people, there are no significant exports of goods or services. Dukes County's economic base is largely supported by visitors, particularly second homeowners, who purchase goods and services during their stay (Martha's Vineyard Commission, 2008; NOAA, 2012).

A total 1,248 private-sector employer establishments in Dukes County employ 8,843 individuals (BLS, 2017). In 2015, the most recent year for which data are available, Dukes County's workforce was comprised of 64.9% of County residents and 35.1% non-residents. The highest percentage of employment, by NAICS Sector, according to CBP data for 2015, is provided by the Retail Trade, Construction, Health Care and Social Assistance sectors. The highest concentration of jobs is in the Vineyard Haven, Oaks Bluffs, and Edgartown

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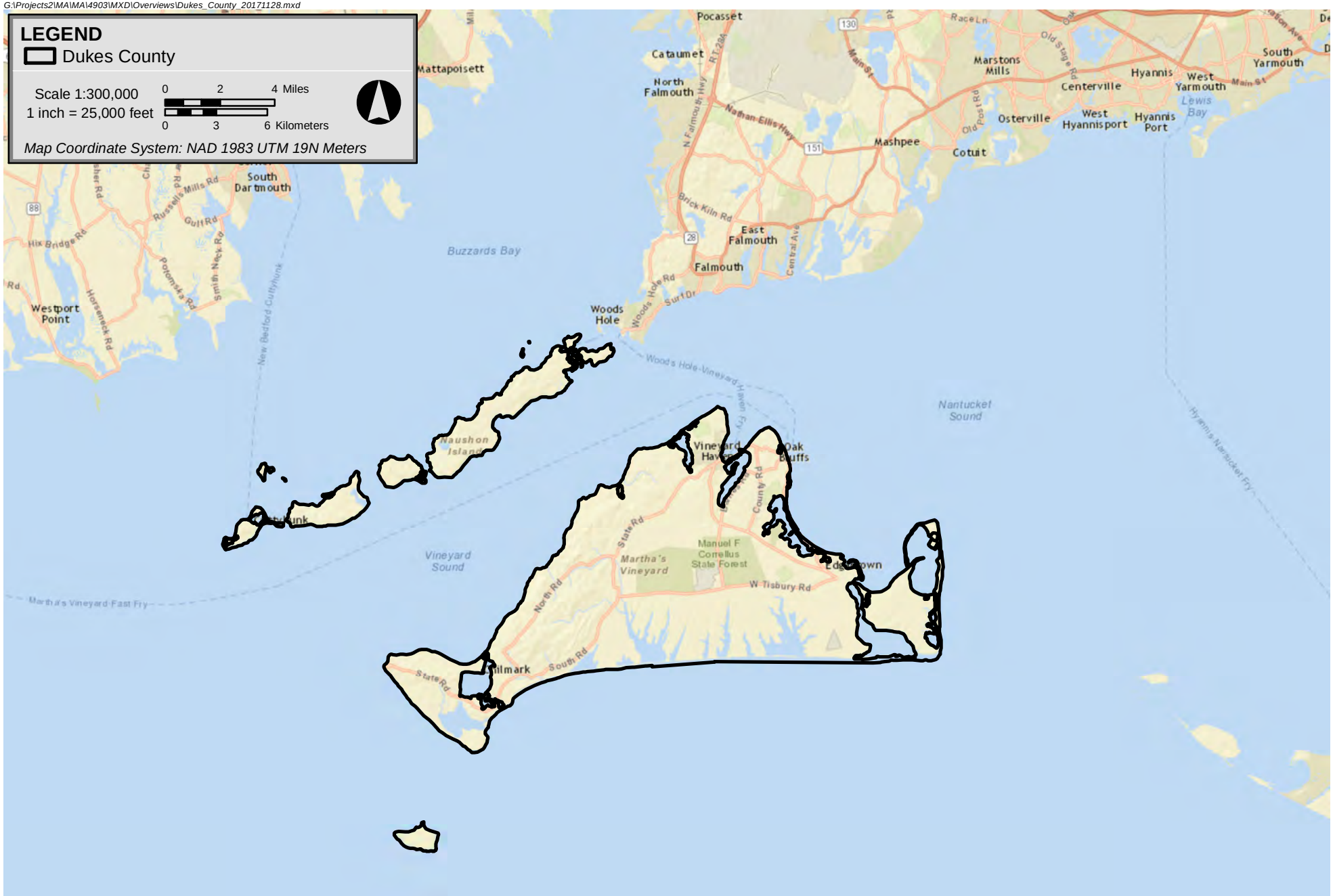

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Figure 7.1-3
Dukes County

communities. The five largest employers in Dukes County are Martha's Vineyard Hospital, Harbor View Hotel, Martha's Vineyard Community Services, Martha's Vineyard Regional High School, and Martha's Vineyard Taxi Company (EOLWD, 2017).

According to NOAA, Ocean Economy activities account for 19% percent of the County's total GDP and those activities employ approximately 1,717 individuals, including self-employed individuals. The largest Ocean Economy sector by dollar value is recreation and tourism, which accounts for 96.2% of total Ocean Economy value. 3.8% of the Ocean Economy is attributed to commercial fishing, aquaculture, and seafood processing.

Housing

Housing statistics for Dukes County are presented in Table 7.1-4, below.

Table 7.1-4 Dukes County Housing[1]

Location	Housing Units[1]	Vacancy Rate	Median Value of Owner-Occupied Units	Median Gross Rent
Dukes County	17,536	65.0%	$656,000	$1,448

[1] US Census Bureau, 2012-2016 American Community Survey 5-Year Estimates.

Census Bureau data for 2016 counts 17,536 total housing units in Dukes County, of which 65.6% are categorized as vacant. Again, the high vacancy rate reflects the intensity of seasonal use and population growth noted above. Of Dukes County's 6,134 occupied housing units, 76.5% are owner-occupied. In 2010, the most recent year vacancy status is categorized as "seasonal, recreational, or occasional," 94.2% of vacant units were for seasonal, recreational, or occasional uses.

7.1.1.1.4 Nantucket County

Demographics

Nantucket County comprises the Island of Nantucket (Figure 7.1-4) and, according to the Census Bureau's PEP, has 11,008 year-round residents. The Nantucket Planning Board estimates approximately 40,000-50,000 seasonal residents, an estimate that excludes short-term visitors of one week or less, locate to Nantucket County during the summer months (Nantucket Planning Board, 2009).

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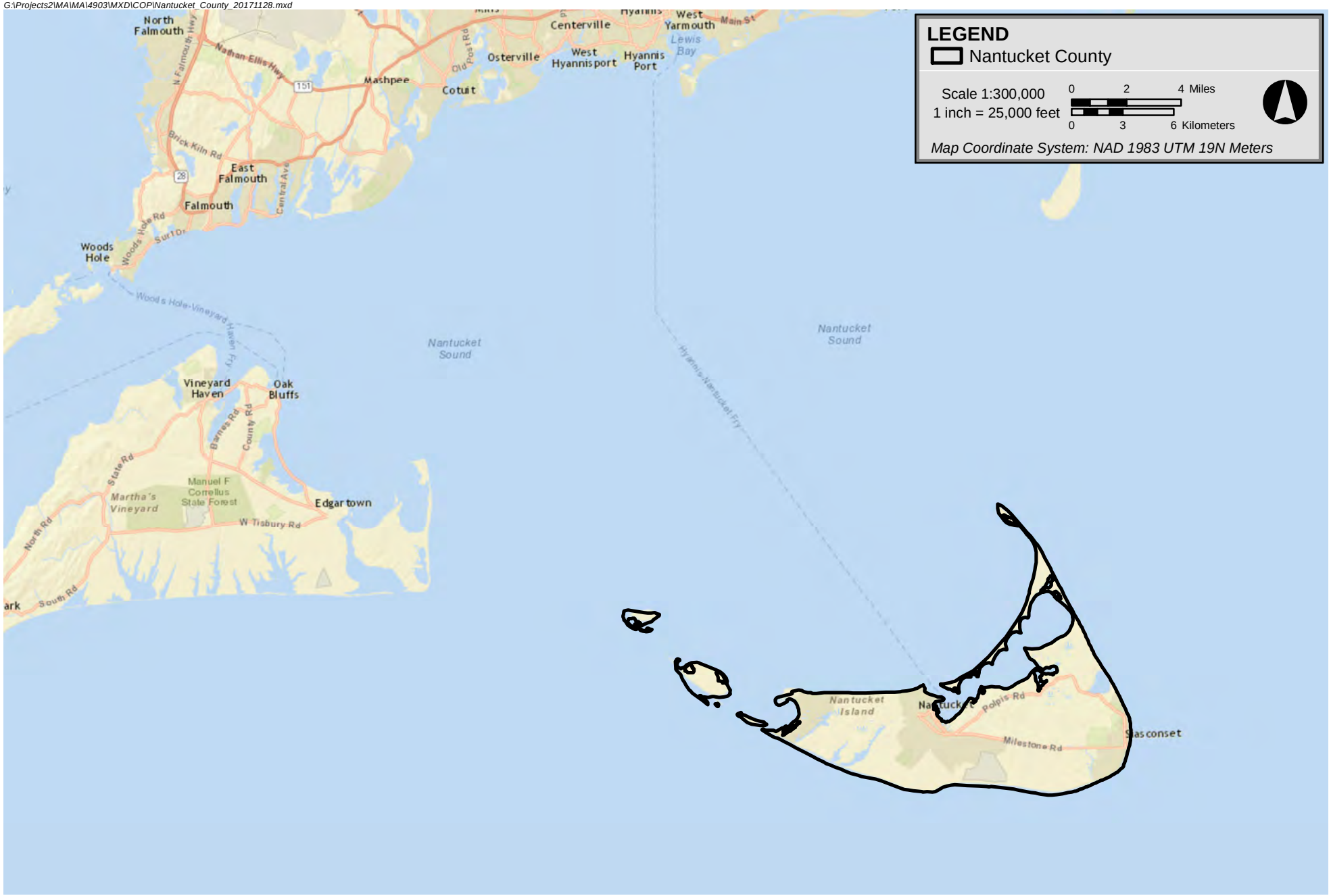

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Figure 7.1-4

Nantucket County

As with the other counties in the Project Region, seasonal population fluctuations dramatically alter Nantucket County's population density which, when not accounting for seasonal residents, remains well below the statewide average of 839.4 people/m2. Estimated seasonal population growth potentially increases density to over 1,000 people/m2, exceeding the statewide average. The County's population density, per capita income, total employment, and unemployment rate are shown in Table 7.1-1. Nantucket County's estimated median household income in 2016 was $89,428.

Economy and Employment

Nantucket County's economy is dominated by seasonal activities related to recreation and tourism, as reflected in unemployment patterns. The unemployment rate, not seasonally adjusted, for July of 2016 was 1.8% and increased to 9.8% in January of 2017. With some variation, this pattern is repeated annually. In 2016, the most recent year for which data are available, Nantucket County's workforce was comprised of 77.3% of County residents and 22.7% non-residents.

Accommodation and Food Service, Retail Trade, and Construction are the three largest employment sectors on the Island. The five largest employers in Nantucket County are Martha's Vineyard Hospital, Harbor View Hotel, Martha's Vineyard Community Services, Martha's Vineyard Regional High School, and Martha's Vineyard Taxi Company (EOLWD, 2017).

According to NOAA, in 2014 Ocean Economy businesses provided 22.0% of the total jobs in Nantucket. 99.5% of these jobs are in tourism and recreation related sectors, producing an estimated $112.6 million in goods and services. The remaining 0.5% of the ocean-related jobs are in fishing, seafood processing and related trades, which produce an estimated $0.6 million in goods and services.

Housing

Housing data for Nantucket County are presented in Table 7.1-5, below.

Table 7.1-5 Nantucket County Housing[1]

Location	Housing Units[1]	Vacancy Rate	Median Value of Owner-Occupied Units	Median Gross Rent
Nantucket County	11,844	67.6%	$966,600	$1,615

[1] US Census Bureau, 2012-2016 American Community Survey 5-Year Estimates.

Census Bureau data for 2016 counts 11,844 total housing units in Nantucket County, of which 67.6% are categorized as vacant. Of the County's 3,836 occupied housing units, 63.9% are owner-occupied. Again, the high vacancy rate reflects the intensity of seasonal use and population growth noted above. In 2010, the most recent year vacancy status is categorized as "seasonal, recreational, or occasional," 91.0% of those vacant units were for seasonal, recreational, or occasional uses.

7.1.1.2 Rhode Island

Population and economic statistics for Providence and Washington Counties, and the State of Rhode Island are provided in Table 7.1-6, below.

Table 7.1-6 Existing Economic Conditions in the Vicinity of Vineyard Wind

Location	Population (2016)[1]	Population Density[2] (persons per sq. mile)	Per Capita Income (2016)[3]	Annual Average Total Employment (2017)[4]	Annual Average Unemployment Rate (22017)[4]
Rhode Island	1,059,639	1,025.0	$31,904	554,658	4.5%
Providence County	637,357	1,556.4	$27,809	308,436	4.8%
Washington County	126,150	383.2	$37,692	66,369	4.0%

[1] US Census Bureau, Population Estimates Program ("PEP"), Updated annually; [2] US Census Bureau, Census of Population and Housing. Land area is based on current information in the TIGER® data base, calculated for use with Census 2010; population from PEP V2017 [3] US Census Bureau, American Community Survey ("ACS") 5-Year Estimates (2016); [4] Quarterly Census of Employment and Wage Program of the Bureau of Labor Statistics, accessed July 2018, not seasonally adjusted.

7.1.1.2.1 Providence County

Demographics

Providence County consists of 16 cities and towns located in the northernmost region of Rhode Island (Figure 7.1-5). The Census Bureau's PEP data for 2016 counts 631,344 residents of Providence County. The estimated population of the County's largest city and the state capital, Providence, is 178,042.

Providence County's population density, per capita income, total employment, and unemployment rate are shown in Table 7.1-6. Providence County is the most populous county in Rhode Island and is more densely populated than the statewide average. At $50,637, median household incomes in Bristol County in 2016, falls below the statewide median of $75,655.

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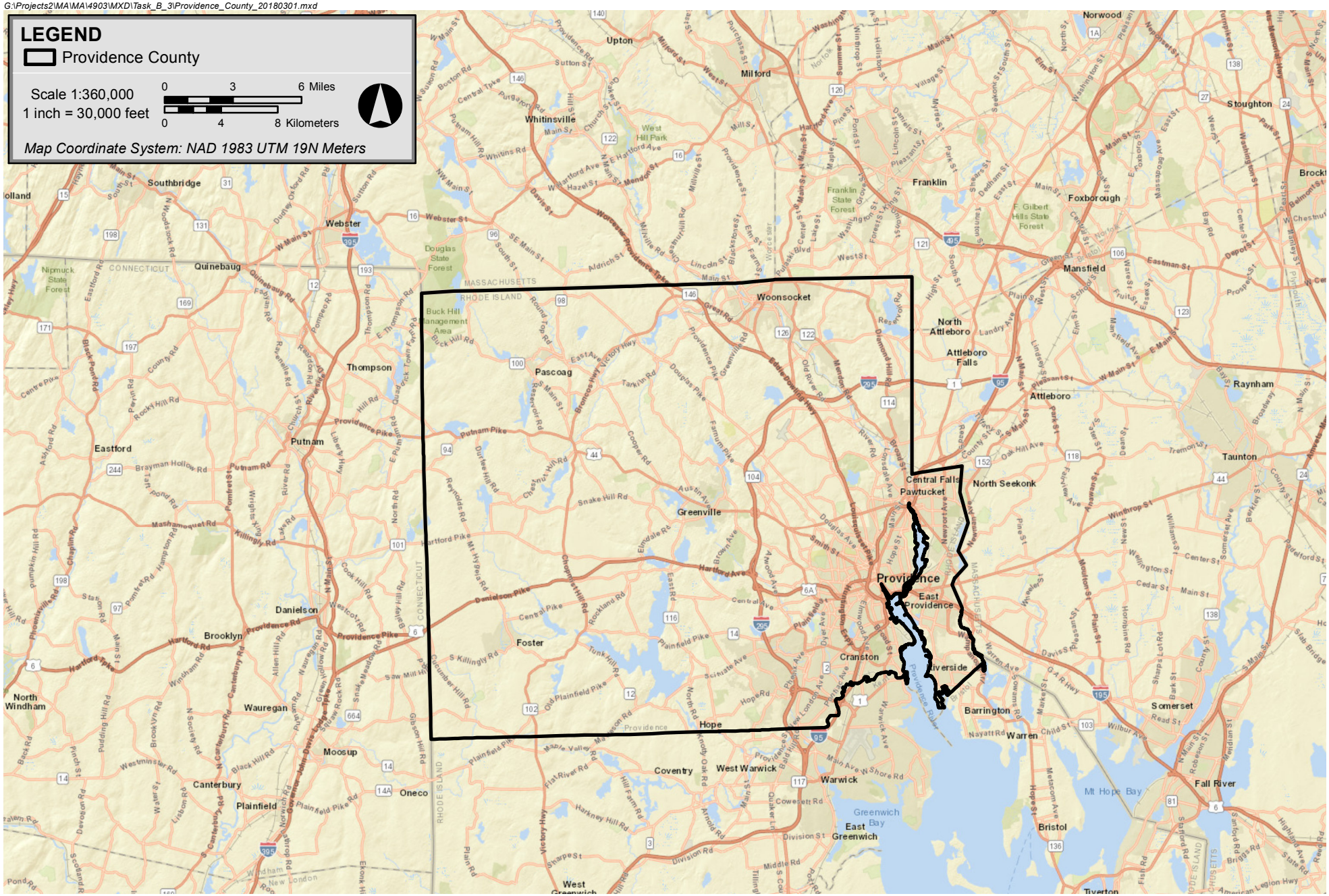

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Figure 7.1-5

Providence County, Rhode Island

Economy and Employment

According to the BLS, Providence County's average annual labor force included approximately 304,086 individuals in 2016 and Bristol County's unemployment rate was 5.7% in 2016.

In 2016, Providence County's 17,507 private-sector employer establishments, employ 249,874 individuals (BLS, 2018). In 2015, the most recent year for which data are available, Providence County's workforce was comprised of 62.6% Providence County residents and 37.4% non-residents, with the largest concentration of jobs in the greater Providence-Pawtucket area. According to BLS data, in 2016, the largest employers by NAICS, are Health Care and Social Assistance, Education Services, and Retail Trade.

According to NOAA, in 2014, Ocean Economy activities accounted for 1.8% of the County's total GDP and employed approximately 15,385 individuals, including self-employed individuals. The largest Ocean Economy sector by dollar value was tourism and recreation which accounted for 85.1% of Providence County's total Ocean Economy value.

The Port of Providence ("ProvPort") is a privately owned marine terminal located within the City of Providence and occupies approximately 105 acres along the Providence River. According to ProvPort, terminal services have resulted in economic output of approximately $164 million for the City of Providence and $211 million for the State of Rhode Island since 1994. The indirect impact of the port has generated approximately $2.8 billion in economic output for the state since 1994, with $1 billion of that occurring within the City of Providence. (ProvPort, 2018)

Housing

Housing data for Providence County are presented in Table 7.1-7, below.

Table 7.1-7 Providence County Housing[1]

Location	Housing Units	Vacant Units	Median Value of Owner-Occupied Units	Median Gross Rent
Providence County	263,549	9.9%	$209,800	$900

[1] US Census Bureau, 2012-2016 American Community Survey 5-Year Estimates.

Census Bureau data for 2016 counts 263,549 total housing units in Bristol County, of which 26,090 are categorized as vacant. Of the County's 237,459, occupied housing units, 53.9% are owner-occupied. In 2010, the most recent year vacancy status is categorized as "seasonal, recreational, or occasional," 6.5% of those vacant units were for seasonal, recreational, or occasional uses.

7.1.1.2.2 Washington County

Demographics

Washington County consists of nine towns located in the southwestern region of Rhode Island (Figure 7.1-6). The Census Bureau's PEP data for 2016 counts 126,319 residents of Washington County. The estimated population of the County's largest city, South Kingstown, is 30,651.

Washington County's population density, per capita income, total employment, and unemployment rate are shown in Table 7.1-6. At $74,302, median household incomes in Washington County in 2016, is just below the statewide median of $75,655.

Economy and Employment

According to the BLS, Washington County's average annual labor force included approximately 65,803 individuals in 2016 and Bristol County's unemployment rate was 4.8% in 2016.

In 2016, Washington County's 4,209 private-sector employer establishments, employ 43,674 individuals (BLS, 2018). In 2015, the most recent year for which data are available, Washington County's workforce was comprised of 49.3% of County residents and 50.7% non-residents, with the largest concentration of jobs in the Westerly and Wakefield areas.

According to BLS data, in 2016, the largest employers by NAICS Sector are Manufacturing, Education Services, and Health Care and Social Assistance.

According to NOAA, Ocean Economy activities accounted for 12.9% of the County's total GDP in 2014 and employed approximately 10,413 individuals, including self-employed individuals. The largest Ocean Economy sector by dollar value was tourism and recreation which accounted for 59.5% of Providence County's total Ocean Economy value.

The Port of Davisville, known locally as "Quonset," including Quonset Business Park, is home to more than 200 companies and nearly 11,000 workers. (Quonset Development Corp., 2018). According to the State of Rhode Island, the Port of Davisville accounts for approximately $333 million in business output within the State of Rhode Island, over 1,500 direct and indirect jobs, and over $97 million in household income in 2014. (RI, 2016)

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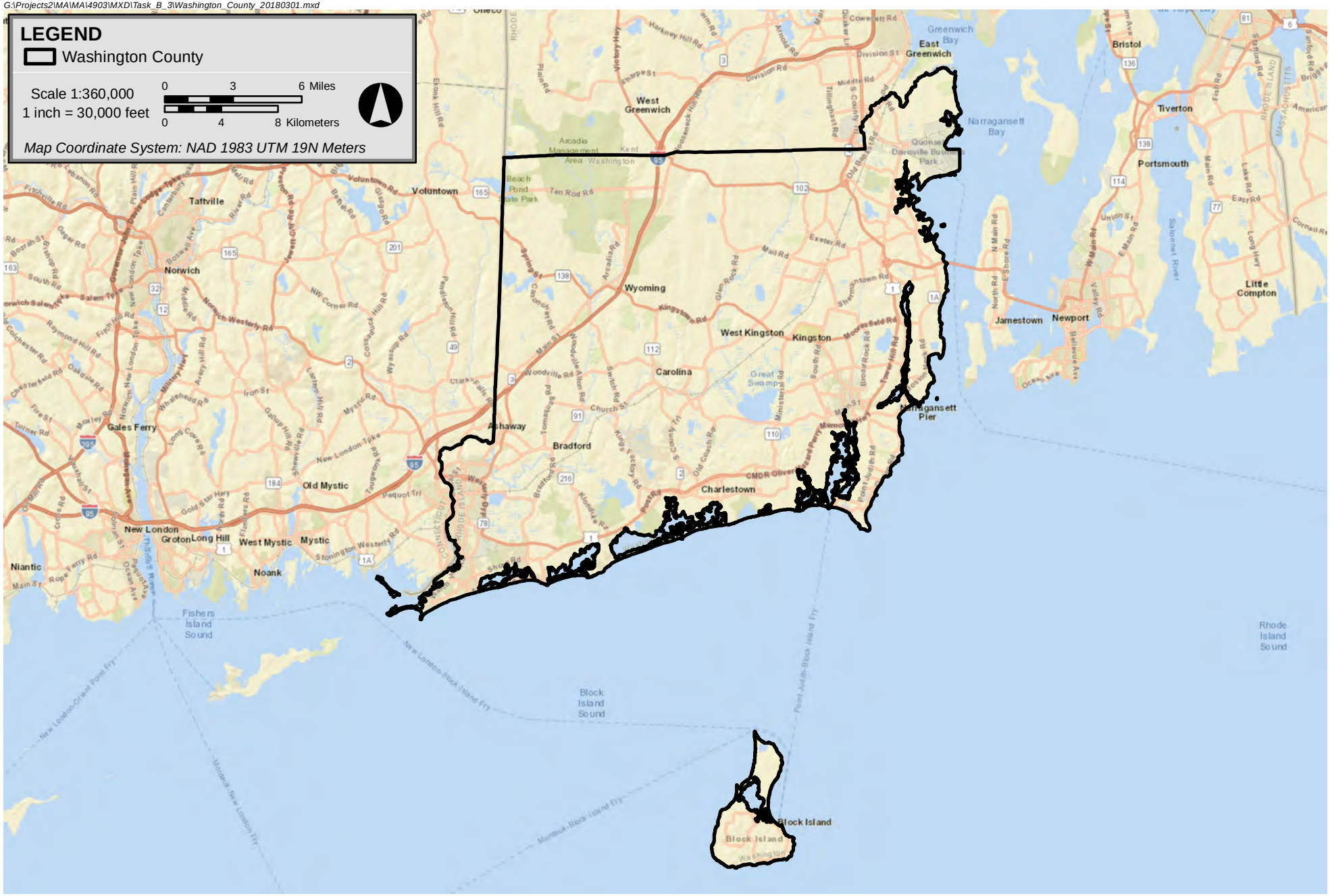

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Figure 7.1-6

Washington County, Rhode Island

Housing

Housing data for Washington County are presented in Table 7.1-8, below.

Table 7.1-8 Washington County Housing[1]

Location	Housing Units	Vacant Units	Median Value of Owner-Occupied Units	Median Gross Rent
Washington County	62,854	21.2%	$315,100	$1,062

[1] US Census Bureau, 2012-2016 American Community Survey 5-Year Estimates.

Census Bureau data for 2016 counts 62,854 total housing units in Washington County, of which 13,301 are categorized as vacant. Of the County's 49,553, occupied housing units, 72.4% are owner-occupied. In 2010, the most recent year vacancy status is categorized as "seasonal, recreational, or occasional," 76.6% of those vacant units were for seasonal, recreational, or occasional uses.

7.1.2 Potential Impacts of the Project

The potential impact-producing factors as they relate to specific Project elements are presented in Table 7.1-9, below.

As noted in Section 7.1, although Project activities may occur in one or more counties within the Project Region, these activities and their socioeconomic impacts, where applicable, are anticipated to occur in proximity to the port(s) hosting Project-related activities.

Table 7.1-9 Impact-producing Factors for Employment and Economics

Impact-producing Factors	Wind Development Area	Offshore Export Cable Corridor	Construction & Installation	Operations & Maintenance	Decommissioning
Workforce hiring	X	X	X	X	X
Procurement of certain construction or maintenance materials	X	X	x	X	
Procurement of non-construction materials	X	X	X	X	X
Vessel charters	X	X	X	X	X
Port Use	X	X	X	X	x
Workforce Training Programs	X			X	
Housing			X	X	X
Temporary Accommodations			X		X

7.1.2.1 Construction and Installation

As described in Volume I, Project components will be installed in the onshore and offshore environments. In the onshore environment, new utility duct bank will be installed beneath and along public rights-of-way from the offshore export cable Landfall Site to the general vicinity of the Barnstable Switching Station. A section of existing rail right-of-way ("ROW") and a segment of existing utility ROW may be used for a portion of the route as well. Horizontal directional drilling ("HDD") operations and other construction activity will also occur at the Landfall Site.

In the WDA, which is located well offshore, WTGs, inter-array and inter-link cables, and up to two electrical service platforms ("ESPs") will be installed as part of the 800 megawatt Project. Construction and installation activities will also occur offshore along the Offshore Export Cable Corridor ("OECC").

The New Bedford Marine Commerce Terminal ("New Bedford Terminal"), described in Section 7.1.1.2.2, will host shore-side WTG construction and fabrication, laydown, and Project management activities. Vessels delivering WTG components to the New Bedford Terminal, construction and installation vessels, and crew transport vessels will likely operate within New Bedford Harbor. Shore-side activities and vessel operations will be most intensive during the construction and installation, and decommissioning phases, though delivery of replacement WTG components may occur at the New Bedford Terminal during the Project's operations and maintenance phase. Construction and installation activities may also occur at the ports described in Sections 7.1.1.1 and 7.1.1.2. The vessels, equipment, and personnel active at those ports will likely be less than those active at the New Bedford Terminal, but for purposes of this analysis they are considered comparable.

Construction and installation activities occurring at the New Bedford Terminal, or at any of the other ports being evaluated are compatible with surrounding and active port uses. Though the offshore wind sector may be new to these ports, ship-to-shore transfers, shore-side fabrication, and other Project-related activities described in Volume I, are consistent with on-going or historic activities at these ports.

Construction and installation activities along the OECC, including at the Landfall Site, may occur in the Towns of Barnstable and Yarmouth. Cable installation procedures, including vessel and equipment types, are described in Volume I.

Construction and installation activities may affect the Project Region as described below.

7.1.2.1.1 Workforce Impacts

During the construction and installation phase, Vineyard Wind anticipates directly hiring a workforce spanning a diverse range of professions for fabrication, construction, and/or assembly of components. As detailed in Appendix III-L, Vineyard Wind and the University of Massachusetts, Dartmouth, Public Policy Center (PPC) analyzed the economic contributions to employment and economic output that the Project can be expected to have on the Commonwealth of Massachusetts and the regional economy of Southeastern Massachusetts (SEMA) It is estimated that the Project will directly support an estimated minimum of 1,100-1,142 full-time equivalent (FTE)[19] job years during the pre-construction, construction, and installation periods and 73-80 direct FTEs annually during operations and maintenance (O&M), for a total of 2,025 – 2,225 FTE job years. Total O&M job figures are based on a 25-year operational period, but have the potential to be higher as the Project is requesting a 30-year operational period.

Vineyard Wind expects that most of these jobs will be located in SEMA as this is where most of the construction activities will occur. In SEMA, conservative estimates in Appendix III-L indicate that the Project will result in 954 – 1,071 FTE job years in the pre-construction, construction, and installation phases and 73-80 direct FTEs annually during O&M. A small number of other personnel may temporarily relocate to the Project Region, including vessel crew and those with specialized technical skills or project-specific management experience. Vineyard Wind has already staffed a New Bedford office and engaged a number of Massachusetts-based environmental consultants, engineers and attorneys to support elements of the design effort, licensing, and permitting. It is anticipated that the share of local supply chain jobs will vary over each phase of the Project as regional investments in supply chain materialize.

As noted, Vineyard Wind may use other ports within the Project Region for staging certain project activities. These ports offer well-established industrial and commercial port facilities and affiliated workforces. The other ports being evaluated include Brayton Point and Montaup in Somerset, Massachusetts and ProvPort and Port of Davisville (Quonset) in Rhode Island. No additional workforce impacts are expected due to the use of these ports.

Alternate locations within the industrial waterfront areas of New Bedford Harbor, and in proximity to the New Bedford Terminal are being evaluated to determine the feasibility of hosting construction and installation related activities at these locations. Due to the proximity of the alternate locations to the New Bedford Terminal, it is anticipated that that no additional workforce impacts would occur if they were used for Project-related activities.

[19] One FTE is the equivalent of one person working full time for 1 year (2,080 hours).

To the extent feasible, construction materials and other supplies, including vessel provisioning and servicing, and certain fabrication work will be sourced from within the Project Region. Impacts associated with materials sourcing are anticipated to have a stimulating effect of the Project Region's economy.

In sum, the Project is expected to provide steady, well-paying jobs that will have a direct positive and stabilizing impact of the Southeastern Massachusetts workforce.

In addition to the direct jobs created during pre-construction, construction and installation, the Project is expected to result in 373-387 indirect jobs statewide. Indirect job creation is expected to be in the areas of transport and support services, as well as professional services such as legal and accounting. Direct and indirect impacts from the Project are expected to induce an additional 898-932 jobs during the same period and support an additional 81 – 89 indirect and induced jobs annually during O&M. This is because induced impacts (the jobs created by the expenditure of wages) are driven by wage amounts, both of workers directly working on the project and supply chain workers.

7.1.2.1.2 Economic Impacts

Most Project-related activities are anticipated to have location-specific effects, largely dependent on the magnitude of changes relative to existing local conditions. The Project, however, will create opportunities for market growth in sectors servicing the offshore wind industry along the Atlantic coast. Overall, the Project will provide benefits to local coastal economies and industries supporting the construction and installation phase. Construction and installation activities will provide a number of job opportunities within the marine trades and affiliated industries, and will have a positive impact on those sectors, particularly those heavily influenced by seasonal hiring. Opportunities for marine trades industries include tug and other vessel charters, dockage, fueling, inspection/repairs, provisioning, and crew work. In addition, the Project will source certain materials within the Project Region whenever feasible.

Vineyard Wind estimates that it will spend $177.4 to $178.8 million procuring materials and services from Massachusetts suppliers to support the development and construction of the Project (Appendix III-L). These expenditures will support a variety of Massachusetts and southeastern Massachusetts-based businesses, from tool suppliers and crane companies to transportation companies and component suppliers. In turn, these expenditures support further job impacts through business-to-business transactions along the Project's supply chain, as well as from the wages that Project suppliers' employees spend in the local economy on goods and services such as gas, rent, food, and childcare.

It is estimated that the Project will generate $13.6 to $14.7 million in state and local taxes as a result of the development, construction, and first year of operations of the 800 MW Project (see Table 3 in Appendix III-L). This includes an estimated $3.9 to $4.7 million increase in Massachusetts personal income and other personal tax payments, a $2.7 to $3.0

million increase in sales taxes, a nearly $5.2 million increase in property taxes, a $1.3 million increase in corporate taxes and payroll taxes, and a $0.5 million increase in fees, fines, and other taxes (Appendix III-L). Although these tax benefits are based on a single year of expenditures during the operations and maintenance phase, tax benefits will continue annually over the Project's lifetime. In addition, Vineyard Wind signed a Host Community Agreement with the Town of Barnstable. As a result of the Host Community Agreement ("HCA") with Barnstable, Vineyard Wind will pay an additional $16 million to the Town above property taxes, plus an additional $60,000 for each year the Project is in operation beyond 25 years, and will provide other material benefits to the Town. Vineyard Wind also committed in the HCA to repave the existing parking area at Covell's Beach Landfall Site and to fund the Town's construction of a new bathhouse at Covell's Beach.

Finally, Vineyard Wind is committing to invest up to $10.0 million in projects and initiatives to accelerate the development of the offshore wind supply chain, businesses, and infrastructure in Massachusetts when a power contract is awarded. This fund will be used to attract investments to upgrade or create new facilities or infrastructure needed to develop the offshore wind industry in Massachusetts. Examples of possible investments by the fund include expanding and improvement of ports to support offshore wind construction and enabling the establishment of offshore wind manufacturing facilities in Massachusetts.

7.1.2.1.3 Avoidance, Minimization, and Mitigation Measures

The construction and installation phase is anticipated to increase in employment and income within the Project Region, including growth in sectors servicing the offshore wind industry and are, therefore beneficial to the Project Region.

Additional coordination with federal, state, and local authorities and other stakeholders will be pursued in advance of the construction and installation process. The Project will continue to work cooperatively with southeastern Massachusetts educational institutions, such as the Massachusetts Maritime Academy, University of Massachusetts Dartmouth, Bristol Community College and others to help create training and educational opportunities for their students and faculty throughout each phase of the Project. One such partnership, Vineyard Wind's "Windward Workforce" initiative, will support workforce training in the offshore wind sector. The Windward Workforce initiative is a set of programs, with Vineyard Wind providing $2 million in underlying support, which will recruit, mentor, and train residents of Massachusetts, particularly southeast Massachusetts, for careers in the Commonwealth's new offshore wind industry. The ultimate objective of the Wind Workforce initiate is to create in Massachusetts the best trained, most experienced offshore wind workforce in the US. The Windward Workforce program will be undertaken in partnership with vocational schools, community colleges, the Fishing Partnership Support Services, and others. Vineyard Wind has already initiated conversations with potential partners including the Bristol Community College, Martha's Vineyard Regional High School, Cape Cod Community College, and Cape and Islands Self-Reliance.

7.1.2.2 Operations and Maintenance

Vineyard Wind plans to locate the Project's O&M Facilities in Vineyard Haven on Martha's Vineyard. The O&M Facilities will function for the operational life of the Project, which is anticipated to extend up to 30 years after construction and installation. Construction of the O&M Facilities may require additional engineering, construction, and trades personnel. Impacts to surrounding communities during the construction of the O&M Facilities will be comparable to other construction projects of similar use and scale. Improvements to Vineyard Haven may be necessary to accommodate Vineyard Wind's operational needs, such as improvements to existing marine infrastructure (e.g., dock space for Crew Transport Vessels ("CTVs"), access, etc.) and to structures (office and warehouse space). Any such improvements are not anticipated to have substantial workforce or economic impacts.

Once operational, the O&M Facilities will operate with a staff of technicians and engineers responsible for long-term operation and maintenance of the Project. The use of machinery and equipment will be necessary for the planned office and training space, shop space, warehouse space. Additional workforce may be required for planned periodic maintenance of the Onshore Project Area, including the Onshore Export Cable Route, and periodic maintenance and repairs to in-water and other Project assets.

Vineyard Wind intends to use port facilities at both Vineyard Haven and the New Bedford Terminal to support O&M activities (see Section 3.2.6 of Volume I). Smaller vessels (e.g. CTVs or SOVs) used for O&M activities will be based out of Vineyard Haven. Larger vessels used for major repairs during O&M (e.g. jack-up vessels, heavy cargo vessels, etc.) would likely use the New Bedford Terminal. Helicopters may be used for fast response visual inspections and repair activities, as needed and are typically used in conjunction with CTVs.

7.1.2.2.1 Workforce Impacts

The O&M Facilities, as described in Section 7.1.2.2, will operate with a staff of technicians and engineers responsible for long-term operation and maintenance of the Project.

Operations and maintenance of the Project will create an estimated 73-80 direct FTE jobs annually, for a total of 2,025-2,225 FTE job years based on a 25-year operational period (Appendix III-L). Vineyard Wind estimates that about 90% of these positions will be based on Martha's Vineyard. Vineyard Wind expects that all of these jobs will be held by Martha's Vineyard's year-round residents within five years of the Project's operation. These jobs will help diversify and stabilize Martha's Vineyard's economy, which is otherwise highly dependent on tourism and related seasonal employment opportunities.

Additional service providers will be necessary during planned inspection, maintenance, and repair of the in-water facilities. Maintenance, repairs, and upgrades to the Onshore Project Area will also be required during the Project's operation and maintenance phase.

The operations and maintenance phase will create a number of job opportunities within the marine trades and affiliated industries, and will have a positive impact on those sectors throughout the anticipated life of the Project by creating job market opportunities and increased employment stability, particularly within those sectors heavily influenced by seasonal hiring. Direct and indirect impacts from the Project are expected to support an additional 81 – 89 indirect and induced jobs annually during O&M.

7.1.2.2.2 Economic Impacts

Overall economic impacts from the Project are expected to yield benefits in the Project Region for the duration of the operations and maintenance phase. Vineyard Wind anticipates opportunities for area marine trades industries including tug and other vessel charters, dockage, fueling, inspection/repairs, provisioning, and other port and harbor services.

A number of ancillary services will also be required during the operations and maintenance phase. These functions include day-to-day workflow management, facilities monitoring, data analysis, and performance optimization services. Logistics management, including maintenance vessel and crew operations, materials storage and handling, tooling, and engineering and fabrication services will be required during the operations and management phase.

In other locations where offshore wind has been developed, vessel and sightseeing operators have expressed interest in providing excursions to the in-water facilities. Vineyard Wind anticipates that similar operations may occur in the WDA.

Finally, the Project anticipates sourcing many goods and services throughout the multi-decade operations and maintenance phase from local and regional providers.

7.1.2.2.3 Avoidance, Minimization, and Mitigation Measures

Vineyard Wind is committed to working with the Bureau of Ocean Energy Management ("BOEM"), the Commonwealth of Massachusetts, local and regional officials, and other stakeholders to maximize this unique and timely opportunity to establish Massachusetts as the center of the offshore wind industry in the US.

7.1.2.3 Decommissioning

As currently envisioned, decommissioning the Project is largely the reverse of the construction and installation process as described in Volume I. Impacts associated with decommissioning are similar to those described in Section 7.1.2.1.

7.1.2.3.1 Workforce Impacts

Vineyard Wind anticipates that the workforce necessary for decommissioning will be approximately the same composition and size of the construction and installation workforce. Personnel may temporarily relocate to the Project Region, including vessel crew and those with specialized technical skills or project-specific management experience, though, because regional growth of the offshore wind sector is anticipated, a larger local share of decommissioning labor may be used.

Impacts associated with decommission activities are anticipated to have a minor stimulating effect of the Project Area economy.

7.1.2.3.2 Economic Impacts

Economic impacts of the decommissioning phase are anticipated to be consistent with the construction and installation impacts described in Section 7.1.2.1.

7.1.2.3.3 Mitigation Measures

Any impacts associated with the decommissioning phase will largely be beneficial to the Project Region. Temporary impacts will be mitigated through best management practices, where practicable. Individual monitoring, outreach, and communication plans are expected to be implemented, as necessary, to assess and address impacts resulting from the decommissioning process. Additional coordination with federal, state, and local authorities and other stakeholders will be pursued in advance of the decommissioning process.

7.2 Environmental Justice / Minority and Lower Income Groups/Subsistence Resources

This section assesses the Project's effects on Environmental Justice ("EJ") populations, which are primarily minority and low-income populations. Socioeconomic characteristics of the Project Region have been examined to determine whether the proposed activities would disproportionately impact any EJ populations. The construction, operation and maintenance, and decommissioning of the Project are not anticipated to create disproportionately high and adverse health or environmental effects of federal actions on EJ populations.

EJ is defined by the Environment Protection Agency ("EPA") as,

> *"The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial,*

ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies." (EPA, 2017)

Executive Order ("E.O.") No. 12898 (1994) requires federal agencies to take appropriate steps to identify and address disproportionately high and adverse health or environmental effects of federal actions on minority and low-income populations. An EJ assessment considers the following:

(1) The areas in which a proposed project may result in significant adverse environmental effects;

(2) The presence and characteristics of potentially affected minority and/or low-income populations (i.e., "communities of concern") residing in these study areas; and

(3) The extent to which these communities are disproportionately affected in comparison to the effects experienced by the population of the greater geographic area within which the affected area is located is determined.

The Council on Environmental Quality ("CEQ") EJ guidance under the National Environmental Policy Act (CEQ, 1997) defines "minorities" as including American Indian or Alaskan natives, Asian or Pacific Islanders, Black, or Hispanic persons. For the purposes of this analysis, a community may be considered to have a minority population when the percentage of minorities in a study area is "meaningfully greater" than the minority percentage of the general population. The composition of the affected area population is therefore compared to the characteristics of the population in the next larger geographic area or political jurisdiction.

A community of concern may also be identified by the presence of low-income populations within the study area. Low-income populations are identified using the poverty thresholds available from the Census Bureau, and a comparison to the general population sets the context for the assessment. Poverty level is defined by the Census Bureau, which considers a variety of factors including family size, number of children, and the age of the householder. To determine a person's poverty status, total family income over a 12-month period is compared against the poverty threshold appropriate for that person's family size and composition. Since poverty status is defined at the family level and not the household level, the poverty status of a household is determined by the poverty status of the householder. Households are classified as below the poverty level when the total income in a 12-month period is below the appropriate poverty threshold. Income thresholds are not adjusted for regional or local variations in the cost of living.

For race and ethnicity, the tables below include a breakdown of the Asian, Black, Hispanic, and white populations in the Project Region. The "other" category includes respondents to US Census surveys who did not identify with any listed racial groups (e.g., white, Black, Asian), or who indicated that they are of more than one race. The US Census Bureau defines persons of Hispanic origin as those respondents who classified themselves in one of the specific Hispanic origin categories in the census questionnaire, such as "Mexican," "Cuban" or "Puerto Rican," as well as those who indicated that they were of "Other Spanish/Hispanic/Latino" origin. These respondents include those whose origins are from Spain, the Spanish-speaking countries of Central and South American or the Dominican Republic, or who are persons of Hispanic origin who identify themselves generally as Spanish, Spanish-American, Hispanic, or Latino. Persons of Hispanic origin may be of any race.

Because the minority populations in the communities within the Project Region do not exceed 50%, and the percentage of minorities and people with income below the poverty level is not significantly higher than the state-wide levels, there are no EJ communities, as defined by the EPA, affected by the Project.

However, as discussed in greater detail below, some areas within the Project Region do meet criteria for EJ populations as established by their respective state authorities.

7.2.1 Description of the Affected Environment

The study area for the EJ analysis encompasses the Project Region and focuses on locations where potential impacts resulting from construction and installation, operations and maintenance, and decommissioning activities may occur. Relevant characteristics of county-level populations in the Project Region are compared to their respective State characteristics as the context for the assessment. Population and demographic data used in this analysis was obtained from the Census Bureau and the EPA's Environmental Justice Screening and Mapping Tool (v2017), as well as information provided by State authorities. As noted above, county-level statistics indicate, based on EPA criteria, that the Project does not affect EJ communities.

7.2.1.1 Massachusetts

Table 7.2-1 summarizes state and county populations in the Commonwealth of Massachusetts.

Table 7.2-1 Minority and Low Income Populations, Massachusetts

Location	Total Population[1]	Race and Hispanic Origin (Percent of Population)[1]					Total Minority (Percent)	Below the Poverty Level (Percent)[2]
		Asian (alone)	Black or African American (alone)	Hispanic or Latino	White (alone)	Other		
Massachusetts	**6,859,819**	**6.9%**	**8.8%**	**11.9%**	**81.3**	**3.0%**	**18.7%**	**10.5%**
Barnstable County	213,444	1.5%	3.2%	3.0%	90.2%	5.1%	9.8%	7.6%
Bristol County	561,483	2.4%	5.4%	8.0%	89.2%	3.0%	10.8%	10.7%
Dukes County	17,325	1.0%	4.5%	3.5%	90.1%	4.4%	9.9%	7.6%
Nantucket County	11,229	1.5%	10.6%	14.4%	85.6%	2.3%	14.4%	6.4%

[1]County Level - US Census Bureau, Population Estimates Program ("PEP"), Updated annually; v2017 [2] County level - The Small Area Income and Poverty Estimates ("SAIPE").

Although, under the EPA's criteria, the socioeconomic statistics for each of the counties indicate they are not EJ communities, EJ populations, as defined by criteria established under the Commonwealth of Massachusetts' Environmental Justice Policy ("EJ Policy") (Executive Order No. 552, 1994), exist within the Project Region.

An Environmental Justice population includes any area that:

(1) Has one or more Census block groups where 25% of households have an annual median household income equal to or less than 65% of the statewide median ($68,563 in 2015), which equates to $44,657; or

(2) Has one or more Census block groups where 25% or more of the residents identify as minority; or

(3) Has one or more Census block groups where 25% or more of households have no one over the age of fourteen who speaks English only or very well (i.e., Limited English Proficiency).

The Massachusetts EJ data layer from 2010, provided by the Massachusetts Bureau of Geographic Information ("MassGIS"), identifies certain census block groups in the Project Region as EJ populations. These populations are located in proximity to the New Bedford Marine Commerce Terminal ("New Bedford Terminal"), onshore facilities in Barnstable and Yarmouth, and the Operations and Maintenance Facilities ("O&M") in Vineyard Haven.

As shown on Figure 7.2-1, MassGIS identifies 12 block groups within one mile of the Project's onshore facilities in Barnstable County. Figure 7.2-2, MassGIS identifies 19 block groups within one mile of the New Bedford Terminal in Bristol County. Figure 7.2-3, MassGIS identifies two block groups within one mile of the site under consideration for an Operations and Maintenance Facility in Dukes County.

7.2.1.2 Rhode Island

Table 7.2-2 summarizes state and county populations in the State of Rhode Island.

Table 7.2-2 Minority and Low Income Populations, Rhode Island

Location	Total Population[1]	Race and Hispanic Origin(Percent of Population)[1]					Total Minority (Percent)	Persons Below the Poverty Level (Percent)[2]
		Asian (alone)	Black or African American (alone)	Hispanic or Latino	White(alone)	Other		
Rhode Island	**1,059,639**	**3.7%**	**8.2%**	**15.5%**	**84.1%**	**4.0%**	**15.9%**	**12.8%**
Providence County	637,710	4.6%	12.2%	22.8%	78.4%	4.8%	21.6%	15.8%
Washington County	126,150	2.1%	1.4%	3.2%	93.5%	3.0%	6.5%	9.8%

[1]County Level - US Census Bureau, Population Estimates Program ("PEP"), Updated annually, v2017; [2] County level - The Small Area Income and Poverty Estimates ("SAIPE"), 2016.

Although socioeconomic statistics for each of the counties indicate they are not EJ communities under the EPA criteria, the State of Rhode Island has identified geographic areas in proximity to the Port of Davisville as potential Environmental Justice areas (Figure 7.2-4)

The Rhode Island Department of Environmental Management (DEM) considers the effects that site remediation activities would have on the Environmental Justice populations surrounding the subject site consider the issues of environmental equity for low income and racial minority populations. Vineyard Wind is not proposing any site remediation activities.

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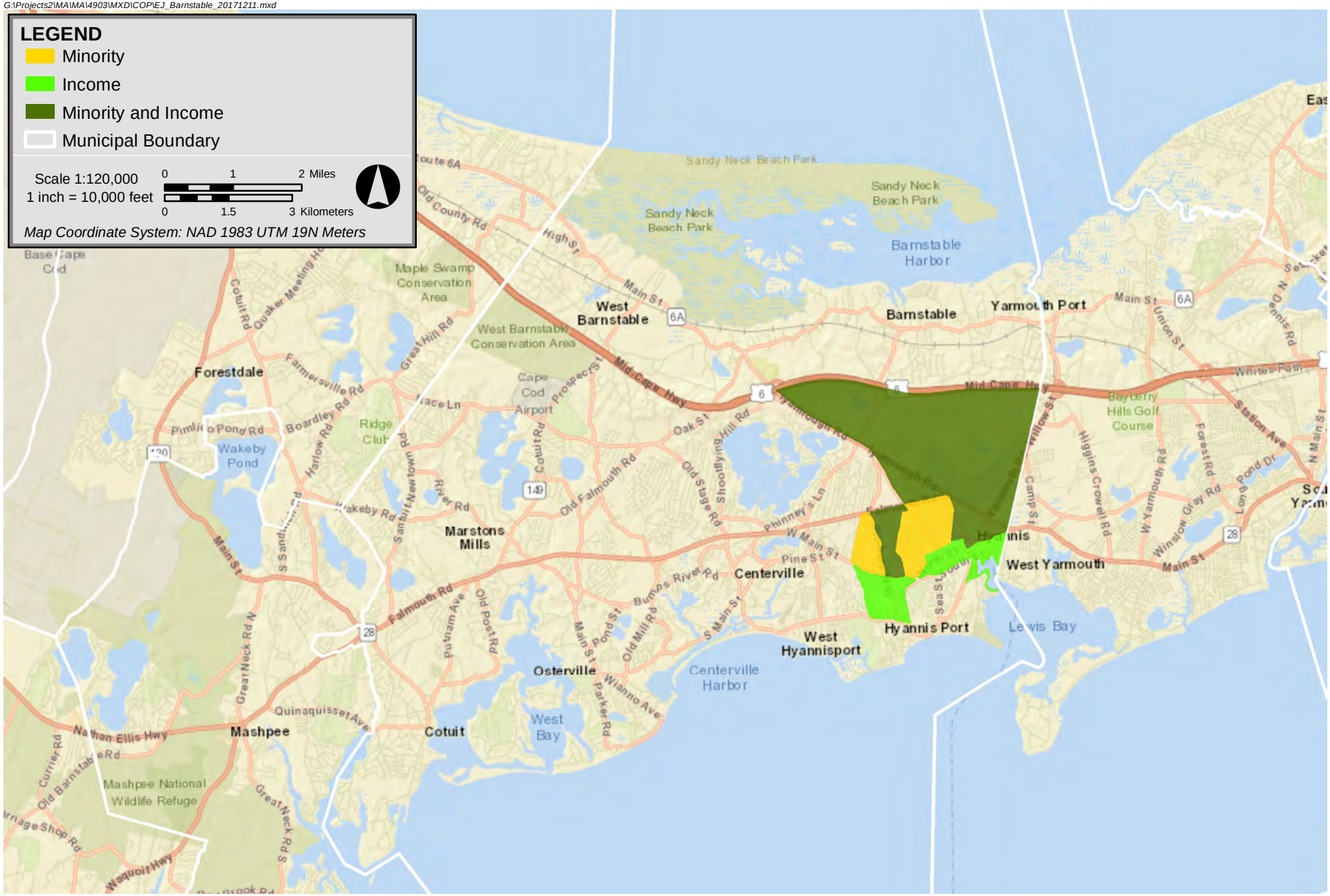

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong

Vineyard Wind Project

VINEYARD WIND

Figure 7.2-1

Environmental Justice Communities, Barnstable

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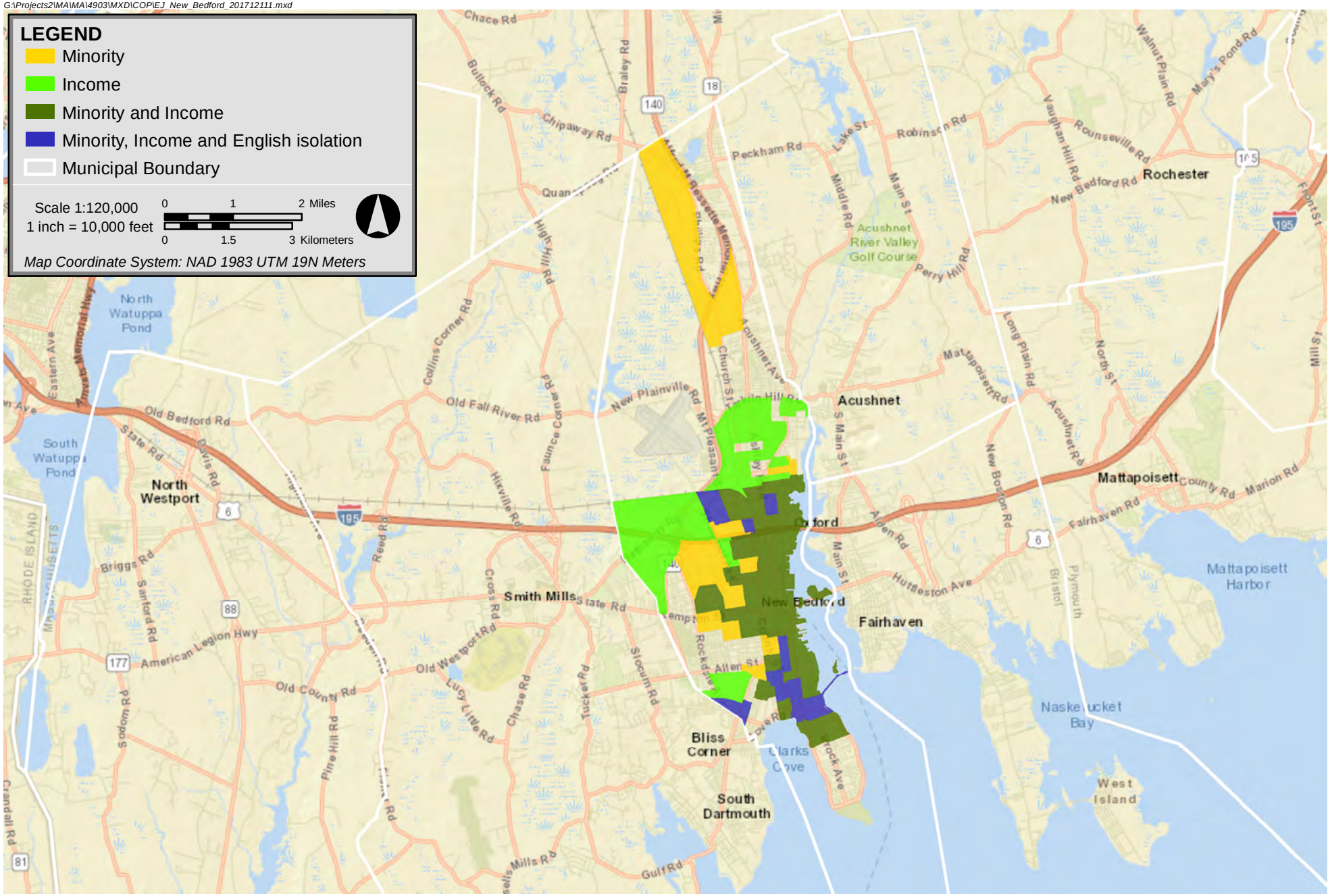

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Vineyard Wind Project

VINEYARD WIND

Figure 7.2-2

Environmental Justice Communities, New Bedford

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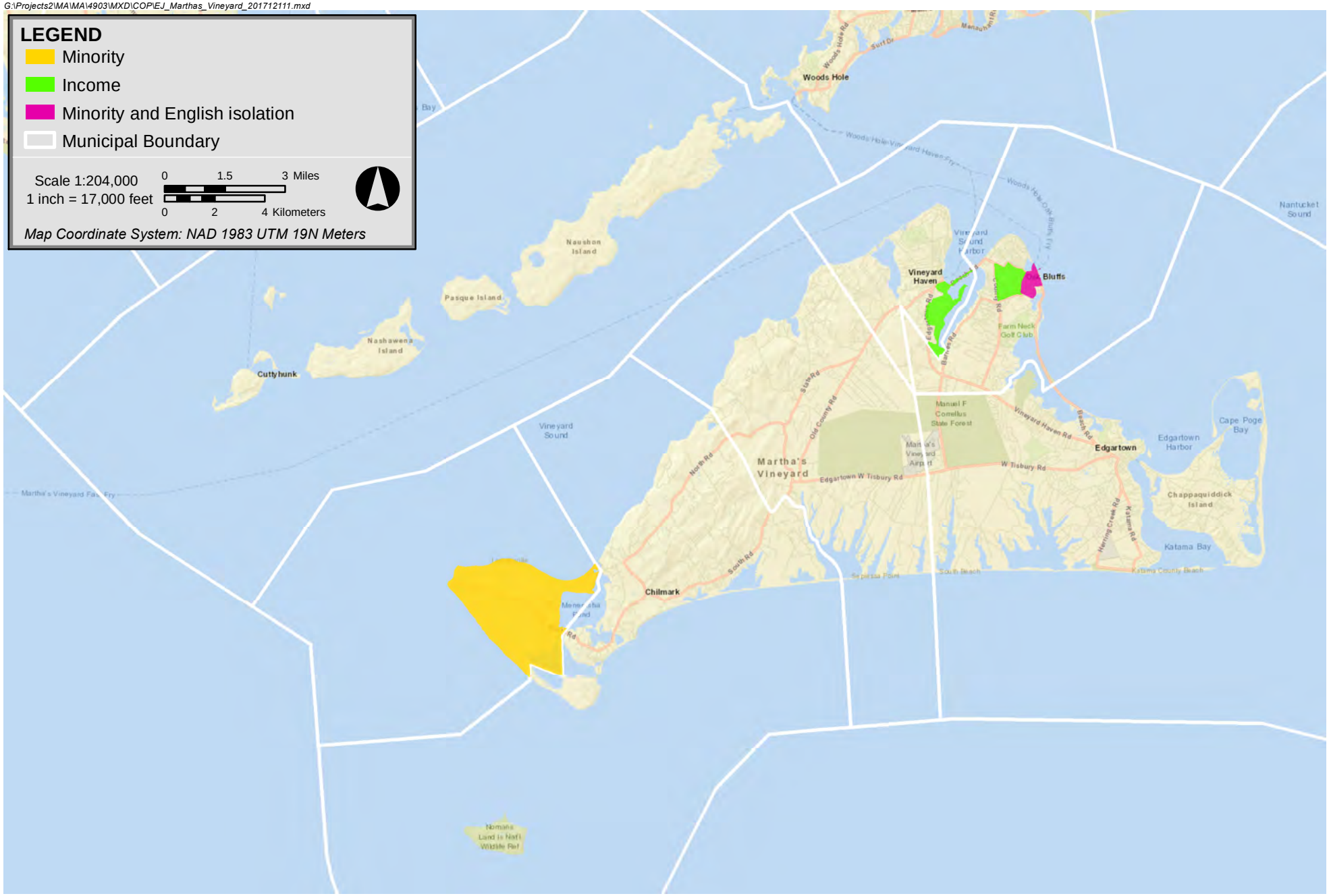

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong

Vineyard Wind Project

VINEYARD WIND

Figure 7.2-3

Environmental Justice Communities, Martha's Vineyard

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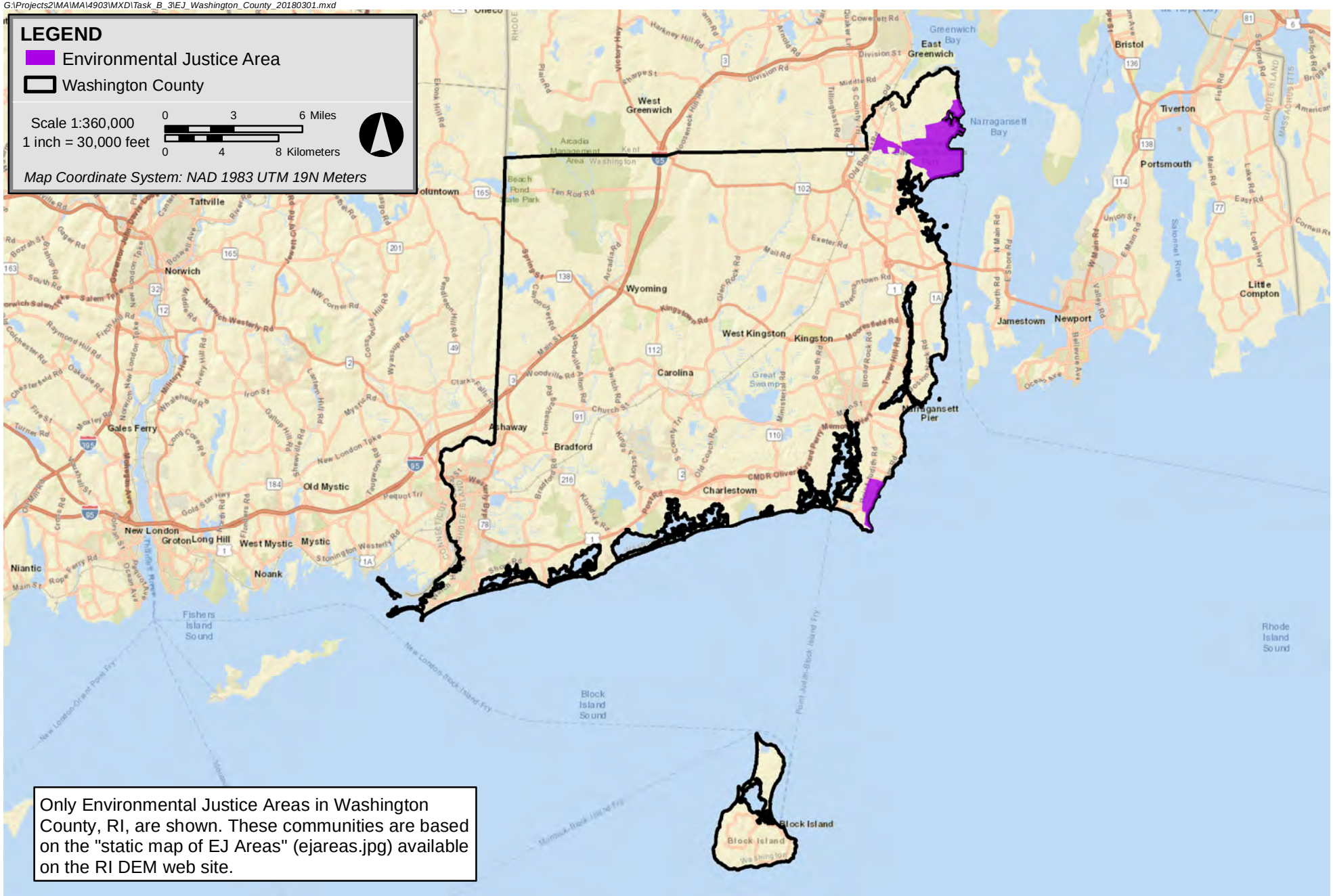


Vineyard Wind Project

VINEYARD WIND

Figure 7.2-4

Environmental Justice Communities, Washington County, Rhode Island

7.2.2 Potential Impacts of the Project

The Project, including each phase, is not anticipated to cause disproportionately high and adverse effects on any minority or low-income populations and is in consistent with the provisions of Massachusetts' EJ Policy.

Table 7.2-3 Impact-producing Factors for Environmental Justice Communities

Impact-producing Factors	Wind Development Area	Offshore Export Cable Corridor	Construction & Installation	Operations & Maintenance	Decommissioning
Workforce hiring	X	X	X	X	X
Cable Installation		X	X	X	X
Port Use	X	X	X	X	x
Local Vehicle Traffic		X	X		
Workforce Training Programs	X			X	
Housing			X	X	X

7.2.2.1 Construction and Installation

See Section 7.1.2.1 for a description of activities during the construction and installation phase of the Project.

7.2.2.1.1 Impacts to Environmental Justice Populations

New Bedford Terminal will be the most active Port facility used for Project-related activities. It is anticipated, however, that construction and installation activities at the New Bedford Terminal will not cause disproportionately high and adverse effects on any minority or low-income populations in accordance with the provisions of E.O. No. 12898 (1994). Other port facilities were selected, in part, because of their extant workforce and capacity to host Project-related activities. These ports are actively engaged in water-dependent marine industrial activities and the introduction of the Project to those ports is anticipated to have exceptionally limited impacts to areas of concern to EJ and other communities.

Additional vehicle and vessel traffic will occur at the New Bedford Terminal, though the facility is well-served by vehicle access roadways and, therefore, the Project is not anticipated to adversely affect those roadways and abutting communities. Traffic and its related impacts are not anticipated to disrupt the normal and routine functions of the nearby communities. Additional information regarding air quality impacts from these activities is provided in Section 5.1.

Construction and installation activities along the Onshore Export Cable Route may also cause traffic and related impacts within the immediate vicinity these activities, though any disruption to normal and routine functions will be eliminated upon conclusion of the construction and installation activity. From a traffic management perspective, there are no road segments of the Onshore Export Cable Route that are considered unique or unusual for this type of construction.

The Project's construction and installation activities are expected to increase employment opportunities, job training, and economic activity within the Project Region.

The Project is consistent with the Massachusetts' EJ Policy. This consistency is based on Vineyard Wind's community engagement and public information process, which will facilitate the opportunities for all interested parties to participate, and is also based on the fact that the Project does not exceed any environmental impact thresholds that would necessitate enhanced analysis or enhanced public participation under the Policy.

7.2.2.1.2 Avoidance, Minimization and Mitigation Measures

The Project is not anticipated to cause disproportionately high or adverse effects on minority or low-income populations. In accordance with the provisions of E.O. No. 12898 (1994), no mitigation measures are necessary.

However, in accordance with Massachusetts' EJ Policy, Project stakeholder engagement plans will include outreach to the communities of the block groups identified in Section 7.2.1. Additionally, a Traffic Management Plan will be developed so as to minimize disruptions to residences and commercial establishments in the vicinity of construction and installation activities.

Prior to construction, Vineyard Wind will work closely with the municipalities to develop a Traffic Management Plan (TMP) for construction and installation activities along the Onshore Export Cable Route. The TMP will be submitted for review and approval by appropriate municipal authorities (typically Department of Public Works/Town Engineer and Police). As part of a Host Community Agreement, Vineyard Wind proposes to pay for the town to hire a construction monitor to ensure compliance with the TMP and communicate with the town and address any resident concerns during construction. Additional outreach to EJ communities, as necessary, will be coordinated by Vineyard Wind and/or its contractors.

7.2.2.2 Operations and Maintenance

Section 7.1.2.2 provides detailed descriptions of the Project's operations and maintenance phase.

7.2.2.2.1 Impacts to Environmental Justice Populations

Operations and maintenance ("O&M") activities are not anticipated to cause disproportionately high and adverse effects on any minority or low-income populations in accordance with the provisions of E.O. No. 12898 (1994).

Minor, temporary and short-term impacts associated with the construction of the O&M Facilities may occur. Construction impacts will be comparable to projects of a similar size and may include increased vehicle traffic, disruptions to existing traffic patterns, noise, dust, and lighting. These impacts will be minor, temporary and short-term.

Following the completion of construction and Project commissioning, only negligible impacts are anticipated from the O&M Facilities, which will provide employment opportunities within the Project Region. During the operations and maintenance phase of the Project, goods, services, and other items will be sourced from the surrounding community.

Periodic planned and unplanned maintenance of Project facilities may cause minor, temporary, short-term impacts to communities in the immediate vicinity of these activities. Such activities may include the clearing of vegetation along rights-of-way, planned replacement of equipment and materials, and the operation of maintenance equipment. Any disruption to normal and routine functions of the Project Area will be eliminated upon conclusion of the construction and installation activity.

7.2.2.2.2 Avoidance, Minimization, and Mitigation Measures

Based on the foregoing discussion, the Project is not anticipated to cause disproportionately high and adverse effects on minority or low-income populations in accordance with the provisions of E.O. No. 12898 (1994). Therefore, no mitigation measures are necessary.

7.2.2.3 Decommissioning

As currently envisioned, decommissioning the Project is largely the reverse of the construction and installation process as described in Volume I. Impacts associated with decommissioning are similar to those described in Section 7.2.2.1.

7.2.2.3.1 Impacts to Environmental Justice Communities

Impacts associated with decommissioning will be consistent with impacts anticipated during the construction and installation phase described in Section 7.2.2.1.1

7.2.2.3.2 Avoidance, Minimization, and Mitigation Measures

Based on the foregoing discussion, the Project is not anticipated to cause disproportionately high and adverse effects on minority or low-income populations in accordance with the provisions of E.O. No. 12898 (1994). Therefore, no mitigation measures are necessary.

7.3 Cultural, Historical, and Archaeological Resources

In support of the assessment of cultural, historical, and archaeological resources that have the potential to occur in the Project Area, comprehensive analyses were developed based on desktop research and field reconnaissance surveys. These comprehensive analyses include terrestrial archaeology reports (included in Appendix III-G) and a "Marine Archaeological Services Report" (Volume II-C). This section provides a brief summary of the noted reports, for additional information refer to Volume II-C and Appendix III-G.

Public Archaeology Laboratory ("PAL") completed an archaeological due diligence review of potential Onshore Export Cable Routes as well as the archaeological permit application that are included as Appendix III-G. The desktop archaeological due diligence review was conducted to provide information about known archaeological sites within one-half mile of the potential routes, provide a sensitivity assessment for archaeological resources with the Project Area, and make recommendations regarding the need for consultation with the Massachusetts Historical Commission ("MHC") and additional cultural resource management investigations. The desktop due diligence review consisted of a search of the MHC's Inventory of the Historic and Archaeological Assets of the Commonwealth ("MHC Inventory") and the Massachusetts Cultural Resource Information System to identify previously recorded archaeological sites within the vicinity of the Project and analyze current environmental conditions to determine archaeological sensitivity. [redacted]

PAL has conducted a reconnaissance level archaeology survey for terrestrial areas, including completion of background research and a walkover survey. The survey included the two proposed Onshore Export Cable Routes with their variants as well as the proposed onshore substation site, and assessed their potential to affect archaeological resources. The reconnaissance survey identified known archaeological sites, previous disturbance, and addressed potential effects to archaeological sites as outlined in the archaeological permit application included in Appendix III-G. The survey was completed in cooperation with local historical commissions and Tribal Historic Preservation Offices. The survey report ranked areas for low, moderate and high archaeological sensitivity and gave recommendations for potential excavations as part of a potential intensive level survey.

[redacted] In early 2020, Vineyard Wind proposed an expansion to the substation site. On March 5, 2020, PAL received an amended permit from MHC to conduct a supplemental intensive survey at the expanded substation site. The field investigation is planned for June 2020.

Curation arrangements for cultural records and materials have been made as Vineyard Wind is required under the State Archaeologist's Permit to house artifacts at PAL's office unless another approved facility is found and deaccession approved by the State Archaeologist.

To facilitate an assessment of marine archeological resources, Gray & Pape, Inc. provided a "Marine Archaeological Services Report" (Volume II-C) which analyzes high-resolution geophysical ("HRG") and geotechnical marine survey of the Wind Development Area ("WDA") and Offshore Export Cable Corridor ("OECC") to a number of potential Landfall Sites on Cape Cod. This research was conducted over three seasons (2016-2018) in conjunction with Alpine Ocean Seismic Surveys, Inc., Fugro Marine Geoservices, Inc., Seaforth Geosurveys, Inc., Horizon Geosciences Limited, and Geoquip Marine in order to satisfy the BOEM's offshore wind energy lease requirements for Vineyard Wind. The goal of this study was to assist Vineyard Wind and BOEM in determining whether or not there are potentially significant cultural resources in the Offshore Project Area, help inform the siting of Project's offshore components, and assist in avoiding and mitigating potential adverse effects to significant cultural resources resulting from the Project.

As summarized in Section 3.5.2 of the COP Addendum and detailed in the full report provided as Appendix II-C, the initial two survey seasons (2016 and 2017) were used for reconnaissance, feasibility assessment of testing methods, and site characterization. In 2016, the northeast portion of the Lease Area OCS-A 0501 was examined; this work included over 800 km (432 NM) of trackline mileage. During the 2017 survey season, a total of approximately 290 km (156.5 NM) were surveyed along the OECC to support route feasibility. In 2018, a comprehensive survey of both the WDA and OECC was conducted, totaling approximately 4,810 km (2,597 NM) of trackline mileage in the WDA and 5,330 km (2,878 NM) of trackline mileage in the OECC.

Archival and documentary research and field investigations were conducted for the WDA and the OECC as part of the cultural resource examination. Background research included review of historical documents, previous research reports, shipwreck inventories, secondary

sources, and historical map analysis. Much of this research was conducted utilizing material from the archives of the Massachusetts Board of Underwater Archaeological Resources (MBUAR).

[redacted]

7.4 Visual Resources

For the Project's offshore facilities, the Area of Potential Effect ("APE") for visual effects was generated using the maximum theoretical distance that the Wind Turbine Generator ("WTG") blades could be visible taking into consideration the curvature of the earth and other variables. This yielded a very conservative overestimate of areas onshore where the WTGs could be viewed. Environmental conditions such as wave height, fog, rain, haze, and other factors were not considered in this calculation, but would serve to further limit visibility.

The Visual Impact Assessment provided as Appendix III-H.a determined that, based on the conservative visual APE, the Project's offshore facilities may be visible from beachfront areas along southern coastlines of Martha's Vineyard and Nantucket Island at distances greater than 23 km (14 mi) under certain meteorological conditions. Areas of visibility are also found on south facing beaches and unvegetated inland areas on uninhabited Esther Island, Tuckernuck Island, Muskeget Island, and Nomans Land Island. In most circumstances Project visibility is quickly screened from inland vantage points by coastal topography and vegetation. It should be noted that coastal scrub/shrub vegetation is dense deciduous and evergreen type that is difficult or not possible to see through with leaves on or off, which creates a year-round obstruction.

A portion of Cape Cod within the APE falls behind Martha's Vineyard, which substantially minimizes the degree of potential visibility in these areas. View of the nacelle for the largest WTG in the Envelope is theoretically possible from the southern shore of Cape Cod in the vicinity of Great Neck in Mashpee (at a distance of 45.7 km [28.4 mi] from the nearest WTG). However, because atmospheric haze reduces visibility, sometimes significantly, maximum theoretical viewing distances typically exceed what is experienced in reality. Moreover, due to the earth's curvature, the presence of ocean waves that obscure objects very low on the horizon, and the limits of visual acuity, the nacelle will not likely be discernable from vantage points on the Cape. Visibility of thin rotating blades above the horizon from this extended distance will be similarly difficult to detect.

Even at the closest point to shore (23.7 km [14.7 mi]), viewing the tallest WTG in the Project Envelope is roughly equivalent to viewing an eight-inch pencil at a distance of about 30 m (100 ft). Similarly, viewing a blade with a maximum width of 7.5 m (25 ft) at that distance is roughly equivalent to the width of a coffee straw viewed at 30 m (100 ft).

With respect to visibility for onshore portions of the Project, all offshore and onshore cables will be subsurface/buried and will not be visible. The Project's onshore substation will be constructed adjacent to an existing onshore substation. The proposed improvements for the onshore substation will be consistent in scale and visual character with the existing electric substation.

The Historic Properties Visual Impact Assessment, provided as Appendix III-H.b, identified a variety of historic properties, including historic buildings and structures, within the APE for the Project. These historic properties include properties listed as National Historic Landmarks, properties on or determined eligible for listing on the National Register of Historic Places (including traditional cultural properties) as well as the Massachusetts State Register of Historic Places, and properties included within the Inventory of Historic and Archaeological Assets of the Commonwealth.

As described in Appendix III-H.b, photo simulations combined with existing conditions photographs, maps, and other graphics were used to investigate the potential visual impact of the Project on historic properties within the APE and identify any previously

undocumented historic properties. The Project has been determined to have an adverse visual effect for the Gay Head Lighthouse on Martha's Vineyard and the Nantucket Historic Landmark District. Additionally, BOEM, for the purposes of its Section 106 review, is recognizing areas on and around Chappaquiddick Island as a traditional cultural property important to the Chappaquiddick Tribe and determined that the Project would have an adverse visual effect on the Chappaquiddick Island traditional cultural property. No adverse effects to properties on Cape Cod, Cuttyhunk Island, or the western shoreline of Buzzards Bay are anticipated due to extreme distance from the WDA. See Appendix III-H.b for details.

7.5 Recreation and Tourism (including recreational fishing)

This section describes the general characteristics of recreation and tourism activities, including recreational fishing, in the Project Region and assesses potential effects of Project-related activities on these recreation and tourism within the Project Region.

The Project Region is the geographic area that could be affected by Project-related activities. For the purposes of recreation and tourism, it consists of the communities in Barnstable County, Bristol County, Dukes County and Nantucket County in Massachusetts and Providence County and Washington County in Rhode Island. As described in Sections 7.1 and 7.2, and in Section 7.5.1 below, this area, especially Cape Cod and the Islands, contains a wealth of recreational resources and attracts large numbers of seasonal residents and visitors. As a general matter, major Project-related activities will occur well offshore and at one or more of the industrial ports selected. Accordingly, Project effects on recreation and tourism, if any, are expected to be highly localized and largely temporary in nature.

7.5.1 Description of the Affected Environment

Construction and installation activities will be staged principally from New Bedford. The Wind Development Area ("WDA") is located south of the Islands of Nantucket and Martha's Vineyard and the OECC will pass through Muskeget Channel and traverse Nantucket Sound. The Onshore Export Cable Route will be installed primarily beneath existing roads in Barnstable and a new onshore substation will be built on an industrial parcel in Barnstable. As noted above, many of the communities in the Project Region are popular tourist destinations and depend on the tourism and recreation industries for significant revenues. For example, an estimated 44% of Cape Cod's economic base is derived from seasonal tourism; this represents approximately one billion dollars in annual spending by tourists (CCC, 2012).

On the water, recreational boating, including paddle sports, sport fishing, and diving are seasonally important recreational activities. Offshore whale watching, deep-sea fishing, and other vessel charters are common seasonal activities. In the Project Region, several wildlife sanctuaries and the Cape Cod National Seashore are important destinations for onshore wildlife viewing.

Recreational boating activity varies seasonally, with peak boating season occurring between May and September. Other boat-based recreational activities, including canoeing, kayaking, and paddle boarding take place close to shore, in sheltered waters, and predominantly within one mile of the coastline. These activities are likely only occur along the OECC, in areas close to shore, and not within the WDA.

Recreational fishing vessels operate from nearly every harbor in the Project Region; in addition, ramp-launched vessels are brought to the Project Region from other parts of New England. Although recreational fishing occurs on a year-round basis throughout the Project Region, the intensity of recreational fishing increases substantially as the weather warms. The timing of migratory species' "run" through the Project Region often dictates the intensity of recreational fishing activity, although offshore fishing is much less variable than surfcasting and nearshore fishing from small boats.

BOEM estimates that, of the nearly two million angler trips occurring in Massachusetts in between 2007 and 2012, approximately 4.4% of those angler trips occurred within one mile of the Massachusetts Wind Energy Area ("MA WEA") (Kirkpatrick et al., 2017). Substantially fewer numbers of angler trips originating in New York and Rhode Islands occurred within one mile of the MA WEA. During that same time period, recreational angler trips occurring within one mile of the MA WEA most frequently originated from Tisbury, Nantucket, and Falmouth Harbors; while fewer than 600 angler trips originated from Rhode Island (Kirkpatrick et al., 2017).

Saltwater fishing tournaments are also frequently held during the summer months in waters throughout the Project Region. Rhode Island and Massachusetts-based organizations sponsor upward of 60 fishing tournaments each year. The tournaments target a variety of different species (e.g., cod, Black Sea Bass [*Centropristis* striata], Bluefish [*Pomatomus saltatrix*], Striped Bass [*Morone saxatilis*], Haddock [*Melanogrammus aeglefinus*], tuna, and fluke) (RI Ocean SAMP 2011; NROC 2015).

The following sections describe with additional detail, recreational activities occurring within the Project Region.

7.5.1.1 Massachusetts

Barnstable County (Cape Cod)

Detailed descriptions of Barnstable County can be found in Sections 7.1.1.2.1. For convenience, this section briefly summarizes some of the relevant tourism and recreational information.

Barnstable County, located in southeastern Massachusetts, is comprised of the entirety of Cape Cod. Much of Barnstable County's 885 kilometer ("km") (550 mile ["mi"]) coastline is sandy beach that is ideal for beach going, walking, snorkeling, windsurfing, and at certain beaches, surfing. The County has more than 150 public beaches, several more private beaches, and limited access coastal areas. There are approximately 30 harbors, 40 marinas and boatyards, and approximately two dozen private boating and yacht clubs in the County (USFWS, 2011; NPS, 2011).

Based on the most recent Census Bureau data available, Barnstable County's recreation and tourism sectors are supported by an estimated 274 facilities offering accommodations. In 2012, these facilities collectively generated nearly $300 million in annual revenue. The County has approximately 869 food and drink establishments generating over $700 million in annual sales. Approximately 31.9% of all residential units in Barnstable County are for seasonal, occupational, or occasional use (US Census Bureau, 2010).

Bristol County ("mainland" county, centered around New Bedford)

Detailed descriptions of Bristol County can be found in Sections 7.1.1.2.2. For convenience, this section briefly summarizes some of the relevant tourism and recreational information.

Bristol County is located on the mainland of southeastern Massachusetts, to the west of Cape Cod. Bristol County's coastline is comprised largely of two bays: Mount Hope Bay, in the upper reaches of Narragansett Bay and extending into the Taunton River, and Buzzard's Bay. The County has five public beaches, two harbors, approximately 20 marinas/boatyards, and five yacht clubs. The County has approximately 12 public boat launch facilities providing access to coastal waters. There are no nationally protected refuges in the County, although the New Bedford Whaling National Historical Park encompasses 34 acres over 14 city blocks in the vicinity of the New Bedford Terminal (USFWS, 2012; NPS, 2012).

Bristol County's recreation and tourism sectors are supported by an estimated 48 lodging facilities offering short-term accommodations. In 2015, these facilities collectively generated over $60 million in annual revenue. The County has approximately 1,193 food and drink establishments generating over $908 million in annual sales. (US Census Bureau, 2016).

Dukes County (Martha's Vineyard and adjoining small islands)

Detailed descriptions of Dukes County can be found in Sections 7.1.1.2.3. For convenience, this section briefly summarizes some of the relevant tourism and recreational information.

Dukes County, off the south coast of Massachusetts has approximately 241 km (150 mi) of coastline consisting almost entirely remote, sandy beaches. Dukes County has approximately 15 large public beaches, but on the Dukes County's largest island, Martha's Vineyard, much of the coast is private access only. There are five harbors, two marinas, and three yacht clubs in Dukes County. The County also has six public boat launch facilities providing access to coastal waters. Dukes County's only nationally protected land is on Noman's Land Island National Wildlife Refuge (ICF Incorporated, 2012). However, nearly a quarter, or approximately 81 square kilometers (20,000 acres), of Martha's Vineyard, is conserved open space, which includes substantial recreational area.

Dukes County's recreation and tourism sectors are supported by an estimated 31 facilities offering lodging, including hotels, motels, inns, and bed and breakfast establishments. In 2015, these facilities collectively generated over $36 million in annual revenue. The County has approximately 107 food and drink establishments generating nearly $84 million in annual sales. Approximately 53.4% of all residential in Dukes County are for seasonal, occupational, or occasional use (US Census Bureau, 2010).

Nantucket County

Detailed descriptions of Nantucket County can be found in Sections 7.1.1.2.4. For convenience, this section briefly summarizes some of the relevant tourism and recreational information.

The island of Nantucket has approximately 177 km (110 mi) of shoreline, of which approximately 129 km (80 mi) is sandy beach open to the public. The Nantucket Wildlife Refuge accounts for 24 acres of nationally-protected land and is the only national refuge on the island. Nantucket's two main harbors, Nantucket Harbor and Madaket Harbor, are both popular seasonal destinations for recreational vessels. The Island of Nantucket has two yacht clubs and multiple marinas (ICF Incorporated, 2012). Nantucket also offers two public access boat ramps in Madaket Harbor.

Nantucket County's recreation and tourism sectors are supported by an estimated 28 facilities offering lodging. In 2015, these facilities collectively generated over $31 million in annual revenue. The County has approximately 83 food and drink establishments generating over $88 million in annual sales. Approximately 56% of all residential units in Nantucket County are for seasonal, occupational, or occasional use (US Census Bureau, 2010).

7.5.1.2 Rhode Island

Providence County

Detailed descriptions of Providence County can be found in Sections 7.1.1.2.1 For convenience, this section briefly summarizes some of the relevant tourism and recreational information.

Based on the most recent Census Bureau data available, Providence County's recreation and tourism sectors are supported by an estimated 36 facilities offering accommodations. In 2012, these facilities collectively generated in excess of $126 million in revenue. Providence County has approximately 1,527 food and drink establishments generating over $1.1 billion in sales. Approximately 0.4% of all residential units in Providence County are for seasonal, occupational, or occasional use (US Census Bureau, 2016).

Washington County

Detailed descriptions of Washington County can be found in Sections 7.1.1.2.2. For convenience, this section briefly summarizes some of the relevant tourism and recreational information.

Based on the most recent Census Bureau data available, Washington County's recreation and tourism sectors are supported by an estimated 80 facilities offering accommodations. Washington County has approximately 381 food and drink establishments. Collectively, Washington County accommodation facilities and food and drink establishments generated $342 million in sales in 2012. Approximately 14.3% of all residential units in Washington County are for seasonal, occupational, or occasional use (US Census Bureau, 2016).

7.5.2 Potential Impacts of the Project

The potential impact-producing factors as they relate to specific Project elements are presented in Table 7.5-1, below. The majority of impact-producing factors identified in Table 7.5-1 will occur in the Massachusetts communities of Dukes County, Nantucket County, and Barnstable County. These impacts are largely associated with the siting of WTGs well offshore of those coastal counties and with the temporary impacts in proximity to the Export Cable Corridor and other onshore facilities. Local expenditures by Vineyard Wind's workforce, include housing and accommodations by the limited number of non-local workers, and other impacts may occur in the vicinity of the port(s) selected for construction and installation activities.

Table 7.5-1 Impact-producing Factors for Recreation and Tourism

Impact-producing Factors	Wind Development Area	Offshore Export Cable Corridor	Construction & Installation	Operations & Maintenance	Decommissioning
Cable installation	X	X	x		
Dredging		X	x		
Increased vessel traffic	X	X	X	X	x
HDD		X	X		
Utility Duct Construction			x		
WTGs (Visual)	X		X	X	
Local Expenditures by Vineyard Wind Workforce			X	X	X
Housing & Accommodations			X	X	
Equipment Operations		X	X	X	X

7.5.2.1 Construction and Installation

As described in Volume I, Project components will be installed in the onshore and offshore environments. In the onshore environment, there will be installation of new utility duct bank located beneath and along public rights-of-way from the offshore export cable Landfall Site to the general vicinity of the Barnstable Switching Station. A section of existing rail right-of-way ("ROW") and a segment of existing utility ROW may be used for a portion of the route as well. Horizontal directional drilling ("HDD") operations and other construction activity will also occur at the Landfall Site.

In the WDA, located well offshore, wind turbine generators ("WTGs"), inter-array and inter-link cables, and up to two electrical service platforms ("ESPs") will be installed as part of an 800 megawatt Project. Construction and installation activities will also occur along the OECC.

7.5.2.1.1 Impacts to Recreational Resources

As described in Section 1.5.3 of Volume I, Vineyard Wind will not conduct activities along the onshore transmission route within public roadway layouts from Memorial Day through Labor Day unless authorized by the host town; such work could extend through June 15 subject to consent from the local Department of Public Works ("DPW"). A Traffic Management Plan will be developed so as to minimize disruptions to residences and commercial establishments in the vicinity of construction and installation activities.

At each potential Landfall Site, the proposed HDD operations, which are described in Section 4.2.3.8 of Volume I, may cause temporary conflicts with pedestrian access to limited areas of the Landfall Site, though any such conflicts would be limited to the very short period of HDD activities.

The Project will also establish Operations and Maintenance Facilities ("O&M Facilities") in Vineyard Haven on Martha's Vineyard. Any impacts to recreational resources associated with the O&M Facilities are anticipated to be negligible, consistent with other marine construction activities, and limited to the construction period of that facility. As noted in Section 3.2.6 of Volume I, site-specific modifications will likely be performed by the site owner/lessor in order to meet Vineyard Wind's requirements for its O&M Facilities.

7.5.2.1.2 Impacts to Recreational Boating and Fishing

The majority of recreational boating in the Project Region occurs within 5.5 km (3 nautical miles ["nm"]) of shore and within state waters (NROC, 2012). Although recreational boaters may transit the WDA, there are no known concentrated navigational routes of any significance in proximity to the WDA. Potential routes of offshore long-distance sailboat races could transit the WDA; however, the preferred vessel routing during those events varies based on weather, tide, and other variables. Navigation and vessel traffic are further discussed in Section 7.8 and Appendix III-I.

The entire near-coastal region and numerous offshore locations within the Project Region may host species targeted by recreational fishermen. Recreational fishing activities have been reported to occur in portions the MA WEA, notably at "The Dump," the approximately 259 km^2 (100 mi^2) Dumping Area identified on National Oceanic and Atmospheric Administration charts near the southerly end of the MAWEA. The Dump, along with "The Owl" and other areas along the 20 fathom line, as well as "The Star" and "Gordon's Gully" along the 30 fathom line, are popular locations for vessels targeting highly migratory and other recreational species. Both the 20 and 30 fathom lines cross the WDA from west to east. Along the OECC, numerous shoals and other structure provide productive fishing grounds for the recreational fishing industry.

Construction activities may affect recreational fishing activities. Potential water quality, noise, and other impacts as they may relate to species targeted by recreational fishing vessels are described in Section 6.6. The proximity of the WDA and OECC to numerous productive recreational fishing areas suggests that the highly localized impacts of construction and installation activities will have only minimal impacts to recreational species. Shore-based fishing activities at the Landfall Site may be temporarily displaced during the construction and installation phase.

Vessel traffic associated with the Project is not anticipated to represent a significant increase over the current levels of vessel traffic within the Project Region. Large draft vessels delivering components to the Project Region and installation vessels servicing the WDA and

along the OECC may cause navigation impacts around confined navigation channels and turning basins, particularly at the entrance to the New Bedford Harbor and at the Hurricane Barrier, for example. Increased vessel traffic may occur through inshore traffic zones and any traffic separation scheme along the selected route to the WDA. Accordingly, the construction and installation phase may result in temporary, minimal impacts to recreational boating activities in the Offshore Project Area. Similarly, increased vessel traffic to and from the WDA may cause negligible impacts to recreational boating activities during the construction and installation phase.

When construction and installation vessels are on station in the WDA and along the OECC, temporary impacts to recreational boating and fishing activities in the immediate vicinity of those vessels may occur. Cable installation within or near areas of restricted navigation, or in close proximity to obstructions, may require additional temporary safety measures.

Noise from construction and installation activities, including pile driving, and low-intensity noise from drilling, dredging, or increased vessel traffic may lead to recreationally targeted species being temporarily displaced from the immediate vicinity of the construction installation activities (Kirkpatrick et al., 2017). Any species affected by construction and installation activities are anticipated to return to the area soon after construction and installation noises cease (Bergstrom, 2014).

7.5.2.1.3 Avoidance, Minimization, and Mitigation Measures

Vineyard Wind's onshore construction schedule minimizes impacts to recreational uses and tourism-related activities during peak summer months and other times when demands on these resources are elevated.

To minimize hazards to navigation, all Project-related vessels, equipment, and appurtenances will display the required navigation lighting and day shapes. Offshore Wind Mariner Updates and Notices to mariners will be distributed by Vineyard Wind and US Coast Guard ("USCG") to notify recreational and commercial vessels of their intended operations to/from and within the WDA.

Mitigation of potential water quality and other impacts as they may relate to species targeted by recreational fishing vessels are described in Section 6.6.

Finally, as noted in Section 7.1.2.1.3 above, and elsewhere, Vineyard Wind will implement a comprehensive communications plan to keep the relevant parties informed throughout this phase of the Project. A draft of the Fisheries Communication Plan is included as Appendix III-E.

7.5.2.2 Operations and Maintenance

Following the completion of construction and Project commissioning, impacts from operation and maintenance of the Project on recreational resources will be negligible. The Project's onshore and offshore cable system, onshore substation, WTGs and ESPs in the WDA will be monitored and controlled remotely from the Project's O&M Facilities, which will be staffed by the necessary personnel, including managers, engineers, technicians, and support personnel. In the event that monitors determine a repair is necessary, a crew would be dispatched to the identified location to complete repairs and restore normal operations.

7.5.2.2.1 Impacts to Recreational Resources

Vineyard Wind is not proposing any vessel exclusions around the WTGs or other areas of the Project during the operations and maintenance phase. As noted in Section 7.5.2.1.2, impacts to recreational boating, including offshore sailboat races, are anticipated to be negligible. The WTGs will also provide additional aids to navigation.

The WDA may provide additional recreational opportunities, as a study of Delaware beachgoers found that 45% of respondents would likely take a tour boat to see an offshore wind facility (Lilley et al., 2010). Hy-Line Cruises, based in Hyannis, had expressed interest in operating sightseeing vessels to other offshore projects with the expectation that such facilities will be popular tourist destinations (Cape Cod Times, 2011). As noted in Section 7.1.2.2.2, vessel and sightseeing operators may provide excursions to the WDA.

The operations and maintenance phase would involve the new infrastructure in the WDA as well as onshore facilities. As noted above, however, Vineyard Wind is not proposing to limit access to the WDA, and recreational and tourism activities in the WDA should not be affected.

Alterations to local aesthetics, important factors in attracting tourists to a coastal area, will not be altered by the operations and maintenance of the Project (BOEM, 2012). WTGs, particularly during the summer months, will be difficult to see from the shoreline of coastal communities in the Project Region, and are expected to not impact onshore and near shore recreational resources.

7.5.2.2.2 Impacts to Recreational Boating and Fisheries

Operations and maintenance of the Project may provide modest, positive impacts to recreational fisheries. By providing additional structure for species that prefer hard, complex bottoms, the WTGs may function as fish aggregating devices (BOEM, 2012) and provide additional habitat for certain species. Based on the intensity of recreational fishing within the WDA and its geographic scale, neither congestion effects nor gear conflicts are expected, in the event that WTGs aggregate recreationally targeted species.

Navigation through the WDA, particularly for smaller vessels, should not be impacted.

7.5.2.2.3 Avoidance, Minimization, and Mitigation Measures

Impacts associated with scheduled, periodic maintenance activities during the operations and maintenance phase will be adequately minimized or mitigated through the implementation of best management practices ("BMPs") when practicable.

To aid mariners navigating the WDA, WTGs and ESP will be lit, marked, and maintained as Private Aids to Navigation in accordance with International Association of Lighthouse Authorities ("IALA") Guidance for the marking of man-made offshore structures (IALA Recommendation O-139, edition 2, 2013), and US Coast Guard approval.

During the operations and maintenance phase, WTG and ESP foundations may become popular fishing locations, and recreational fishing activities may increase. Anglers' interest in visiting the WDA may also lead to an increased number of fishing trips out of nearby ports which could support an increase in angler expenditures at local bait shops, gas stations, and other shore side dependents (Kirkpatrick et al., 2017).

7.5.2.3 Decommissioning

As described in Section 4.4.3 of Volume I, no decommissioning work is planned for the Project's onshore facilities, although removal of Project cables via existing manholes may occur if required. The splice vaults, duct bank, and onshore substation will likely remain as valuable infrastructure that would be available for future offshore wind projects developed within the Vineyard Wind Lease Area or elsewhere.

Decommissioning of the offshore components, described in Section 4.4 of Volume I, include removal of WTG and ESP pile foundations and cables within the WDA and OECC. Impacts from these activities will be similar to those associated with construction.

The O&M Facilities can be easily repurposed for continued use by Vineyard Wind or another site operator. Decommissioning of the offshore components is described in Section 4.4 of Volume I.

7.5.2.3.1 Impacts to Recreational Resources

During the decommissioning phase, vessel operations will increase in the area surrounding the Project's ports, navigational channels, inshore traffic zones and any traffic separation scheme along the selected route to the WDA.

7.5.2.3.2 Impacts to Recreational Fisheries

During the decommissioning phase, vessel operations will increase in the WDA and along the selected route to and from the WDA.

Potential water quality impacts as they may relate to species targeted by recreational fishing vessels are described in Section 6.6.

7.5.2.3.3 Avoidance, Minimization, and Mitigation Measures

As noted in Section 7.1.2.1.3 above, and elsewhere, Vineyard Wind will implement a comprehensive communications plan to keep the relevant parties informed throughout this phase of the Project. All Project-related vessels, equipment, and appurtenances will display the required navigation lighting and day shapes. Offshore Wind Mariner Updates and Notices to Mariners will be distributed by Vineyard Wind and USCG to notify recreational and commercial vessels of their intended operations to/from and within the WDA.

Mitigation of potential water quality and other impacts as they may relate to species targeted by recreational fishing vessels are described in Section 6.6.

7.6 Commercial Fisheries and For Hire Recreational Fishing

Commercial and for-hire recreational fishing are vital economic activities that take place in state and federal waters off the south coast of Massachusetts, Cape Cod and the Islands; and off the coast of Rhode Island, Connecticut, and the eastern Long Island region of New York. For purposes of describing commercial and for-hire regional fisheries and assessing potential fishery-related economic impacts of the Project, this area is referred to as the "Project Region." The Project Region also includes an important and growing aquaculture industry which is focused primarily on shellfish, and is currently located along the south coast of Massachusetts.

This section describes commercial and for-hire recreational fishing activities within the Project Region, within the Massachusetts Wind Energy Area ("MA WEA"), and within the Wind Development Area ("WDA"). It also develops estimates of potential economic impacts on these fisheries from Project activities during construction and installation, operation and maintenance, and decommissioning. These estimates of economic impacts are based primarily on how the Project is expected to impact fish resources, as described in Section 6.5 (benthic resources) and Section 6.6 (finfish and invertebrates), and how it is expected to impact fishing activity, as described in Section 4.1.7 of the Vineyard Wind Navigational Risk Assessment (Appendix III-I). Economic impact estimates were also based on Vineyard Wind's extensive outreach and engagement with the commercial fishing industry, which includes interviews with fishermen and meetings with groups of fishermen who operate in and near the Project Region, and supplemental fishing data and fishing information provided by fishermen.

This section has five main parts.

- Section 7.6.1 provides an overview of fishing fleets, fishing ports, fishing activity, and the value of fish harvested in the Project Area, and outlines how state and federal regulations affect fishing in the Project Area.

- Section 7.6.2 presents baseline "without Project" estimates of the economic value of fishing activity in the Project Region, within the MA WEA and within the WDA. These values represent the economic "exposure" or potential economic impact of development in these areas.

  It also describes sources of data that were used to develop baseline economic values. These include maps of fishing activity based on Vessel Monitoring System ("VMS"), Vessel Trip Reports ("VTRs"), and landings databases maintained by the Northeast Regional Ocean Council ("NROC") and the Mid-Atlantic Council on the Ocean ("MARCO"); estimates of the baseline economic value of commercial fisheries in the MA WEA presented in a recent study by BOEM (Kirkpatrick, et. al. 2017); and baseline economic values of commercial fishing in the Vineyard Wind Lease Area that were presented in a recent study by the Rhode Island Department of Environmental Management ("DEM" [Livermore, 2017]). Baseline estimates of fishing values were modified and refined based on individual interviews and group meetings with commercial fishers and supplemental fishing data provided by them.

- Section 7.6.3 describes the approach that was used to estimate "with Project" economic values associated with fishing activities within the WDA and to determine potential fishery-related impacts of the WDA. The approach used was a conventional application of fishery economic methods which aims to trace two separate pathways by which changes in fishing conditions affect fishing trip performance and generate economic impacts. The first pathway involves changes in fish resources which, for purposes of fishery economic analysis, are best characterized in terms of changes in the abundance, availability, and catchability of various fish species. Section 6.5, Benthic Resources, and Section 6.6, Finfish and Invertebrates, provided the basis for this analysis. The second impact pathway involves Project-related activities within the WDA that may change the level or allocation of fishing effort; in particular, changes that increase steaming, searching, or idle time or otherwise reduce fishing time, or require more time fishing in less productive or less familiar waters. Section 4.1.7 of Appendix III-I and interviews with fishermen provided the basis for assessing this pathway of potential economic impacts.

- Section 7.6.4 summarizes results of the analysis and presents "sensitivity" tests which show how fishery-related economic impact estimates respond to worst-case assumptions (e.g., higher than average fish abundance in the WDA when it is closed to fishing) as opposed to assumptions based on expected conditions (e.g., typical

fish abundance in the WDA which is not closed to fishing). This section also presents information to help interpret the extent of potential economic impacts associated with disruptions in certain fishing conventions within the WDA that were identified by fishermen, such as the need for vessels to make straight east-west tows when trawling for squid and "gentlemen's agreements" between mobile and fixed gear fishers which are used to prevent space/use conflicts and gear loss.

- Section 7.6.5 discusses for-hire recreational fishing within the Offshore Project Area.

To provide context for interpreting results of the analysis presented in Section 7.6.2 through 7.6.4, it is useful to consider the relative size of the WDA with respect to the MA WEA, and the proximity of the WDA to important fishing ports and fishing areas. The Vineyard Wind Lease Area occupies 22.5 percent of the MA WEA and the WDA, which represents 45.3 percent of the Lease Area, accounts for 10.2 percent of the MA WEA. This is relevant because the BOEM fisheries study (Kirkpatrick, 2017) estimated the average annual value of fish taken in the MA WEA during 2007-2012 to be $3.03 million and the DEM fisheries study (Livermore, 2017) estimated the average annual value of fish taken in the Lease Area during 2011-2016 to be $0.858 million. That is 28.3 percent of Kirkpatrick's (2017) harvest value estimate for the MA WEA which was based on data for a few years earlier. Accounting for differences in the sample years the results of the two studies validate one another and indicate that the economic value of fishing is fairly uniformly distributed across the MA WEA at $1,000 to $1,200 per km^2 with the average value of annual catches from the WDA during 2011-2016 estimated to total $348,450.

Additionally, the estimated value of fishery exposure within the MA WEA and/or WDA does not reflect fishermen income from fishing in the WDA because estimated exposure does not account for fishing costs. By some estimates, including that of NOAA's Fisherman's Contingency Fund Program, fishing costs may be approximately 50 percent of landed value. Applying such an estimate to aid in valuing potential income from landings harvested in the WDA suggests that approximately half of estimated fishery exposure described below might be considered loss of income should vessels elect to not fish within the WDA.

7.6.1 Description of the Affected Environment

This section provides an overview of fishing fleets, fishing ports, fishing activity, and the value of fish harvested in the Project Area, and outlines how state and federal regulations affect fishing in the Project Area. Landings data is largely sourced from NOAA's Fisheries Statistics Division and the Atlantic Coastal Cooperative Statistics Program's ("ACCSP") "data warehouse."

7.6.1.1 Massachusetts Commercial Fishing Ports

Data from the NMFS Fisheries Statistics Division identify several important commercial fishing ports within the Project Region, including ports in Massachusetts, as some of the most valuable in the US. Although the highest revenue producing fishery in the Project Region is the scallop fishery, largely landed at the Port of New Bedford, other species are important to Massachusetts's commercial fishing fleets. Prominent among the Massachusetts fisheries are sea scallop, lobster, oyster, surf clam, haddock, and monkfish; each of these fisheries consistently exceed ten million dollars in landed value each year. Massachusetts' Jonah crab fishery exceeded $10 million in landed value for the first time in 2017.

According to NMFS data, the two most valuable Massachusetts fisheries are the sea scallop and lobster fisheries. Each year since 2007, the sea scallop fishery has landed an average of 28.9 million pounds, worth an annual average of approximately $276 million. Over the same period of time, the state's second most valuable fishery, the lobster fishery, landed an annual average of approximately $61 million.

Port of New Bedford

The Port of New Bedford is home to a commercial fleet of an estimated 500 commercial fishing vessels, including approximately 238 federally permitted vessels in 2017. New Bedford has a well-established shore side economy serving the commercial fishing industry; including approximately 44 fish wholesale companies, 75 seafood processors, and another 200 related shore side industries. Maritime International, which operates in New Bedford, has one of the largest US Department of Agriculture-approved cold treatment centers on the East Coast. American Seafoods, one of the largest seafood companies in the US, has a large processing facility in New Bedford where they process primarily scallops. Northern Pelagic Group, LLC ("Norpel"), also in New Bedford, is one of the largest pelagic processing companies in the US, catching and processing both mackerel and herring with a dedicated fleet of mid-water trawlers. Eastern Fisheries, Inc. is the New Bedford-based owner and operator of the largest scallop fleet in the industry. New Bedford's auction house, Whaling City Seafood Display Auction, opened in 1994, allowing fishermen to get fair prices for their catch and providing buyers with a more predictable supply of seafood (Colburn et al., 2010).

Much of New Bedford's commercial fishing revenue comes from the sale of scallops. Commercial fishermen landed 22.8 million pounds of sea scallops in Massachusetts worth over $280 million in 2016, and the majority of this catch was landed in New Bedford. In addition to scallops, other top species landed in New Bedford include: Monkfish (Lophius americanus), Atlantic Surf Clams, Ocean Quahog, American Lobster (Homarus americanus), Skate, Mackerel, Atlantic Butterfish (Peprilus triacanthus), Summer Flounder (Paralichthys dentatus), Scup (Stenotomus chrysops), Black Sea Bass (Centropristis striata) (NOAA, 2018).

In total, commercial fishermen operating from New Bedford landed over 106.6 million pounds of fish in 2016, worth an estimated $326.5 million dollars. New Bedford has consistently been the highest value-producing fishing port in the US.

Provincetown and Chatham

Combined, the commercial fishermen in the communities of Provincetown and Chatham landed over 26.5 million pounds of fish in 2016, worth an estimated $32.8 million dollars. Top species landed in Provincetown and Chatham include American Lobster, Scallops, Skate, Monkfish, Dogfish, Summer Flounder, Scup, Black Sea Bass, Atlantic Surf Clams, and Ocean Quahog (Colburn et al., 2010).

Martha's Vineyard and Nantucket

Martha's Vineyard, and to a lesser extent, Nantucket have commercial fishing and for-hire recreational fishing fleets active in the Project Region. Traps, pot, and gillnet fishermen from the Martha's Vineyard Fishermen's Preservation Trust, and other active fishermen on Martha's Vineyard, have identified a number of active fishing locations in the Project Region.

7.6.1.1.1 Near-Shore Commercial Shellfish Resources

As noted in Section 7.6.1.1, Massachusetts cities and towns manage the shellfisheries in all waters within their boundaries that are not closed by the DMF for public health or other reasons, with the exception of the commercial harvest of Surf Clams and Ocean Quahogs that remain under state control. The OECC includes two potential Landfall Sites that may affect near-shore commercial shellfishing activities in the Towns of Yarmouth and Barnstable.

Town of Yarmouth

There are a total of seven aquaculture grants within Lewis Bay in Yarmouth. As shown on Figure 7.6-1, three aquaculture grants are located in a close group near Pine Island, and four others are located within Uncle Roberts Cove off Great Island. The Town of Yarmouth also operates two "upweller" facilities for the propagation of shellfish seed.

Lewis Bay is reportedly one of the best remaining areas where bay scallops can be effectively targeted for commercial harvest in the Project Region. There are approximately 20 licensed vessels participating in the fishery, and approximately ten of those are actively harvesting from Lewis Bay on a daily basis. The vessels participating in this fishery are typically small boats that are often launched from trailers at either Englewood Beach or the Hospital Ramp.

The Town of Yarmouth stocks quahogs in the area located between Englewood Beach and Mill Creek to a distance of approximately 365 meters ("m") (400 yards ["yds"]) offshore, in the area of the New Hampshire Avenue Landfall Site, as shown on Figure 7.6-1. This is a put-and-take relay program whereby contaminated Quahogs from the Taunton River are transplanted to Lewis Bay and, after a sufficient depuration period, are made available for commercial and recreational harvest.

Town of Barnstable

The Town of Barnstable has an active shellfish propagation program for Quahogs, Oysters, Soft Shell Clams, and Bay Scallops. The Town's propagation programs, including the in-town and out-of-town shellfish relay programs, Quahog upwelling facility and the Oyster propagation program are credited with helping to replenish shellfish resources throughout the study area, which includes the Three Bays and the Centerville River estuarine systems and adjacent waterfront. The in-town relays take contaminated Quahogs from the Centerville River and East Bay, and relay them to West Bay, and most recently to Bay Street, Osterville. For the out-of-town relay, mildly contaminated Quahog stock from off Cape Cod locations is purchased by the Town and transplanted into the designated shellfish relay areas.

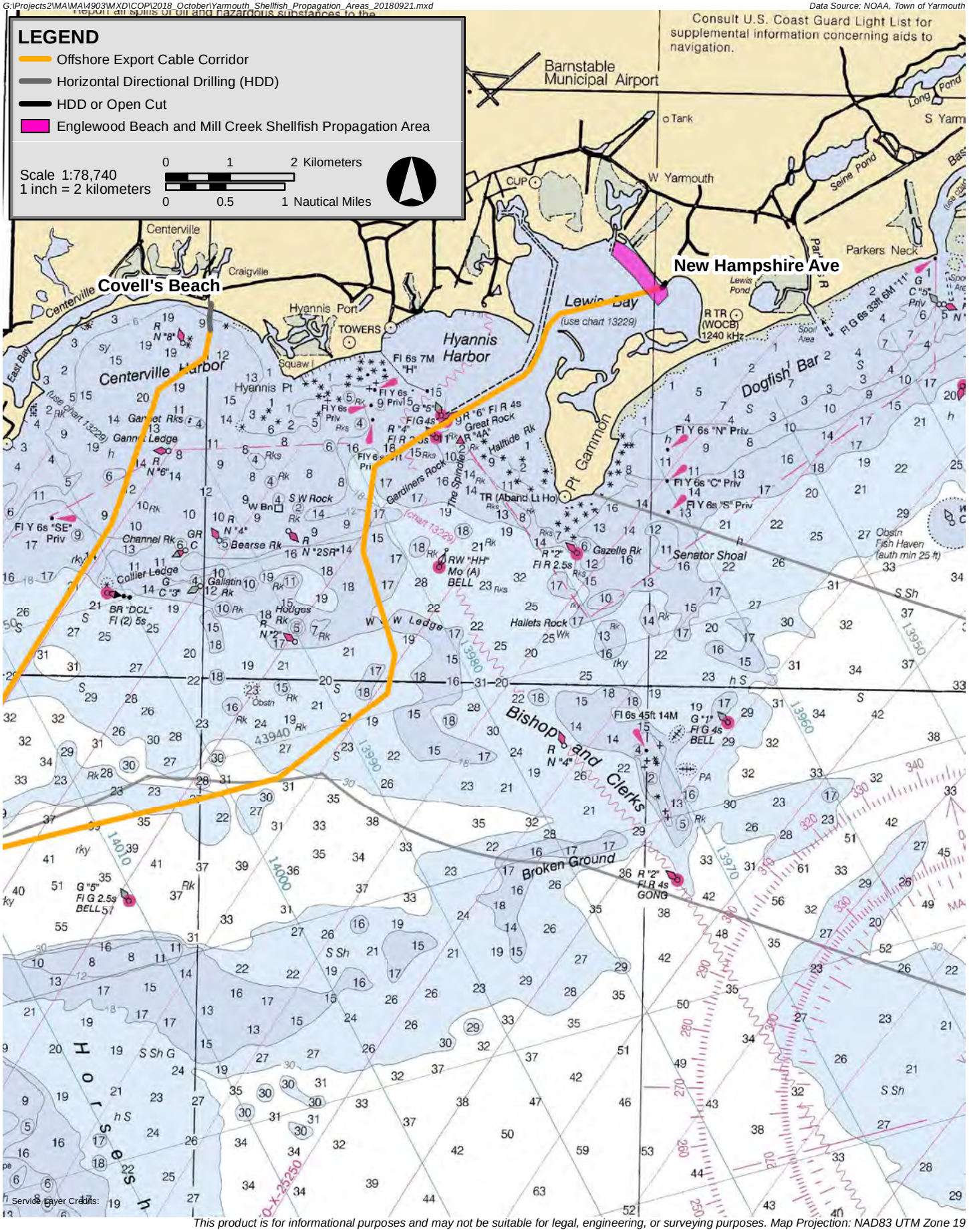
As shown on Figure 7.6-2, as of 2016, Hyannis Inner Harbor and west of the terminus of Long Beach Road along Craigville Beach, in proximity to the Covell's Beach Landfall Site, are closed to shellfishing.

7.6.1.2 Rhode Island Commercial Fishing Ports

Commercial fishermen operating in the MA WEA may also be homeported in Rhode Island. The MA WEA is relied on primarily by pot, gillnet, bottom trawl, and midwater trawl fishermen operating from Rhode Island ports. Landings from these vessels consist mainly of small mesh species (Hake, Squid, Mackerel and Butterfish), Ocean Quahogs, Skates, Monkfish, and Jonah Crab (*Cancer borealis*) (Kirkpatrick, et al., 2017). Fishermen active in the MA WEA may be operating from harbors in addition to those described below.

Point Judith and Narragansett

The Port of Galilee in Point Judith is the most active fishing port in Rhode Island, and is supported by bait shops, commercial marine suppliers, and vessel repair shops. In 2017, there were 120 federally permitted vessels with their home port in the Point Judith, 92 of which possess a federal permit in the Squid, Mackerel, Butterfish Fishery Management Plan. The Port has a number of fish processing companies that do business locally, nationally, and internationally. Point Judith's largest fish processors are the Town Dock Company,



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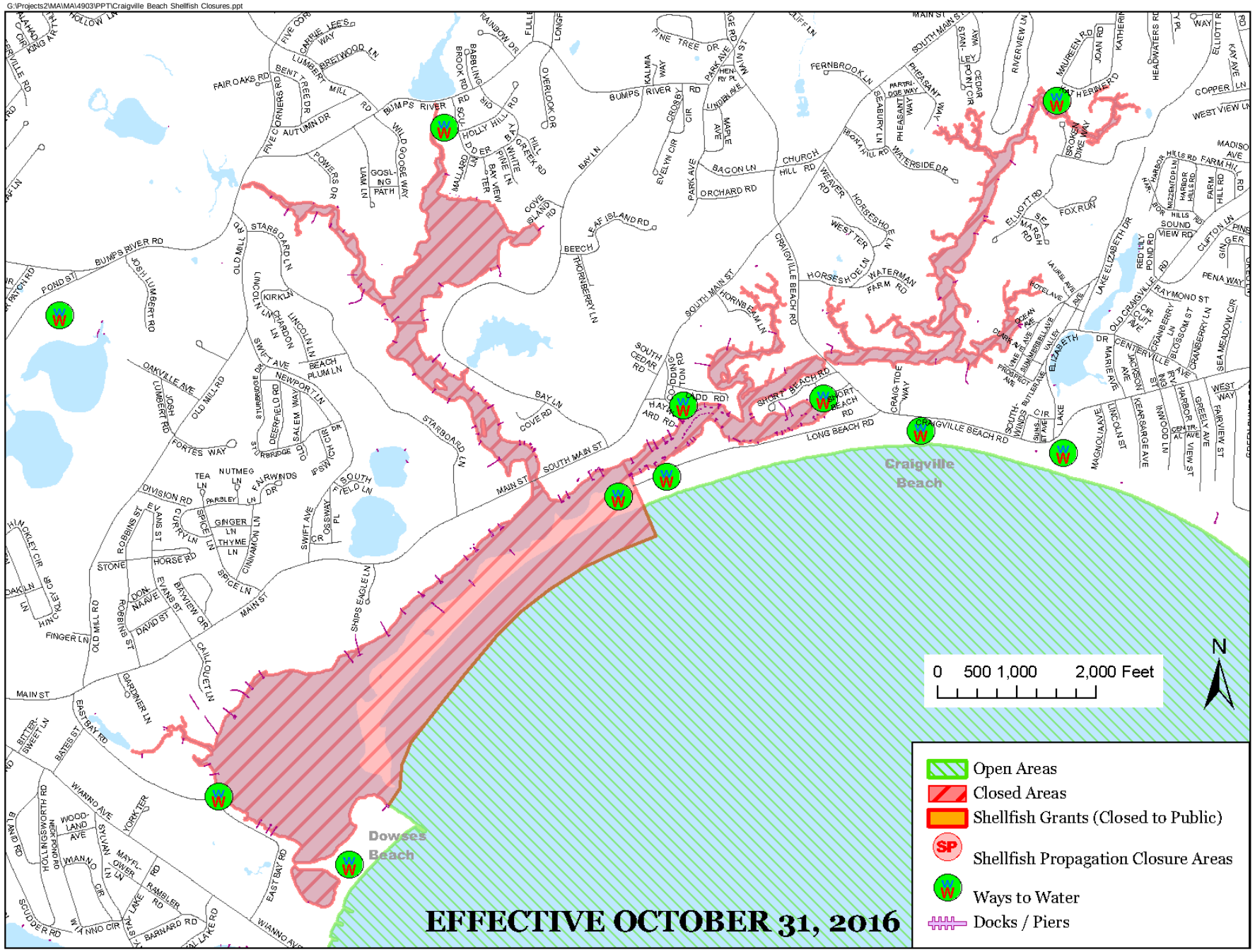
Vineyard Wind Project

VINEYARD WIND

Figure 7.6-1

Yarmouth Shellfish Propagation Areas



Vineyard Wind Project

VINEYARD WIND

Figure 7.6-2

Craigville Beach Shellfish Closures

Handrigan's Seafood, and Seafreeze Shoreside. Several smaller processors are also located in the Point Judith area: Ocean State Lobster Co., Narragansett Bay Lobster Co., Fox Seafood, Osprey Seafood, Sea Fresh America, and The Local Catch Inc., a Community Supported Fishery (Colburn et al., 2010).

In 2016, Point Judith ranked 18th in landed weight, with 53.4 million pounds, and 15th, in terms of dollars landed out of all major ports in the US. In the New England Region, Point Judith ranked third in both pounds and dollar value landed (NOEP, 2017). Most of Point Judith fishing revenue comes from the sale of squid, American Lobster, Summer Flounder, Sea Scallop (*Placopecten magellanicus*), Scup, Monkfish, Silver Hake (*Merluccius bilinearis*), Jonah Crab, Atlantic Herring (*Clupea harengus*) and Yellowtail Flounder (*Limanda ferruginea*). A seasonal longline fishery for Tuna also operates out of the port (Colburn et al., 2010).

North Kingstown

The North Kingstown fishing fleet lands a wide variety of species groupings and the port has a number of commercial operations and associations involved in commercial fishing industry. Located in North Kingstown are American Mussel Harvesters, one of the Rhode Island's largest purchasers and suppliers of clams and mussels, and SeaFreeze, Ltd., which is the largest producer of sea-frozen fish on the east coast of the US and berths the two largest fishing vessels in the state, F/V Relentless and F/V Persistence. Top species harvested in port: squid, mackerel, butterfish, herring. (Colburn et al., 2010).

7.6.1.3 Connecticut Commercial Fishing Ports

Commercial fishermen operating in the MA WEA may also be homeported in Connecticut. According to Kirkpatrick, et al. (2017), the MA WEA is relied on by vessels operating from Stonington, Connecticut. However, Connecticut ports were not among the commercial fishing ports most exposed to development in the MA WEA. Kirkpatrick (2017) indicates that the less than 0.5% of Connecticut's total commercial fishing revenue, if any, would be sourced from the MA WEA. Fishermen active in the MA WEA may be operating from harbors in addition to those described below.

Stonington

Stonington is the largest fishing port in the state of Connecticut, both by pounds and value landed. Stonington vessels landed 9.0 million pounds of catch in 2016 worth $5.1 million, making Stonington the 111th most valuable port in the US. The limited data available on Stonington's commercial fishing fleet suggests it is small but diversified, and includes gillnetters, draggers, and lobster fishermen. (Colburn et al., 2010; Hall-Arbor, et al., 2001). Stonington's most valuable landings in 2014, as reported by NOAA, are Fluke, Scup, Black Sea Bass, Butterfish, Mackerel, and Squid. The commercial fishing fleet is supported by local processing facilities.

Port of New London

The New London fishing fleet is the second most productive in the State of Connecticut. New London vessels landed 2.1 million pounds of catch in 2016 worth $5.1 million, making New London the 116th most valuable port in the US. New London's most valuable landings in 2014, as reported by NOAA, are Scallops, Whiting, Butterfish, Mackerel, and Squid,

7.6.1.4 New York Commercial Fishing Ports

Commercial fishermen operating in the MA WEA may also be homeported in New York. According to Kirkpatrick (2017), the MA WEA is relied on by hand gear, longline and bottom trawl fishermen operating from New York ports, though dredge fishermen have been reported to also operate in the MA WEA. Fishermen active in the MA WEA may be operating from harbors in addition to those described below.

Montauk

The village of Montauk is the largest fishing port in the state of New York, both by pounds and value landed. Montauk landed 11.8 million pounds of catch in 2016 worth $16.3 million, making Montauk the 68rd most valuable port in the US. Kirkpatrick's (2017) analysis of the MA WEA estimated that 1.3% of Montauk's commercial fishing revenue was sourced from within the MA WEA.

Hampton Bays and Shinnecock

Hampton Bays and Shinnecock, here considered to be the same community, is New York's second largest fishing port. Shinnecock is the fishing port located in Hampton Bays, and fishermen use either port name in reporting their catch (NOAA, 2005). Combined, the Hampton Bay and Shinnecock commercial fishing fleet landed 5.2 million pounds of catch in 2016, worth $8 million. Fifty-four commercial vessels were homeported in Hampton Bays in 2006, the most recent year data available (Colburn et al., 2010). No estimate of Hampton Bays' commercial fishing revenue sourced from within the MA WEA is available, though vessels from Hampton Bays operate in the area, according to BOEM data (Kirkpatrick, 2017).

7.6.1.5 New Jersey Commercial Fishing Ports

Commercial fishermen operating in the MA WEA may also be homeported in New Jersey. According to BOEM (Kirkpatrick, 2017), the MA WEA is relied on by longline and dredge fishermen operating from Cape May and Barnegat Light, New Jersey. Fishermen active in the MA WEA may be operating from harbors in addition to those described below.

Cape May/Wildwood

The Port of Cape May/Wildwood is the largest commercial fishing port in New Jersey. The Port serves as the center of fish processing and freezing in New Jersey and has numerous shore side support and supply services. Cape May has an active trawler fleet in addition to Scallop and Sea Clam dredgers, pot boats, handliners and purse seiners (NJDA, n.d.).

In 2016, the Cape May/Wildwood commercial fishing industry landed 46.6 million pounds of fish, worth an estimated $84.7 million. Cape May's fishing industry currently generates most of its revenue from the sale of Sea Scallops, Squid, Mackerel, and Butterfish.

Top species harvested in port: Sea Scallops, Butterfish, Summer Flounder, Scup, Black Sea Bass, Atlantic Surf Clams, Ocean Quahog, American Lobster, Atlantic Herring, Monkfish (Colburn et al., 2010).

Barnegat Light

Barnegat Light is the primary commercial seaport on Long Beach Island with approximately 36 commercial boats, working year-round, as well as recreational vessels and transient vessels. Barnegat Light's two commercial docks are home to several scallop vessels, longliners, and a fleet of smaller, inshore gillnetters

7.6.1.6 Fisheries Management

Under the Magnuson-Stevens Fishery Conservation and Management Act, 16 USC. § 1801 et seq., which is the primary mechanism governing fishing in US federal waters, including the WDA, certain fish species are managed through species-specific management plans developed by eight Regional Councils. The Regional Council system allows regional, participatory governance of different fisheries by knowledgeable stakeholders. These councils develop fishery management plans ("FMPs"), which include fishing seasons, quotas, and closed areas. The Regional Councils propose rules for fishermen operating in federal waters and also address habitat issues across multiple plans. The FMPs and other measures are implemented by the National Marine Fisheries Service ("NMFS").

Within the Project Region, the New England Fisheries Management Council ("NEFMC"), the Atlantic States Marine Fisheries Commission ("ASMFC"), the Mid-Atlantic Fisheries Management Council ("MAFMC"), and the National Oceanic and Atmospheric Administration's ("NOAA") Highly Migratory Species Office manage the various fisheries. The NEFMC is the primary council in the Project Region, and is charged with conserving and managing the fishery resources of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut, including the Gulf of Maine and Georges Bank. The NEFMC overlaps with the Mid-Atlantic Council for some species harvested in the New England Region.

The ASMFC has coordinated interstate management of the lobster fishery from zero to three miles offshore since 1996. The management unit includes all coastal migratory stocks between Maine and Virginia. American Lobster is currently managed under Amendment 3 and Addenda I-XXIV to the Fishery Management Plan. Three separate stocks of lobsters are managed: the Gulf of Maine, Georges Bank, and Southern New England, with each stock further divided into seven management areas. The WDA is within Area 2 of the Southern New England Stock.

The Massachusetts Division of Marine Fisheries ("DMF") and the Rhode Island Department of Environmental Management ("DEM") oversee commercial fishing within their respective state waters. DMF maintains the sole authority for the opening and closing of areas for the taking of any and all types of fish in state waters. In the Massachusetts Ocean Management Plan (2015), areas of "high commercial fishing effort and value" within state waters were identified, including portions of the Project Region; notably, within Nantucket and Vineyard Sounds, as shown on Figure 7.6-3.

In Massachusetts, cities and towns manage the shellfisheries in all waters within their boundaries that are not closed by the DMF for public health or other reasons, with the exception of the commercial harvest of Atlantic Surf Clams (*Spisula solidissima*) and Ocean Quahogs (*Artica islandica*) that remain under state control.

7.6.2 Baseline "Without Project" Economic Value of Fishing Activity

Following sections present baseline "without Project" estimates of the economic value of fishing activity in the Project Region, within the MA WEA, and within the WDA. These values represent the economic "exposure" or potential economic impact of WDA development in these areas. More detailed economic exposure estimates for Rhode Island and Massachusetts fisheries are provided in Appendix E and F of the COP Addendum, respectively.

7.6.2.1 Commercial Fishing Data Sources

Several data sources and reports provide information on commercial fishing activities within the Project Region, the MA WEA, and the WDA. The following section describes the different data sources and reports compiled for the COP, the sources of that data, and the geographic area for which the data is available.

Vessel Monitoring Systems (VMS) Data

Both the Northeast Regional Ocean Council ("NROC") and the Mid-Atlantic Regional Council on the Ocean ("MARCO") maintain a suite of databases and maps of the ocean ecosystem and ocean-related human activities, including commercial fishing.

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Data Source: NOAA, BOEM

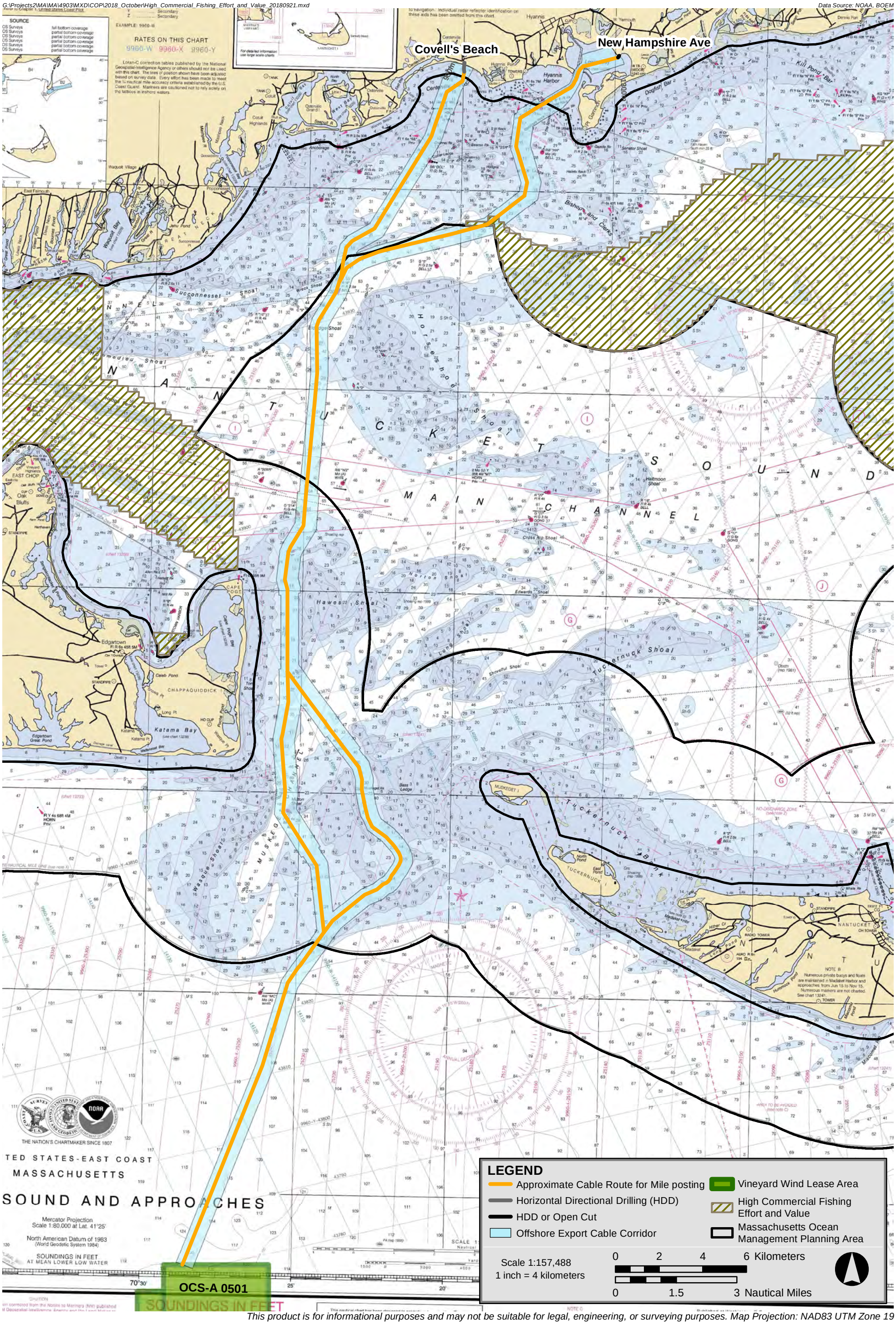

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Figure 7.6-3

Massachusetts Ocean Management Plan, High Commercial Fishing Effort and Value

The NROC and MARCO commercial fishing datasets and associated mapping of those datasets characterize the density of commercial fishing vessel activity for seven fisheries[20] in the northeast and mid-Atlantic regions of the US based on VMS data for the years 2006 to 2016. MARCO makes available NROC's VMS-based mapping products through their Mid-Atlantic Ocean Data Portal, where the VMS data is provided by NMFS. NMFS describes VMS as a satellite-based system primarily used to monitor the location and movement of commercial fishing vessels active in certain fisheries in the Project Region.

VMS data provided to NROC by NMFS contains the day, month, and year; the geographic coordinates of the vessel at the time of transmission; speed over ground; and the vessel's declaration code, which may signify fishery plan, program within that plan, and associated area identifier or gear-type information. VMS data are subject to strict confidentiality restrictions. Therefore, the maps produced by NROC[21] depict the density of vessel locations following the removal of individually identifiable vessel positions. The process of removing confidential vessel locations follow the "rule of three" mandated by NMFS Office of Law Enforcement ("OLE") by using a screening grid to identify which grid cells contained three or more VMS records. Per the rule of three, any record within a cell that contain fewer than three VMS records has been eliminated from the analysis.

In order to more likely identify active fishing rather than fishing vessels transiting the WDA, certain figures below characterize VMS data from vessels operating at or below a vessel speed consistent with gear deployment for that fishery. According to NROC, the speed thresholds were vetted through engagement with fishermen in each fishery. Although transformation of the VMS data expands the fine scale footprint of the more precise VMS data points, it provides visually informative results (Shmookler, 2015). The resulting density grids represent a "heat map" of the vessel activity which indicate a relative level of vessel presence and spatially represent specific fisheries over specific timespans.

Characterizing fishing effort with VMS data is also complicated by the fact that VMS is not required for all fishermen in some fisheries. For example, the Monkfish fishery has different requirements for vessels operating in the Southern Fishery Management area than for those vessels operating in the Northern Fishery Management Area. Moreover, fisheries oversight and management measures that affect the characterization of commercial fishing density are not static and are anticipated to be altered over time. Changes to fisheries as a result of oversight and management, fish distribution patterns, or environmental factors should be anticipated (Battista, et. al, 2013).

[20] The fisheries include Multispecies, Monkfish, Herring, Scallop, Surfclam/Ocean Quahog, Pelagics (Herring/Squid/Mackerel), and Squid.

[21] Analysis of the VMS data was performed by Applied Science Associates, Inc. ("RPS ASA") on behalf of NROC.

Vessel Trip Report (VTR) Data

MARCO[22] also produces a commercial fishing data visualization product using VTRs. Operators of NOAA Fisheries Greater Atlantic Region permitted vessels are required to submit a VTR for every fishing trip regardless of where the fishing occurs or what species are targeted, with the exception of those vessels that possess only a lobster permit. VTRs provide information on when and where catch occurred and each report includes the trip date, number of crew on board the vessel, species and quantities caught, and the trip location. Vessel permit data additionally includes a vessel's "principal port" as well as other variables describing the vessel itself (e.g. length, horsepower, and age).

VTR, however, only requires that fishermen report a single geographic position (point location) each fishing trip unless they switch to a new gear type or move into a new statistical reporting area. As a result, mapping of fixed gear fishing activity may be more accurate than mapping of mobile fishing gear, and mapping of single day trips may be more accurate than mapping of multi-day trips. VTR reporting requires that fishermen record the position where the majority of fishing occurred but because a new VTR is necessary only when gear type changes or fishing occurs in a new statistical areas, multiple tows within the same statistical area using the same gear will likely be assigned only a single point location, which may not necessarily represent the actual location of fishing activity.

MARCO's VTR-based maps characterize both fixed and mobile gear fisheries within the Project Region using trip location point data as inputs to create density polygons representing vessel visitation frequency. The VTR-based maps depict total labor including crew time and the time spent in transit to and from fishing locations. According to MARCO, VTR data were aggregated to the "community" level and none of the resultant maps represent a fishing area of any individual fisherman or fishing vessel.

When accessed through MARCO's Mid-Atlantic Ocean Data Portal, querying any single location on the VTR maps will display, for example, the various port communities that have recorded a significant level of fishing activity at that location. According to MARCO, drafts of the maps were reviewed with diverse fishermen and fishing industry managers throughout the Mid-Atlantic and New England states, including at Mid-Atlantic Fishery Management Council and New England Fishery Management Council meetings. MARCO also notes that overlay comparison of their VTR based maps with VMS based maps reveals substantial agreement between the two, and the VMS maps provide additional useful precision for fisheries where both VTR and VMS data are available.

[22] MARCO obtained VTR data from NOAA NMFS Northeast Fisheries Science Center, with methodology, data processing, and cartography provided by staff at the Center for Remote Sensing and Spatial Analysis (CRSSA) at Rutgers University.

Landings Data

The NOAA Fisheries Statistics Division maintains a publicly accessible automated data summary program of US commercial fisheries landings. The data summary program can be queried for commercial landings in several formats, including pounds and dollar value of commercial landings by years, months, states, and species for the years 1990 onwards.

The ACCSP also maintains a publicly accessible data warehouse of Atlantic coast fishery-dependent data supplied by the ACCSP's program partners. ACCSP's data warehouse includes commercial landings data which include state and federal landings submitted by both dealers and fishermen.

Vessels with Massachusetts Commercial Permits are required to submit monthly "Trip-level" reports for commercial landings. Permits with federal reporting requirements are exempt from reporting to DMF. Certain non-confidential landings data reported to DMF for landings within state designated Statistical Reporting Areas ("SRAs") were provided to Vineyard Wind. Landings data, reported below, are for those SRAs where Project-related activities may occur and are the cumulative total of federal and state landing reports. Only the OECC is within the SRAs; WTGs, ESPs, and inter-array cables are not located within SRAs or the waters of Massachusetts.

Automatic Identification System

The Automated Identification System ("AIS") is, in part, a shipborne mobile equipment system that typically consists of integrated Very High Frequency ("VHF") radio and Global Positioning Systems ("GPS") which broadcast a vessel's name, dimensions, course, speed and position, as well as destination and estimated time of arrival, amongst other vessel characteristics. The primary use of AIS systems is to allow vessels to monitor marine traffic in their area and to broadcast their location to other vessels with AIS equipment onboard. Broad categories of vessel type, including fishing vessels, can also be identified using the information contained in a vessel's AIS transmissions. Federal regulations require self-propelled commercial fishing vessels greater than 20 m (65 ft) in length to operate an AIS Class B device to broadcast vessel information. (33 C.F.R. § 164.46; USCG NAVCEN, 2017a).

Because of the autonomous and continuous nature of AIS data, it can also be compiled to establish a record of a vessel's operating history. Vineyard Wind obtained AIS data for portions of the Project Region that include the WDA and OECC. The AIS datasets were used to evaluate vessel traffic in the vicinity of the Project, including commercial fishing vessel traffic counts within the Lease Area, the WDA, and along the OECC.

7.6.2.2 Baseline Fishing Activity in the Offshore Project Area

Portions of the WDA are utilized by commercial fishermen. Vineyard Wind's extensive outreach and conversations with over 100 fishery stakeholders has aided in identifying commercial fishing effort in the WDA. Based on feedback from the fishing community during that outreach, the following fisheries likely fish within the WDA and along to the OECC and therefore are potentially impacted by the Project:[23]

- Static gear fisheries (gill nets, traps/pots)
- Groundfish/Bottom trawl mobile gear (Squid/Fluke/Atlantic Mackerel, Whiting, Butterfish)
- Atlantic Surfclam/Ocean Quahog dredge fishery

AIS data was queried to establish estimates of commercial fishing vessel traffic within the WDA and along the OECC. These vessel counts are believed to capture larger commercial fishing vessels which are required to operate an AIS Class B device, such as the bottom trawl vessels over 65 feet in length characterized by MARCO's analysis of VTR data. The bottom trawl vessels that appear active in proximity to the WDA, likely representing small mesh gear mobile trawl vessels that are understood to be targeting squid in the Project Region. Thus, the AIS data provides additional clarity on the types and numbers of vessels that may operate near the WDA and OECC.

Table 7.6-1 identifies the number of commercial fishing vessels operating within the WDA in 2016 and 2017 based on AIS data. Vessel counts were tabulated individually; therefore, vessels may be counted more than once if present in the WDA across multiple months.

Table 7.6-1 Number of fishing vessels in the WDA per month (AIS 2016/17 data)[24]

Number of Fishing Vessels per Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	3	7	14	7	15	37	45	64	68	22	16	11
2017	11	15	26	56	60	67	53	44	26	18	9	6

[23] Vineyard Wind's on-going assessment of fishing effort in the Project Region will continue to be a collaborative effort among fishermen, Vineyard Wind, regulatory authorities, and other stakeholders and will inform the Project's best management practices ("BMPs") during construction.

[24] For more details on the AIS data, see Appendix III-I.

Vessel speed reported by AIS data may also indicate whether a vessel is fishing or transiting. Commercial fishing vessels are assumed to operate at vessels speeds up to four knots when mobile gear is deployed. When these vessels are transiting an open water area such as the WDA, they are assumed to operate at speeds in excess of seven knots. To estimate the number of the vessels that were potentially fishing within the WDA, the AIS data was queried to identify which of these vessels were operating at or below four knots. Based on this analysis, it is estimated that in 2017 approximately 54 percent of AIS–equipped commercial fishing may have deployed fishing gear within the WDA. This suggests, for example, that approximately 36 AIS-equipped commercial fishing vessels may have been fishing within the WDA the months with the highest count of AIS-equipped fishing vessels (June, 2017; September, 2016).

As described above, VMS data from commercial vessels has been used to characterize commercial fishing effort in the Project Region, including within the MA WEA and the WDA. The VMS datasets and associated mapping by NROC and MARCO qualitatively characterize the density of commercial fishing vessel activity for seven fisheries in the northeast and mid-Atlantic regions (Shmookler, 2015).

Maps of commercial fishing effort using VTR data were also created by MARCO and made available on their Mid-Atlantic Ocean Data Portal. Using VTR data to create density polygons that represent the visitation frequency of fishing vessels, MARCO's maps can be interpreted as an indicator of "community presence," in this case, the type of gear deployed in the WDA and the ports from which these vessels are operating.

Each of the aforementioned datasets produced qualitative representations of vessel activity within the Multispecies,[25] Monkfish, Herring, Scallop, Atlantic Surf Clam/Ocean Quahog, Mackerel, and squid fisheries, and within the bottom trawl, dredge, gillnet, longline, and pots and traps fisheries.

Figures 7.6-4 through 7.6-10 depict a standardized density of commercial fishing vessel activity within the Multispecies, Monkfish, Herring, Scallop, Atlantic Surf Clam/Ocean Quahog, Mackerel, and squid fisheries in the northeast and mid-Atlantic regions of the US based on NROC's VMS data for the years 2006 to 2016.

NROC's VMS-based analysis indicates the density of multispecies vessel activity can be characterized largely as "Medium-Low" throughout the WDA with some areas characterized as "Medium-High" (see Figure 7.6-4). Little to no multispecies vessel activity

[25] The multispecies data includes the following species: Cod, Haddock (*Melanogrammus aeglefinus*), Yellowtail Flounder, Pollock (*Pollachius pollachius*), Plaice, Witch Flounder (*Glyptocephalus cynoglossus*), White Hake (Urophycis *tenuis*), Windowpane Flounder (*Scopthalmus aquosus*), Atlantic Halibut (*Hippoglossus hippoglossus*), Winter Flounder, Redfish, Atlantic Wolffish (*Anarhichas lupus*), and Ocean Pout (*Macrozoarces americanus*).

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Data Source: NOAA, CZM, BOEM

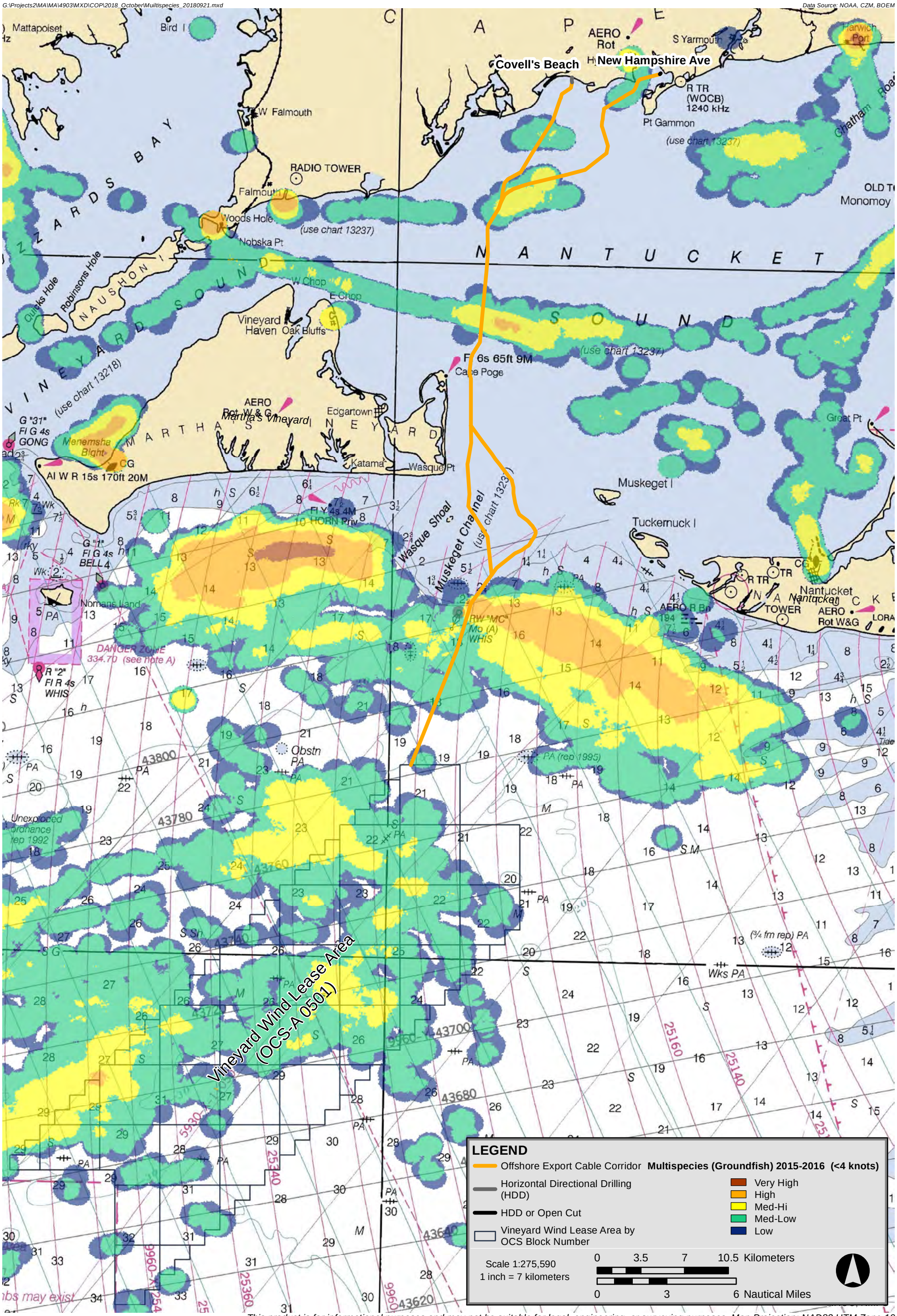

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Figure 7.6-4

Northeast Multispecies 2015-2016 (<4 knots) Commercial Fishing Density

is shown in the southerly portions of the WDA during the years analyzed. NROC does not define the terms "Medium-Low" or "Medium-High" other than to note they are relative to the density of vessel traffic estimated by their model. The highest relative vessel density is to the north, outside of the WDA. Along the OECC south of Martha's Vineyard and Nantucket, NROC identifies multispecies vessels active to the east and west of Muskeget Channel.

Some vessels targeting Monkfish (see Figure 7.6-5) appear to be deploying gear in portions of the WDA during the years analyzed. Vessel density increases to the north of the WDA, in the areas on either side of Muskeget Channel.

Scallop vessel density during the years analyzed is Medium-Low, with a small section characterized as "Medium-High" within limited areas of the WDA and along a section of the OECC near Muskeget Channel (see Figure 7.6-6).

Vessels targeting Surfclam/Ocean Quahogs appear to have a limited presence in the WDA during the years analyzed. Areas of Medium-High to High density occur to the northwest of the WDA (see Figure 7.6-7).

Squid vessels appear active in the WDA and along portions of the OECC through Nantucket Sound (see Figure 7.6-8) during the years analyzed. However, the highest level of squid activity occurs outside and to the north of the WDA. Fishermen indicate that squid activity primarily occurs near the WDA, offshore in federal waters, from approximately May/June to August, and areas within Nantucket Sound and Massachusetts coastal waters are active from April to June. This is consistent with the AIS data presented in Table 7.6-1.

During the years analyzed, vessels targeting Mackerel and Herring do not appear to deploy gear in the WDA (see Figures 7.6-9 and 7.6-10).

Fisheries representatives have also indicated that vessels targeting Whiting (*Merluccius bilinearis*) and Scup, may be active in the WDA throughout the year and vessels targeting Yellowtail and Winter Flounder (*Pseudopleuronectes americanus*) are active south of the WDA, in proximity to the northwest corner of The Dump. The Whiting fishery is not represented in VMS heat map data since regulations allow vessels to "Declare Out of Fishery" or "DOF" when targeting Whiting. Vineyard Wind is working with Whiting fishermen to obtain data on vessel activity in the WDA to better understand the fishery.

As noted above, the American Lobster fishery is active in the Project Region, which is located in Area 2 of the Southern New England Lobster Management area. The American lobster resource and fishery are cooperatively managed by the states and NMFS under the framework of the Atlantic States Marine Fisheries Commission. According to the Greater Atlantic Regional Fisheries Office, 172 Federal lobster permits were issued for Area 2 in 2017. Based on review of the Federal Permit dataset for 2017, approximately 68 of these

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Data Source: NOAA, BOEM, CZM

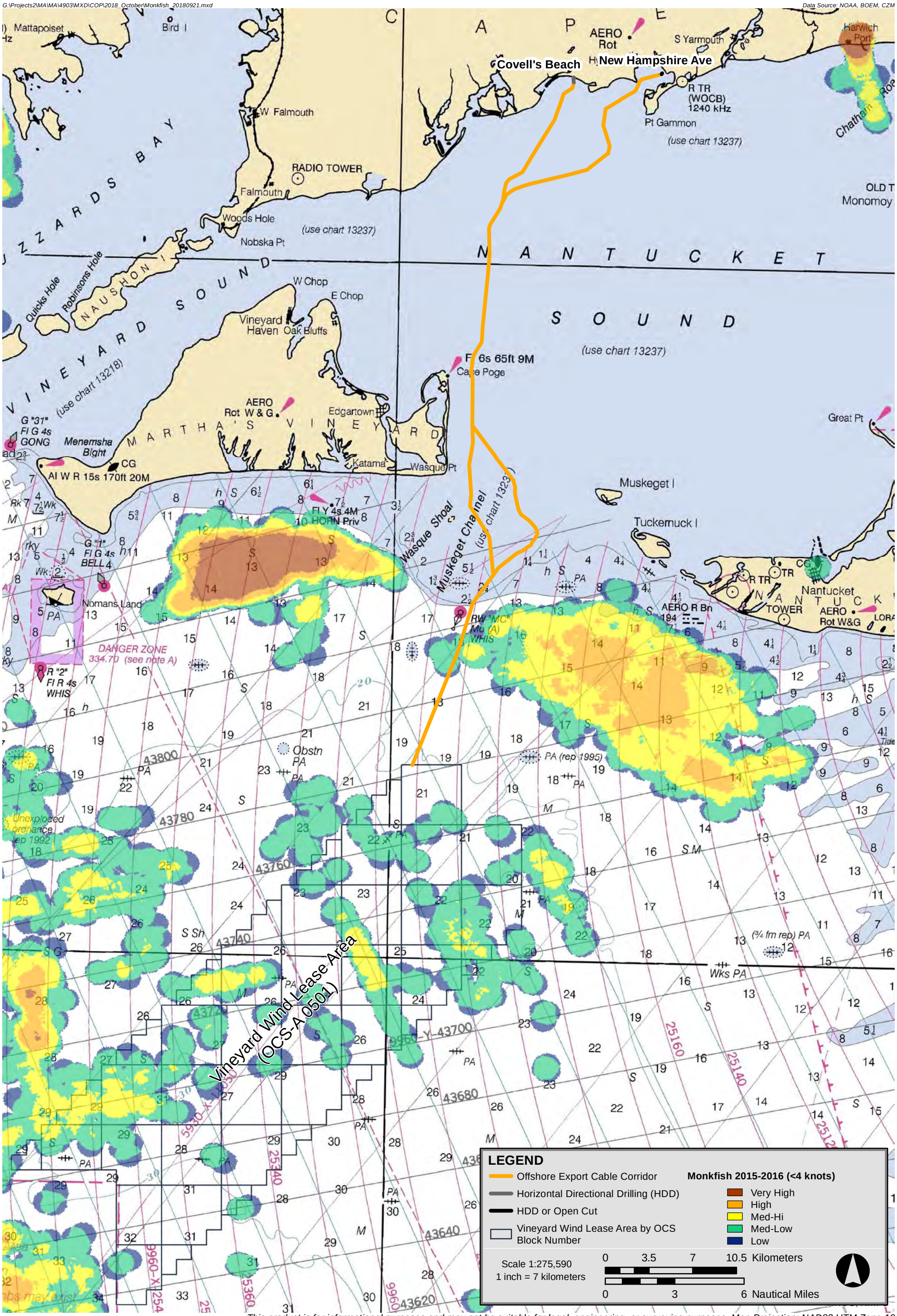

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Figure 7.6-5

Monkfish 2015-2016 (<4 knots) Commercial Fishing Density

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Data Source: NOAA, BOEM, CZM

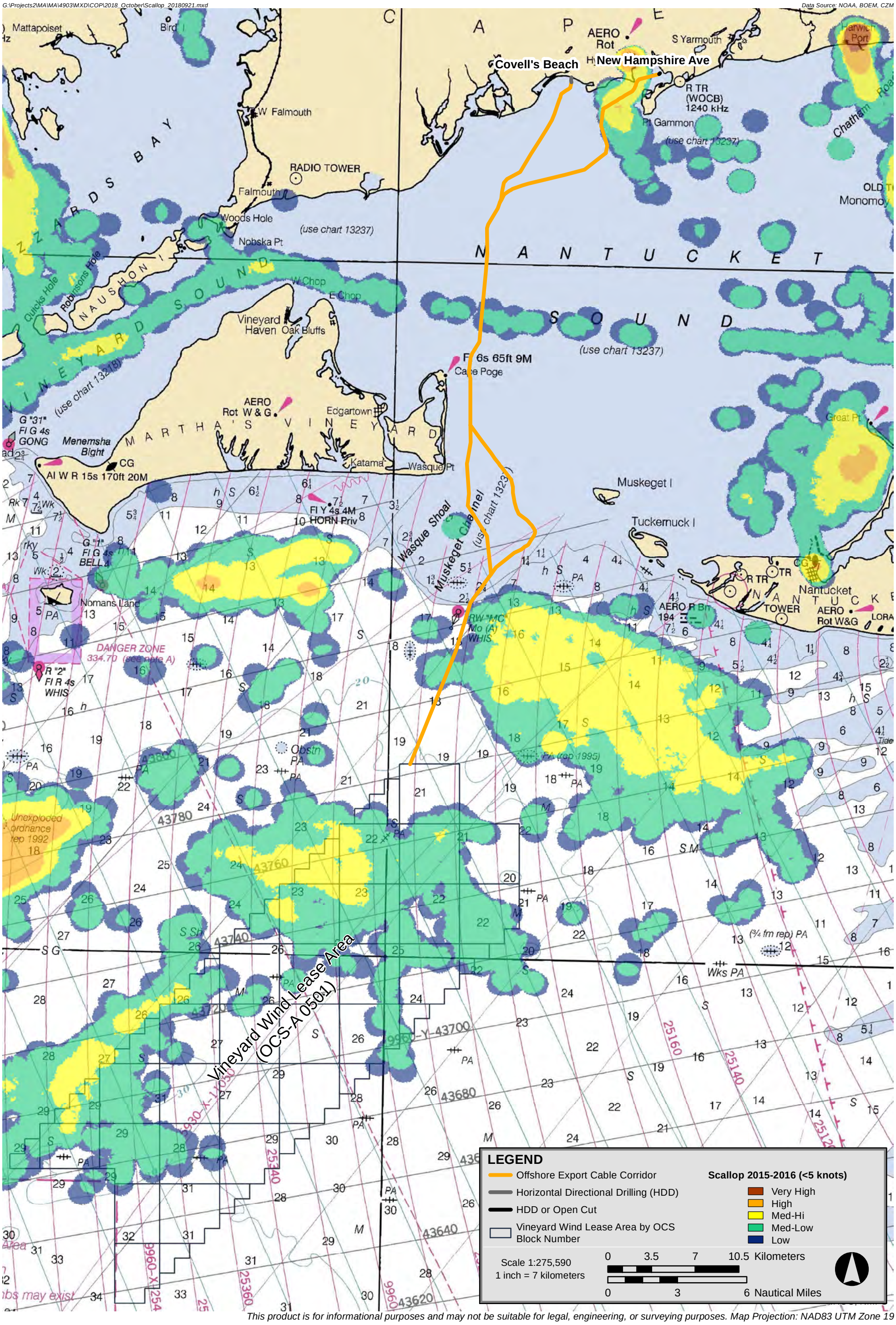

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Figure 7.6-6

Scallop 2015-2016 (<5 knots) Commercial Fishing Density

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Data Source: NOAA, BOEM, CZM

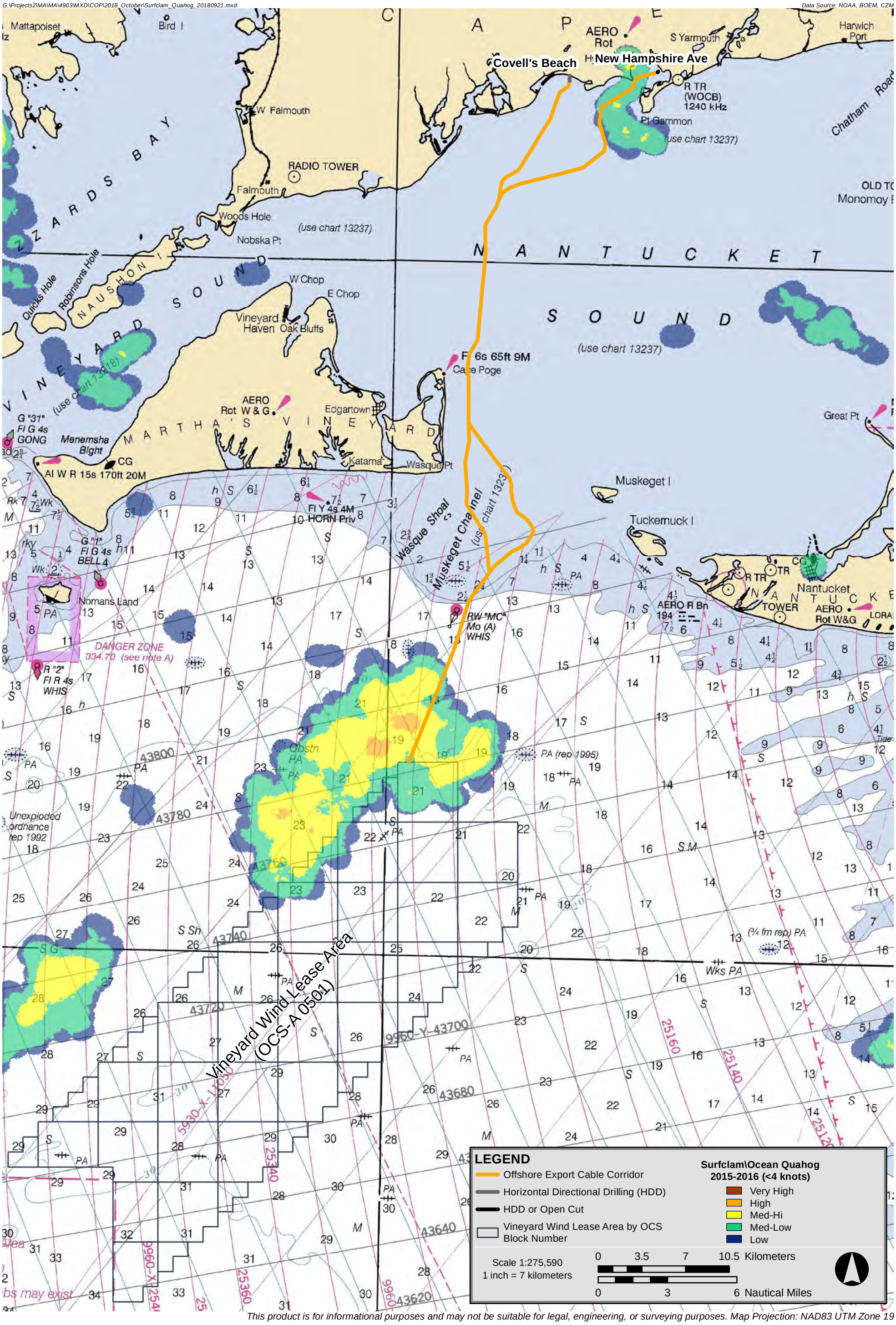

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Figure 7.6-7

Surfclam/Ocean Quahog 2015-2016 (<4 knots) Commercial Fishing Density

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Data Source: NOAA, BOEM, CZM

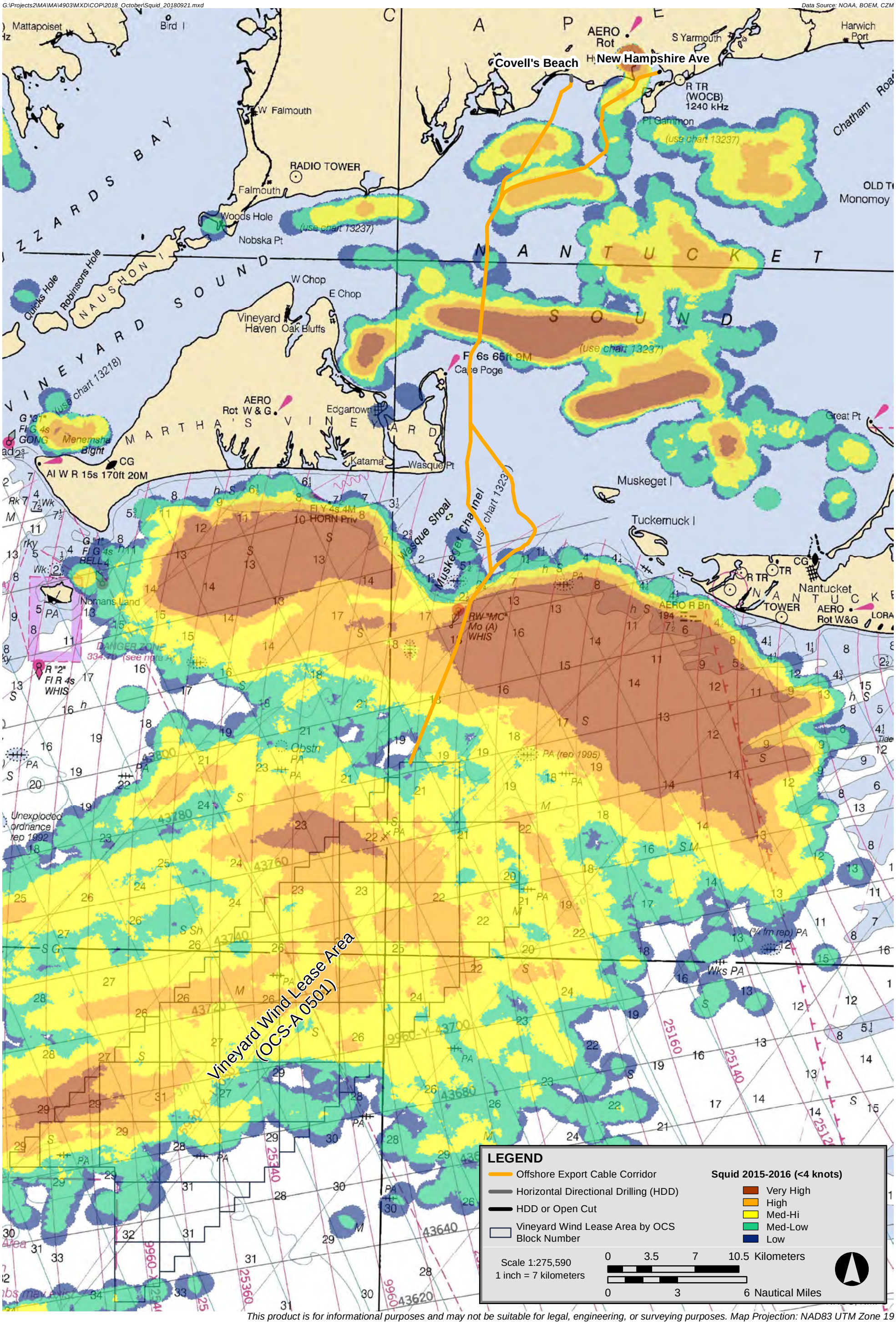

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Figure 7.6-8

Squid 2015-2016 (<4 knots) Commercial Fishing Density

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Data Source: NOAA, BOEM, CZM

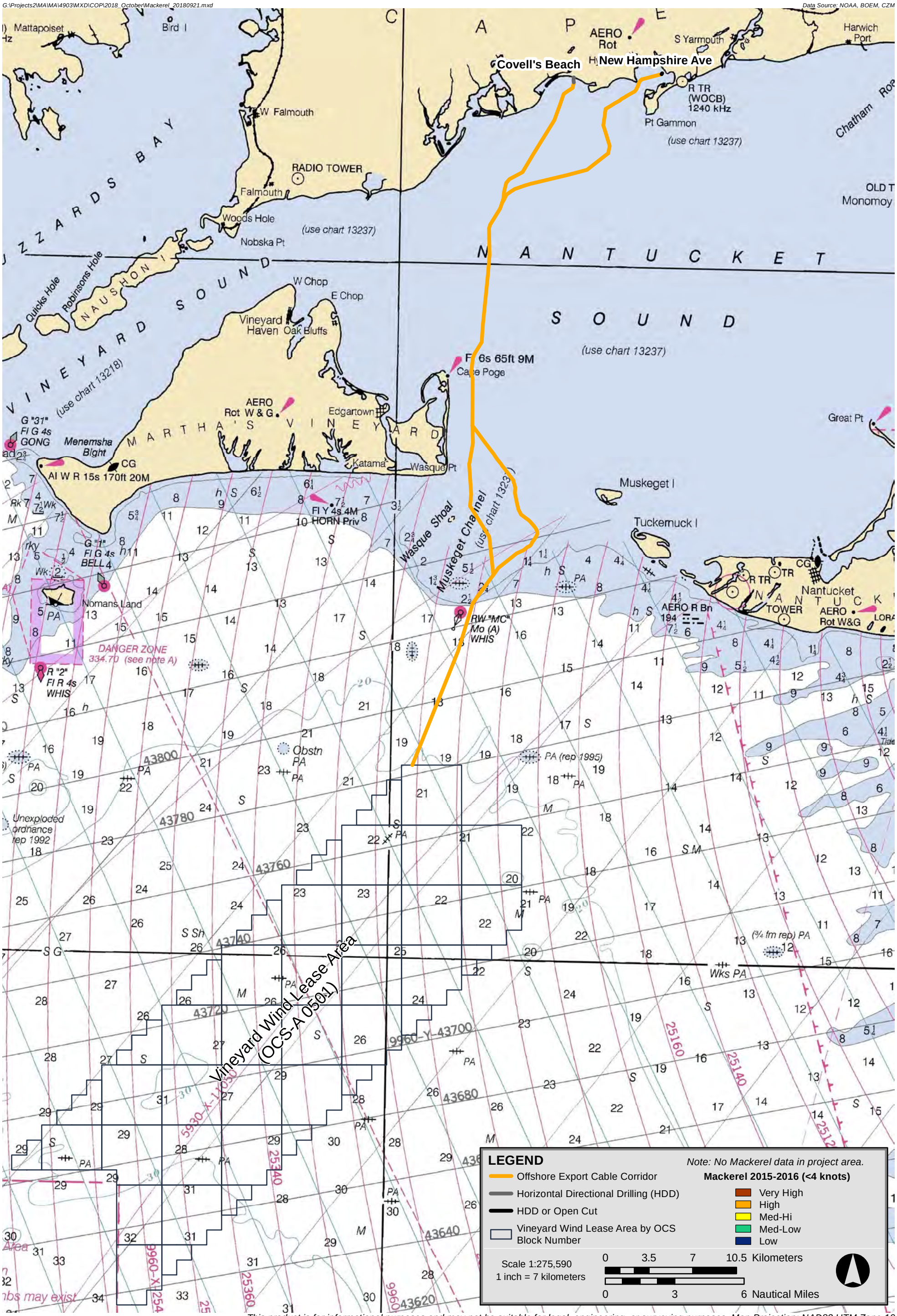

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Figure 7.6-9

Mackerel 2015-2016 (<4 knots) Commercial Fishing Density

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Data Source: NOAA, BOEM, CZM

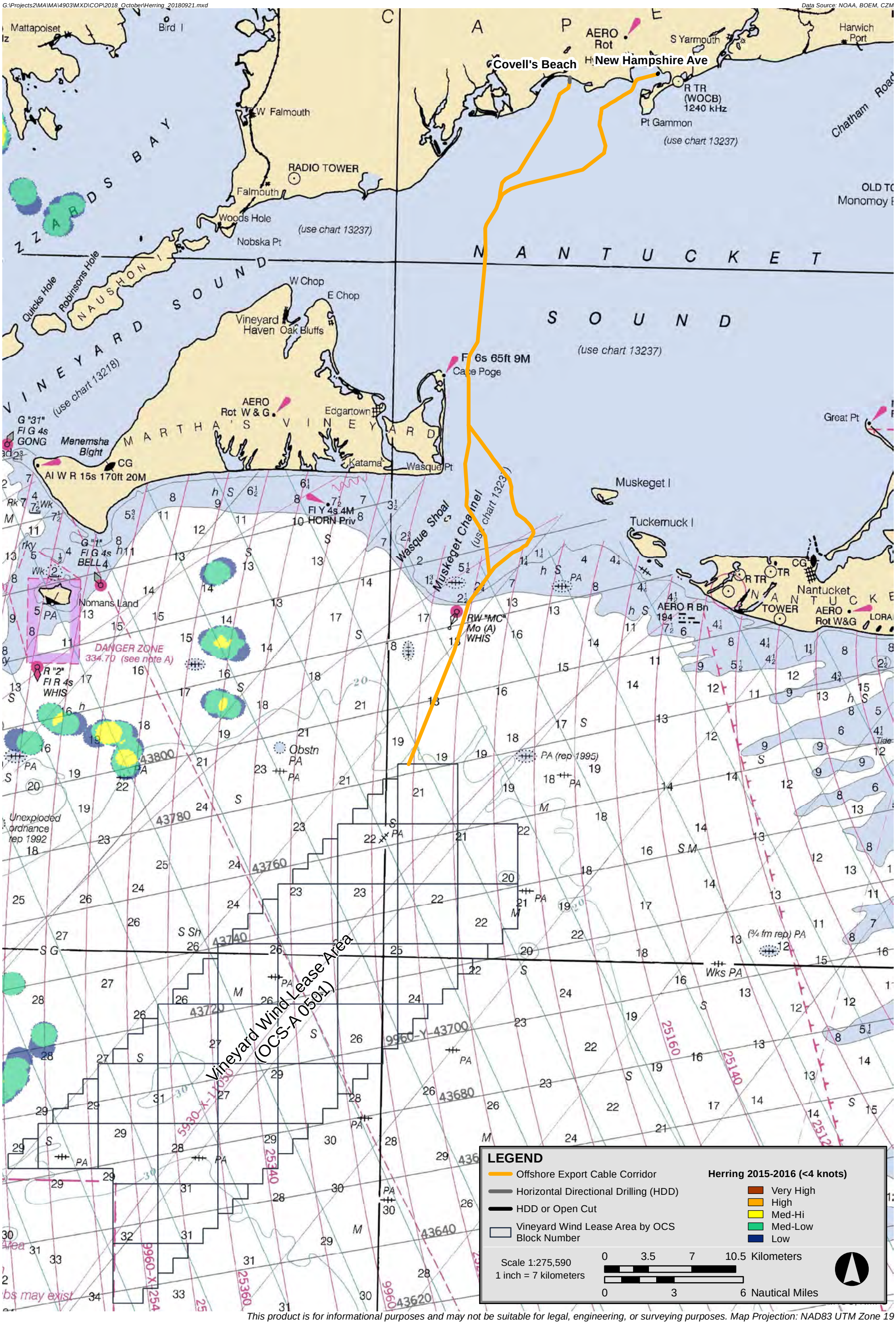

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Figure 7.6-10

Herring 2015-2016 (<4 knots) Commercial Fishing Density

vessels were homeported in Rhode Island, and 63 vessels were homeported in Massachusetts. NMFS published a "final rule" in 1999 that establishes a moratorium on any new entrants into the Federal lobster fishery. Existing permits, when associated with a vessel, however, may be sold to another entity.

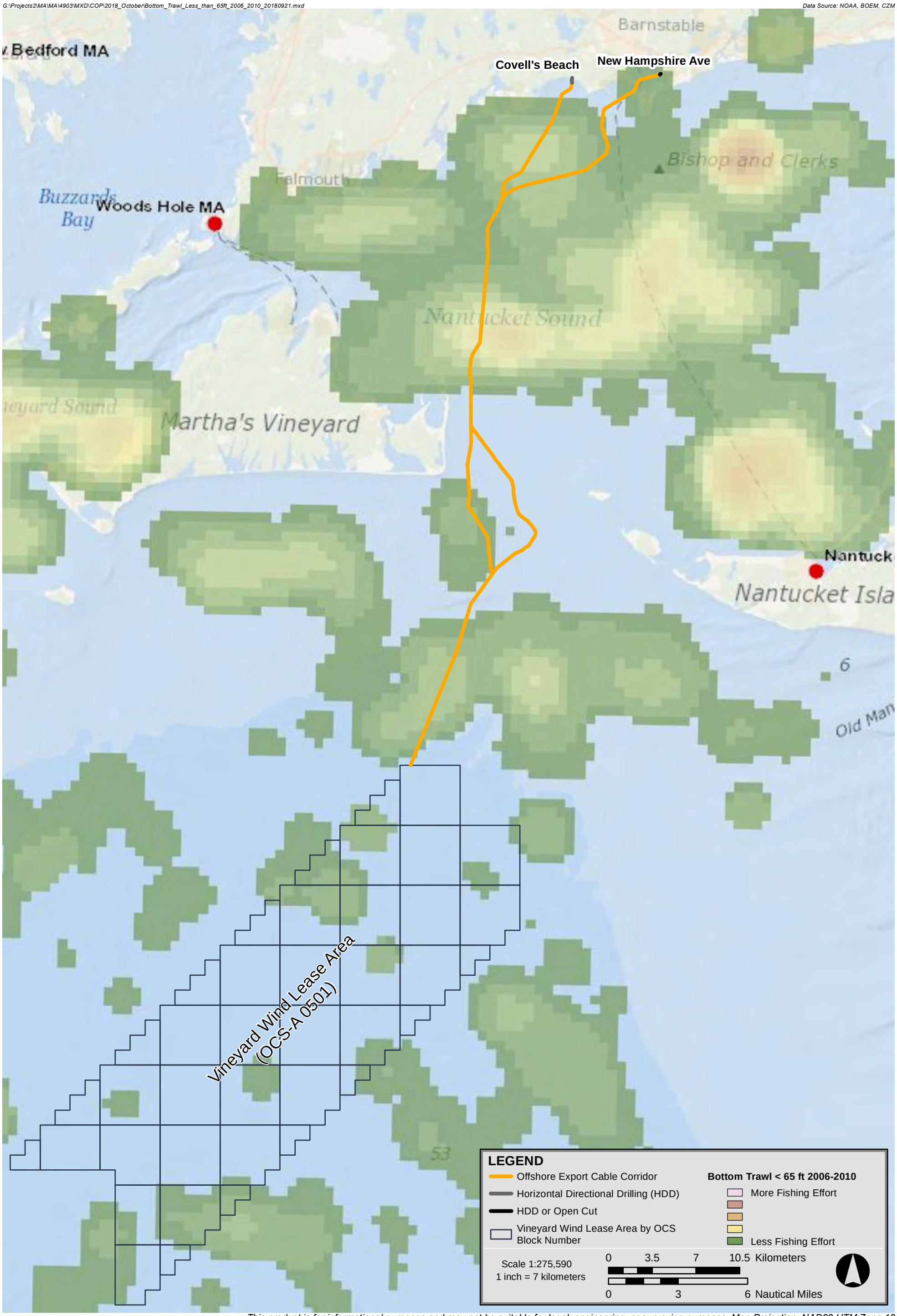
Vineyard Wind has had limited success verifying lobster activity within the Lease Area. Due to NOAA regulations, lobster fishing vessels are not required to have installed operational VMS units on their vessels. The Greater Atlantic Regional Fisheries Office requires permitted vessels to submit a VTR for every fishing trip regardless of where the fishing occurs or what species are targeted, with the exception of those vessels that possess only a lobster permit. Without VTR or VMS data, lobster catch data relevant to the Lease Area has been difficult to verify.

Based on outreach to fishermen that hold Area 2 lobster permits who are currently actively fishing, Vineyard Wind understands that there may be only five to six lobstermen who actively fish in the Lease Area. Lobstermen have also indicated to Vineyard Wind that the scour protection placed at the base of the WTGs will attract lobster and other fish species and could improve lobster fishing within the WDA.

As described above, portions of the OECC are within the state waters of Massachusetts. Harvesting of lobster in Massachusetts also requires a commercial lobster permit issued by the Massachusetts Department of Marine Fisheries ("DMF"), and landings must be sold only to licensed Massachusetts dealers. In 2017, DMF reports 1,088 coastal and 407 offshore lobster permits were issued. A Coastal Lobster Permit allows the taking and landing of lobster from within the coastal waters of the Massachusetts, and the sale of those lobsters to a licensed dealer. An Offshore Lobster Permit allows the landing and sale of lobster to a licensed dealer taken outside of the coastal waters of the Commonwealth, pursuant to the appropriate federal permit(s).

Figures 7.6-11 through 7.6-22 are MARCO's VTR-based maps depicting the bottom trawl, dredge, gillnet, longline, and pots and traps fisheries. It is important to note that the NROC figures depict relative vessel density between 2015 and 2016, while VTR data from MARCO's Data Portal, as referenced herein, has been aggregated, separately, for 2006 to 2010 and 2011 to 2015.

MARCO's VTR-based analysis of the bottom trawl fishery is further divided into two categories: vessels less than 65 feet in length (Figures 7.6-11 and 7.6-12) and vessels greater than 65 feet in length (Figures 7.6-13 and 7.6-14). During the years analyzed, smaller bottom trawl vessels appear to operate largely within Nantucket Sound and in areas outside the WDA, south of Nantucket and Martha's Vineyard. Figures 7.6-11 and 7.6-12 depict areas of low to moderate fishing effort by these vessels. During the years analyzed, low fishing effort by vessels greater than 65 feet in length appears distributed throughout the



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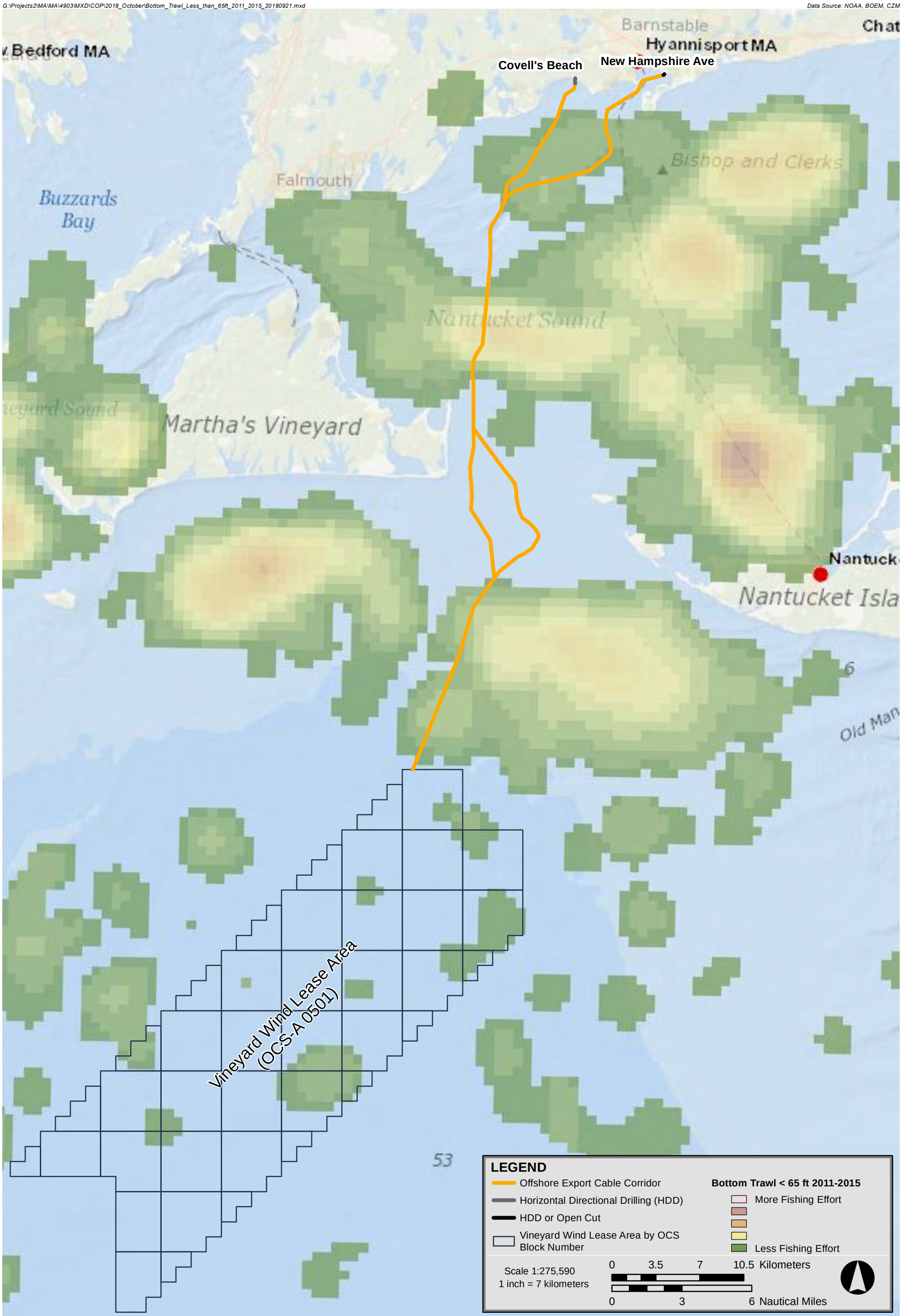
Data Source: NOAA, BOEM, CZM



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VINEYARD WIND

Figure 7.6-12

MARCO – Bottom Trawl (Vessels <65 ft.) 2011 - 2015

WDA and along the portions of the OECC within Nantucket Sound, as shown on Figures 7.6-13 and 7.6-14. Elevated fishing effort, likely reflecting vessels targeting squid, occurs outside and to the north of the WDA (just south of Martha's Vineyard and Nantucket).

During the years analyzed, limited areas of low fishing effort by vessels deploying dredge gear occur along the OECC (Figures 7.6-15 and 7.6-16). Though Figure 7.6-16 identifies nearly no fishing effort by dredge vessels between 2011 and 2015. Fishing effort by dredge vessels is not reflected within the WDA during the years analyzed.

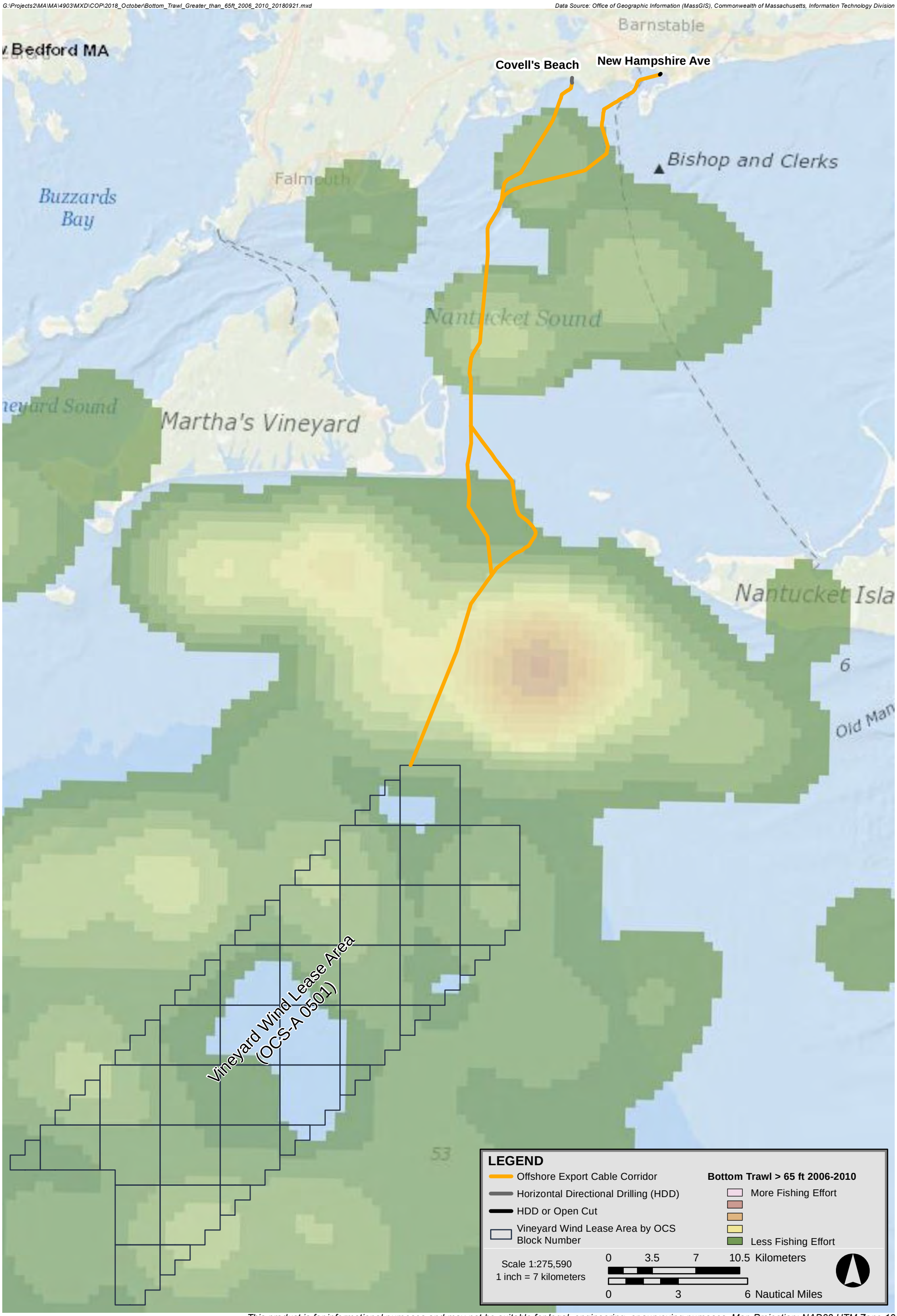
During the years analyzed, only limited areas of low fishing effort by gillnet vessels is reflected in the WDA and along the OECC (Figures 7.6-17 and 7.6-18).

During the years analyzed, no fishing effort by longline vessels occur within the WDA or along the OECC (Figures 7.6-19 and 7.6-20).

During the years analyzed, deployment of pots and traps occurs predominantly within Nantucket Sound and no pots and traps fishing effort is reflected within the WDA or along the OECC south of Muskeget Channel (Figures 7.6-21 and 7.6-22).

Cable installation work along the OECC and Project-related vessel traffic will occur within a limited geographic area of two DMF Statistical Reporting Areas: Statistical Reporting Area 10 (SRA 10) and Statistical Reporting Area 12 (SRA 12), shown on Figure 7.6-23. These Statistical Reporting Areas are within the waters of Massachusetts and the federal waters of Nantucket Sound; they partially overlap the OECC. Only a very short segment of the OECC, in the vicinity of Muskeget Channel, traverses SRA 12. The WDA is not within either reporting area.

Certain non-confidential landings data reported by the DMF for those Statistical Areas were made available to Vineyard Wind. Landings reported to DMF within SRA 10 are shown in Table 7.6-2 and landings reported to DMF within SRA 12 are shown in Table 7.6-3.



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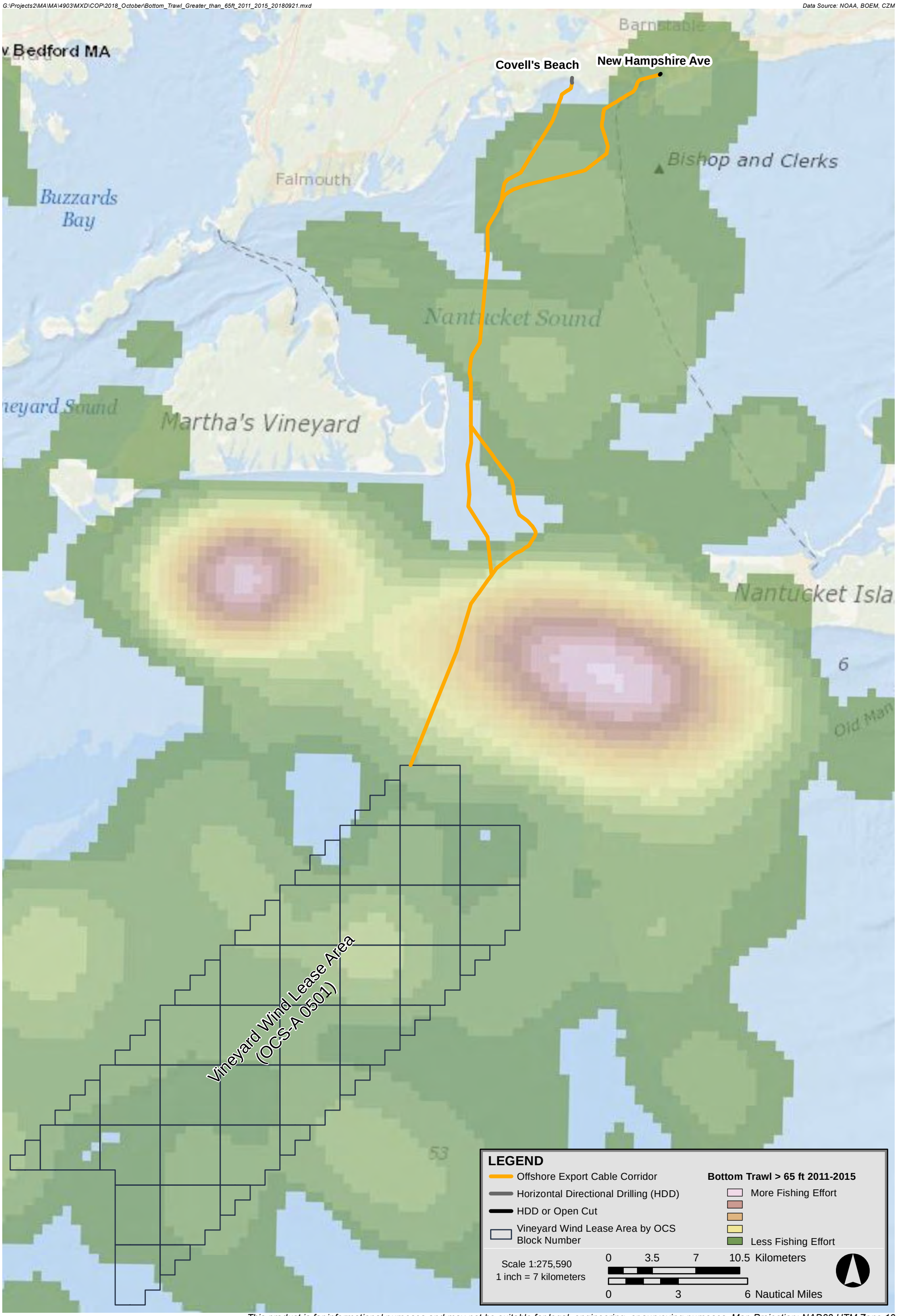

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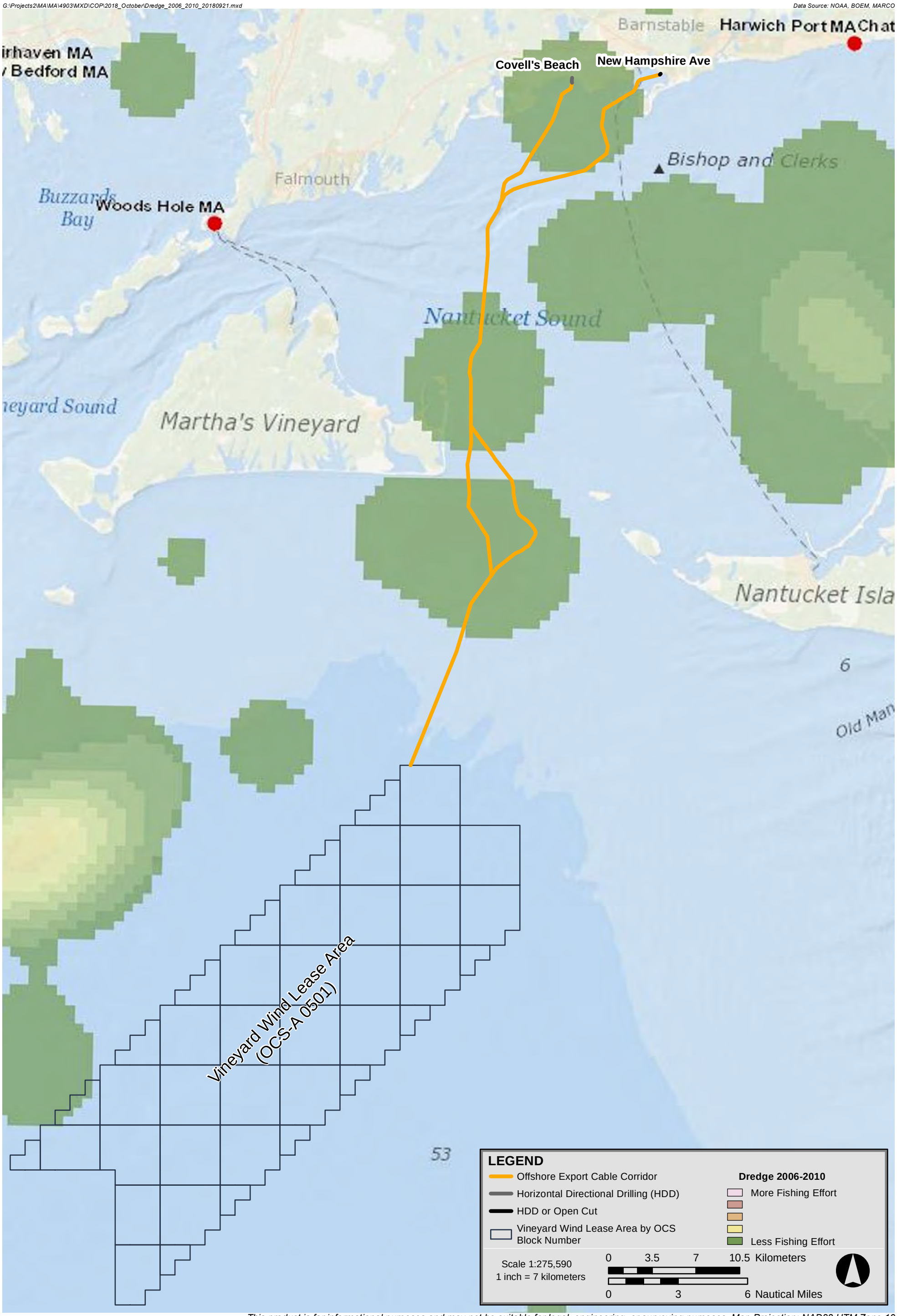
Data Source: NOAA, BOEM, MARCO



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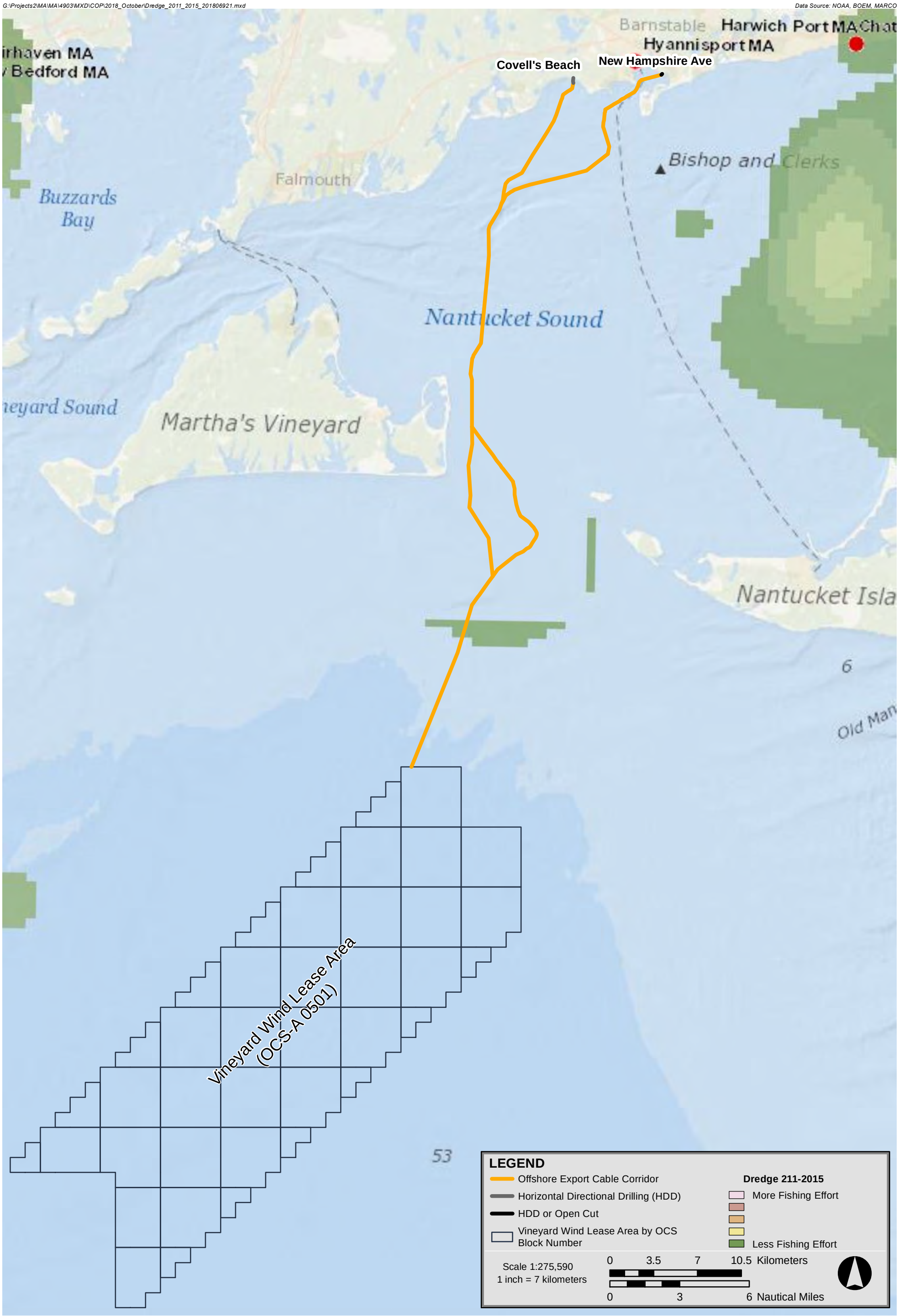

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Figure 7.6-16

MARCO – Dredge 2011 - 2015

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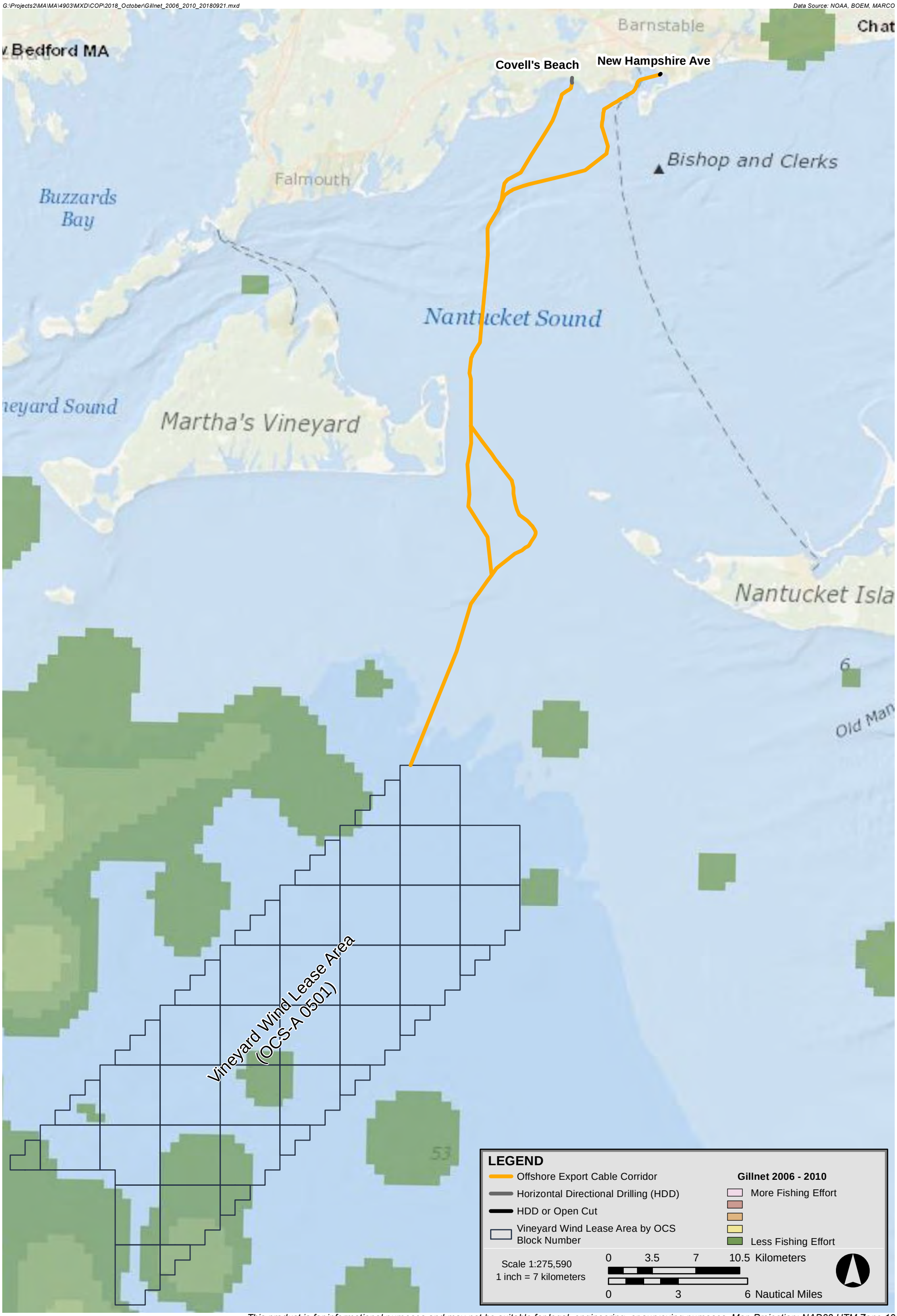
Data Source: NOAA, BOEM, MARCO



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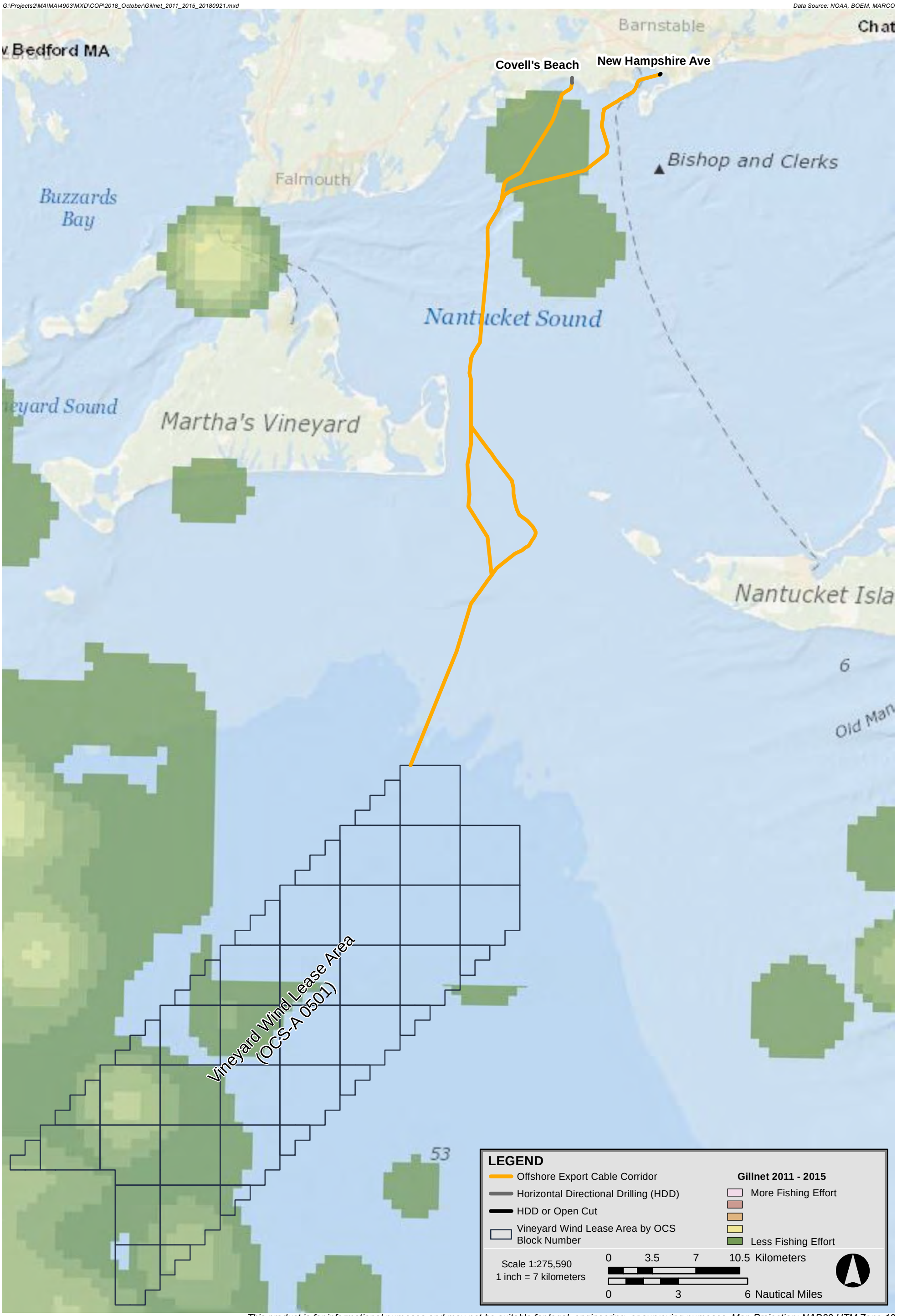
Data Source: NOAA, BOEM, MARCO



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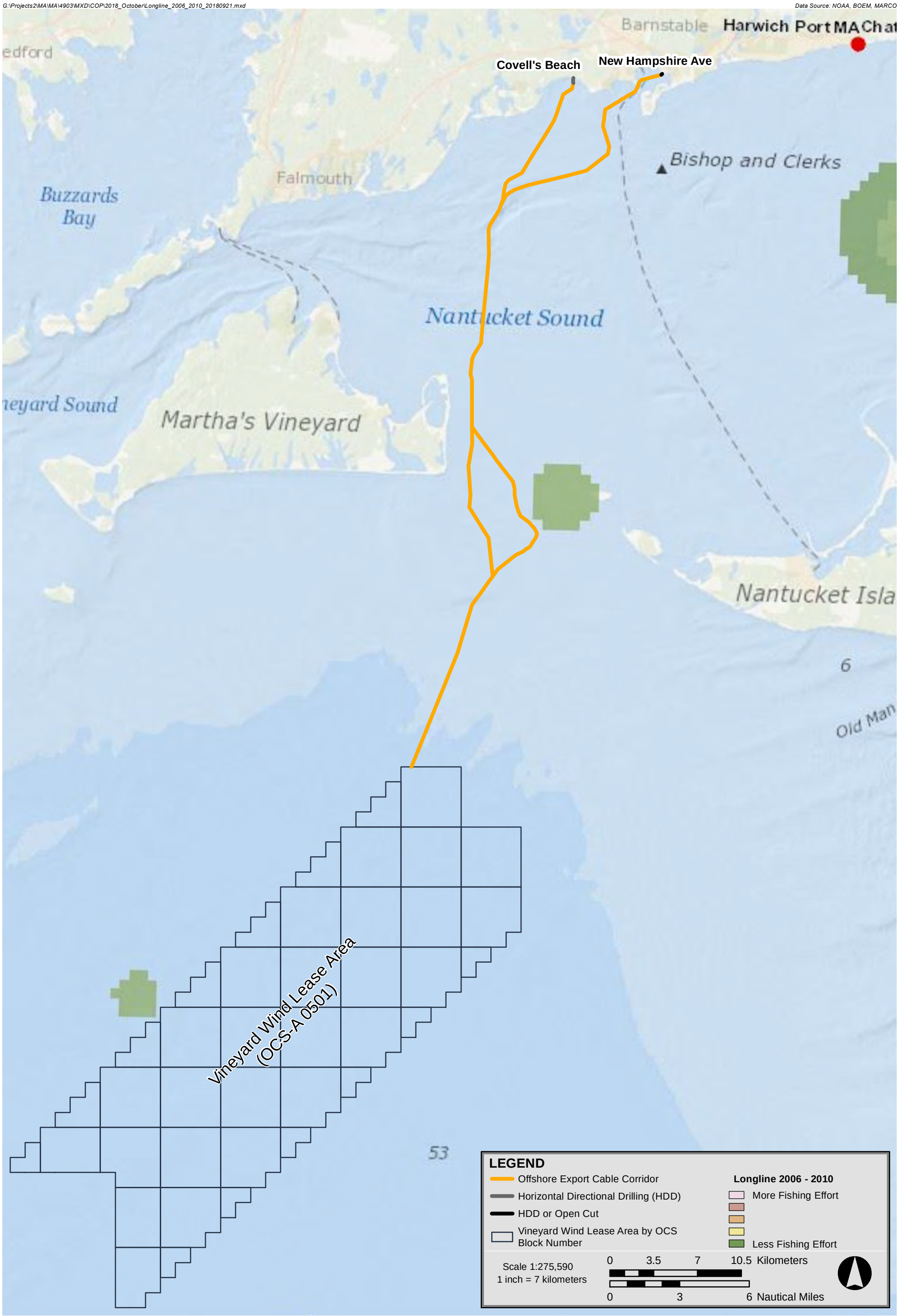
Data Source: NOAA, BOEM, MARCO



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Data Source: NOAA, BOEM, MARCO

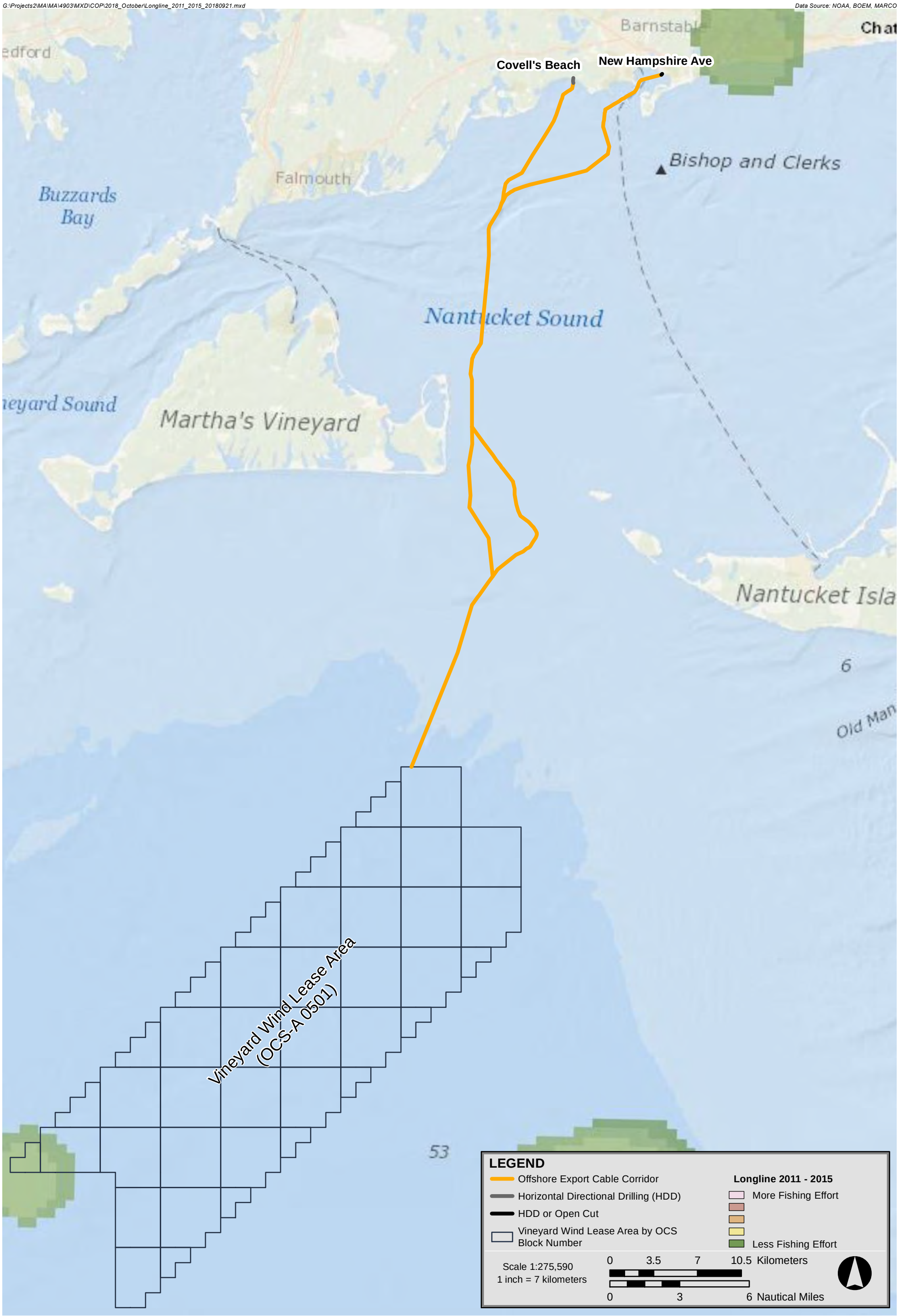

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Figure 7.6-20

MARCO – Longline 2011 - 2015

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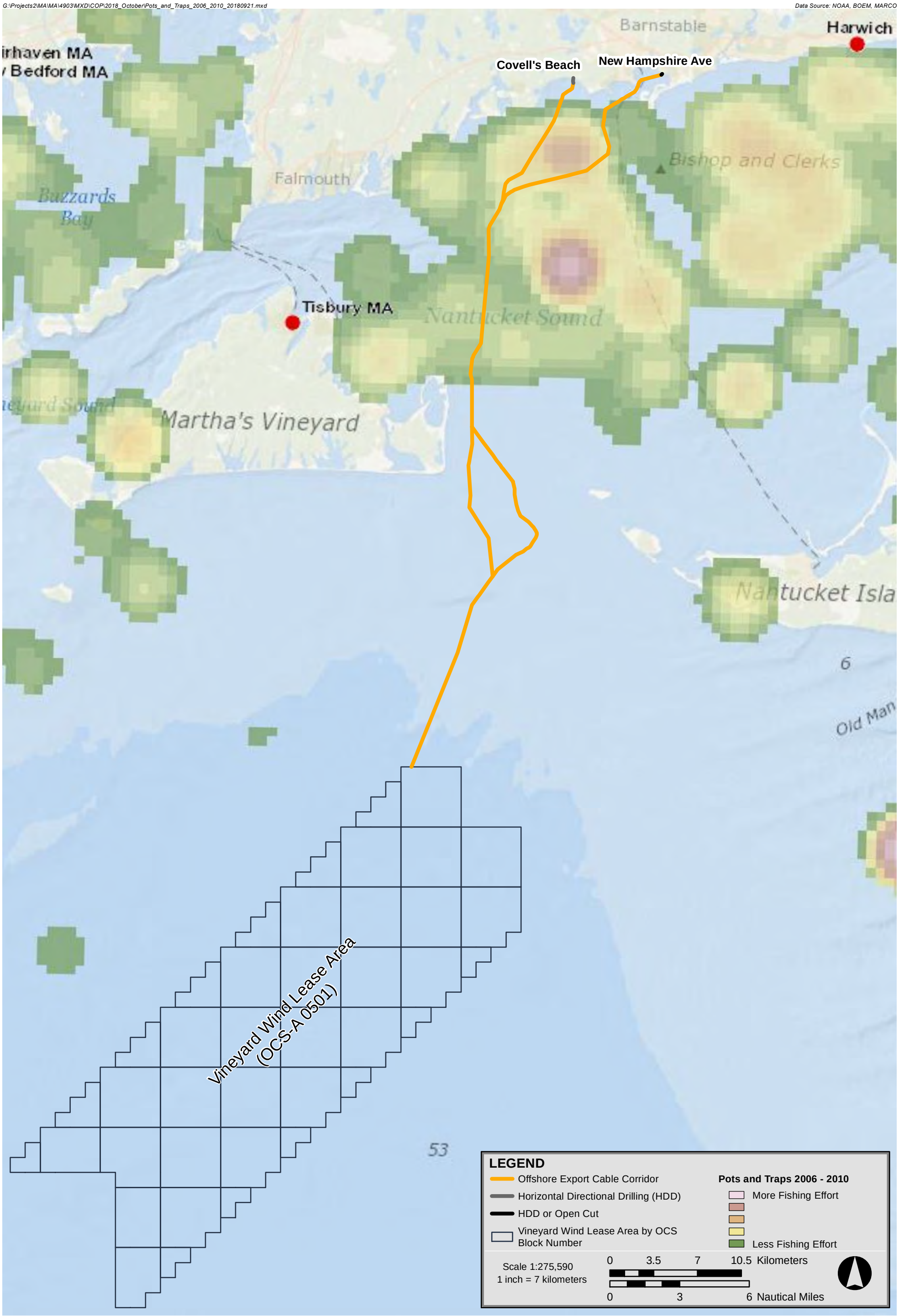
Data Source: NOAA, BOEM, MARCO



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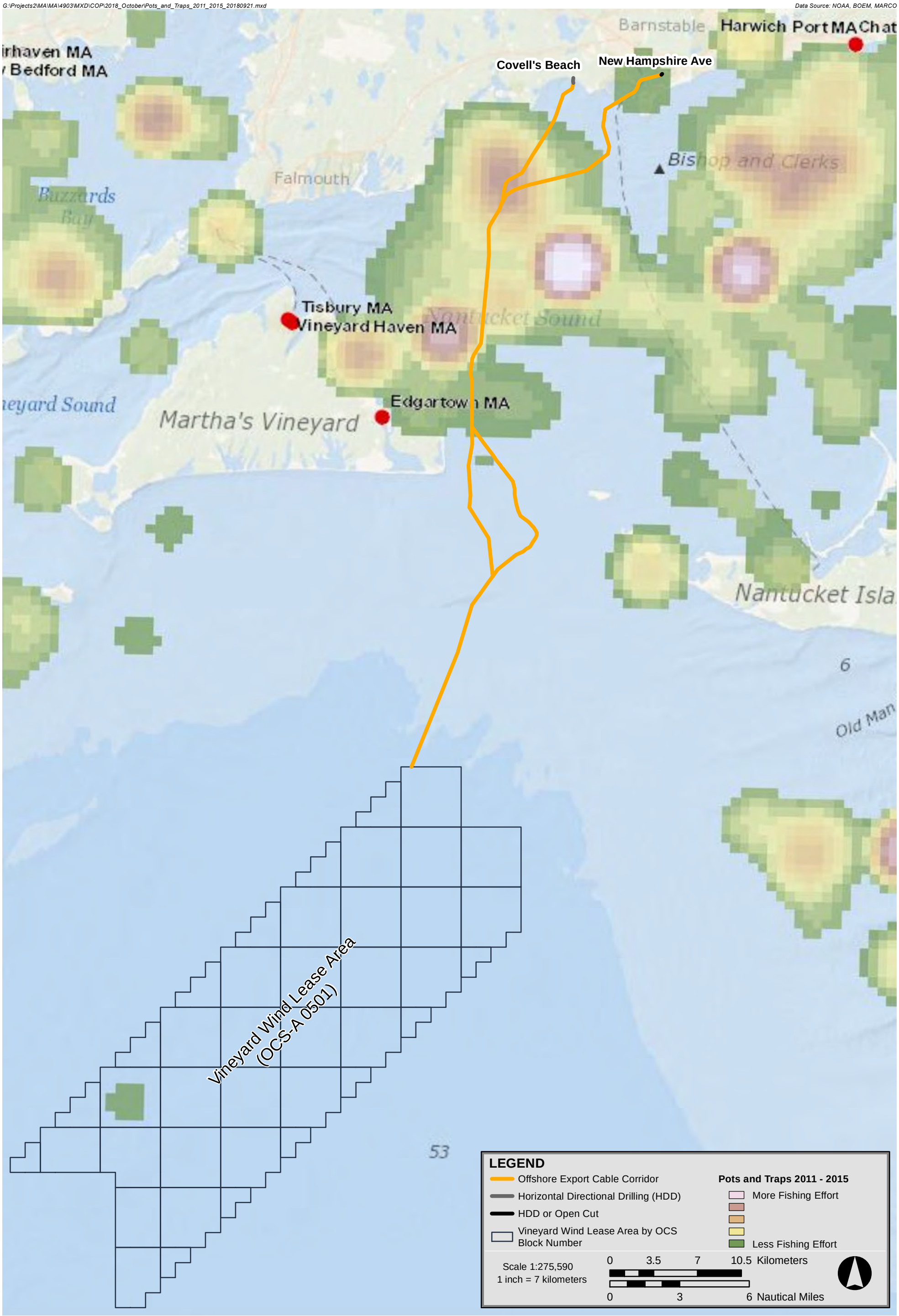
Data Source: NOAA, BOEM, MARCO



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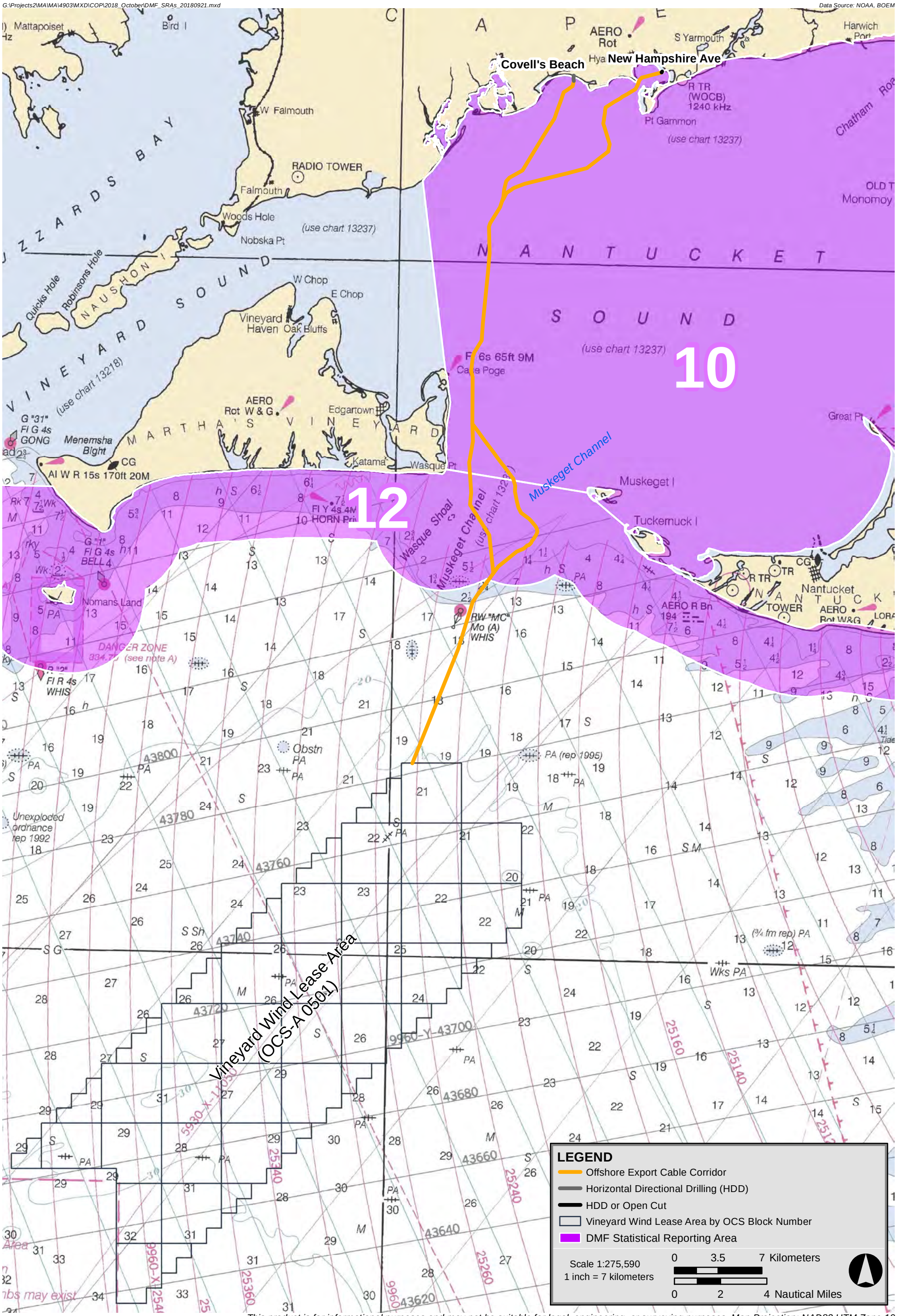
Data Source: NOAA, BOEM



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Table 7.6–2 Massachusetts Annual Landings (live pounds) by Species in Statistical Reporting Area 10 (DMF)

SPECIES	2010	2011	2012	2013	2014	2015	2016
BLUEFISH	90,002	187,726	167,410	230,235	179,905	200,223	81,329
BUTTERFISH	24,451	6,388	13,982	2,371	8,215	28,283	15,113
CLAM, NORTHERN QUAHOG	2,486,062	1,622,147	1,505,640	1,464,435	1,499,151	1,435,501	1,505,251
CLAM, OCEAN QUAHOG / CLAM, SURF	4,887,623	2,039,872	175,253	1,149,764	81,335	321,553	249,524
CLAM, RAZOR, ATLANTIC	C	C	23,866	234,019	20,556	794	4,307
CLAM, SOFT	244,115	472,253	1,567,163	505,958	183,372	436,526	451,337
CRAB, HORSESHOE	244,175	246,705	287,587	414,784	325,824	327,566	345,405
DOGFISH, SPINY	29,503	113,957	205,508	187,788	33,977	25,156	109,795
FINFISH-OTHER	26,959	13,009	485,410	8,270	33,663	6,595	564,600
FLOUNDER, WINTER	16,402	1,558	1,201	4,732	1,489	877	241
MONKFISH	9,500	1,262	4,499	874	C	811	10,157
GROUNDFISH-OTHER	66,070	48,615	6,103	5,821	0	3,092	2,157
INTERTIDAL SHELLFISH-OTHER	3,488	C	C	C	1,882	4,128	9,301
INVERTEBRATES-OTHER	19,805	157	49,068	1,792	18,815	393	61,317
LOBSTER, AMERICAN	22,668	29,537	21,163	23,689	16,497	5,983	8,323
MACKEREL, ATLANTIC	336	1,093	2,806	533	55,259	7,253	21,782
MUSSEL, BLUE	52,529	63,215	492,391	1,761,182	C	C	1,046,261
OFFSHORE SHELLFISH-OTHER	C	2,587	C	8,382	13,854	17,445	21,105
SCALLOP, SEA	C	71,434	647,799	56,573	19,492	47,881	C
SCUP	508,787	179,618	221,308	145,862	213,255	125,555	367,974
SEA BASS, BLACK	90,764	94,712	74,404	90,525	105,622	100,945	94,511
SKATES	15,873	34,994	14,937	142,641	3,006	12,158	34,062
SQUID, LONG FINNED (LOLIGO)	601,296	353,590	1,771,748	60,305	1,125,117	356,793	1,004,261
STRIPED BASS	83,026	85,772	97,776	102,115	203,500	39,126	49,756
TAUTOG	2,170	5,377	3,802	7,863	7,699	807	2,565
WHELK, CHANNELED	1,757,666	2,331,299	2,165,836	1,757,928	1,349,020	1,158,208	1,052,329
WHELK, KNOBBED	118,938	211,222	256,366	427,062	421,941	302,924	212,402

SOURCE: MATL Reports, NMFS VTRs
C = Confidential Data

Table 7.6-3 Massachusetts Annual Landings (live pounds) by Species in Statistical Reporting Area 12 (DMF)

SPECIES	2010	2011	2012	2013	2014	2015	2016
BLUEFISH	3,591	6,524	9,743	25,412	9,599	7,571	5,943
CLAM, SOFT	7,960	C	14,902	21,570	20,683	30,342	23,024
FINFISH-OTHER	23,465	61,527	82,043	47,166	6,360	15,616	1,737
FLOUNDER, SUMMER (FLUKE)	52,919	76,750	89,501	51,587	50,721	64,665	24,178
FLOUNDER, WINTER	1,368	3,179	3,739	2,986	3,279	1,559	248
GOOSEFISH	16,826	46,247	53,805	23,214	1,515	6,894	5,728
GROUNDFISH-OTHER	51,285	10,698	3,960	88	399	444	1,439
INTERTIDAL SHELLFISH-OTHER	C	C	C	C	C	C	C
INVERTEBRATES-OTHER[1]	4,355	3,815	142,480	7,345	68,730	111,469	283,172
LOBSTER, AMERICAN	65,640	62,328	86,310	99,966	65,630	109,772	150,408
OFFSHORE SHELLFISH-OTHER	437,553	482,269	21,451	4,687	2,202	C	27,778
OYSTER, EASTERN	2,495	6,529	11,167	35,491	50,185	250,850	40,254
SCALLOP, BAY	396	15,221	25,119	56,740	26,715	C	C
SCUP	100,692	124,950	246,814	262,032	146,774	140,483	173,868
SEA BASS, BLACK	5,320	8,801	4,183	26,501	30,777	55,252	57,299
SKATES	441,577	424,667	378,647	150,208	65,741	65,037	2,508
STRIPED BASS	45,389	24,348	20,161	21,387	32,136	12,272	14,137
TAUTOG	C	1,229	1,565	4,354	2,901	4,971	3,245
WHELK, CHANNELED	14,157	113,462	44,468	37,007	67,754	1,172	8,950

SOURCE: MATL Reports, NMFS VTRs

C = Confidential Data

1 Squid may be included in this category by the state to preserve confidentiality of data.

It has been reported that species of large gastropod whelks (Busycon carica and Busycotypus canaliculatum) are present within SRA 10 and SRA 12, which is confirmed by the landings of those species shown in Tables 7.6-1 and 7.6-2. Similarly, the Massachusetts Ocean Management Plan's (2015) identification of areas of commercially and recreationally important species with high abundance in the vicinity of the Project, based on MA DMF trawl survey data, included both channeled whelk and knobbed whelk. DMF reports that in 2016 the Massachusetts channeled whelk fishery landed, in total, approximately 1.9 million pounds valued in excess of $4.8 million. Based on DMF's 2016 landings data, approximately 54 percent of channeled whelk harvested in Massachusetts was sourced from SRA 10 and SRA 12, though largely from SRA 10. In 2017 the Massachusetts channeled whelk fishery landed, in total, approximately 1.1 million pounds valued in excess of $3.1 million, a substantial decrease from 2016 though; species management could be a factor in the decrease. 2017 landings data for SRA 10 and SRA 12 have not yet been made available to Vineyard Wind.

DMF also reports that recent stock assessments indicate that the whelk stock in Nantucket Sound is over fished, and overfishing is still occurring. The biomass index based on the DMF trawl survey has declined by over 70% since the early 1980s. Indeed, DMF biologists conducting sampling trips aboard commercial vessels fishing targeting channeled whelk in Nantucket Sound and Buzzards Bay since 2003 have identified a ⅜-inch decrease in the average size of channeled whelk observed. And, despite minimum legal size increases that occurred in 2014, 2015, and 2017, the average size has decreased and there are fewer whelk above the size at which females reach maturity than in previous years (DMF, 2017).

Vineyard Wind has consulted with shellfish constables in Yarmouth and Barnstable, DMF, and members of the commercial bay scallop and whelk fishing communities. These consultations will continue and will be useful for determining the extent of commercial fishing effort for these species. Project-related impacts along the OECC as they may impact the whelk fishery will be limited both in spatial extent and duration, and the Project will continue to avoid and minimize disturbance in coordination with DMF.

7.6.2.3 Baseline Economic Value of Fishing Activity in the Massachusetts Wind Energy Area

BOEM funded a study conducted by NOAA's Northeast Fisheries Center that characterizes commercial fishing from Maine to North Carolina and provides insight into revenue generated by federally permitted fishermen. (Kirkpatrick (2017), *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic*). The report details the average value of fish harvested over the six-year period between 2007 and 2012 and identifies the ports and fishery sectors (e.g., gear, species) supporting that activity. NOAA also developed a model to estimate the socio-economic impact of wind energy development on commercial fishermen. Making use of VTR data, spatial data from the Northeast Fisheries Observer Program database (NEFOP), and VMS data[26], the study provides information on commercial harvest by location, species caught, gear type, and port group. Using haul locations recorded by observers from 2004-2012, Kirkpatrick was able to model the area associated with the reported VTR point, and identify the proportion of catch that are sourced from within the MA WEA from any VTR record, or groups of VTR records. This methodology, ultimately, produced an estimate of revenue "exposure" within discrete geographic areas, including the MA WEA.

The following section describes commercial fisheries within the entire MA WEA based on Kirkpatrick's modelling of revenue exposure. The 306.01 km^2 (118.15 mi^2) WDA is only a small subset of the MA WEA; the WDA encompasses 45.3 percent of the entire Vineyard Wind Lease Area and only 10.2 percent of MA WEA. Fishery revenue exposure within the WDA, therefore, is expected to be a fraction of fishery revenue exposed within the MA WEA reported by Kirkpatrick (2017). As Kirkpatick notes, economic impacts depend upon

[26] "Because the VMS is used to generate high resolution vessel-specific spatial data, VMS data were used only to analyze specific impacts where appropriate." (Kirkpatrick, 2017).

many factors, including the ability of a given vessel to fish within the MA WEA as currently permitted by regulation. Vessels will not be precluded from operating within the WDA, with the exception of when temporary safety zones in the immediate vicinity of construction and installation vessels are imposed by the Coast Guard. Therefore, commercial fishing vessels may continue operations within the WDA as currently permitted. If commercial fishing vessels elect to avoid the WDA or OECC, alternative nearby fishing grounds are available. If alternative fishing grounds are accessed at no additional cost to vessels electing to operate outside the WDA or OECC, revenue may not be affected (Kirkpatrick, 2017).

Table 7.6-4 shows the percentage of each fishery management plan's revenue derived from the MA WEA between 2007 and 2012. According to Kirkpatrick (2017), between 2007 and 2012, the fisheries producing the most revenue from the MA WEA, as a percentage of the fishery's total revenue, are the Small Mesh Multispecies, Skate, Monkfish, Atlantic Surf Clam/Ocean Quahog fisheries. For other fisheries during those same years, revenue derived from the MA WEA, as a percentage of the fishery's total revenue, represented less than one percent of their respective total average annual revenue (Kirkpatrick, 2017).

Table 7.6-4 Average Annual Revenue from the MA Wind Energy Area by Fishery Management Plan (2007-2012, Kirkpatrick et al. 2017)

Fisheries Management Plan	Average Annual Revenue from BOEM's Wind Energy Area	Average Total Revenue of Fishery	Percent of Fishery Revenue from BOEM's Wind Energy Area
Small Mesh Multispecies	$368,710	$10,675,728	3.5
Skate	$199,021	$7,796,915	2.6
Monkfish	$340,775	$19,759,447	1.7
Surf Clam/Ocean Quahog	$854,205	$64,967,095	1.3
Squid, Mackerel, Butterfish	$357,115	$40,849,295	.09
Atlantic Herring	$138,193	$21,241,713	0.6
Summer Flounder, Scup, Black Sea Bass	$158,752	$33,166,172	0.5

Kirkpatrick (2017) identified which species, as a percentage of the total average revenue generated from that species, were most exposed within the MA WEA. Table 7.6-5 identifies those species. As noted above, the WDA encompasses 10.2 percent of the geographic area of the MA WEA, and any estimate of a fishery's revenue from the WDA should be reduced accordingly.

Table 7.6-5 Average Annual Revenue from the MA Wind Energy Area by Species (2007-2012, Kirkpatrick et al. 2017)

Species	Average Annual Revenue from BOEM's Wind Energy Area	Species Total Average Annual Revenue	Percentage of Revenue from BOEM's Wind Energy Area
Silver Hake	$327,355	$9,592,553	3.4%
Ocean Quahog	$851,030	$27,233,867	3.1%
Skates	$119,890	$6,054,223	2.0%
Monkfish	$340,775	$19,759,447	1.7%
Jonah Crab	$87,011	$5,130,697	1.7%
Squid (Loligo)	$285,547	$24,867,195	1.1%
Atlantic Herring	$138,193	$23,241,713	0.6%
Summer Flounder	$90,433	$22,019,367	0.4%
Lobster	$175,972	$212,474,994	0.1%
Sea Scallop	$203,180	$428,413,267	~0.0%

Within the MA WEA, bottom trawl gear is used primarily for targeting species from the Small Mesh Multispecies Fisheries Management Plan. Silver Hake was the most abundant landing of the small mesh species sourced from the MA WEA (Kirkpatrick et al., 2017). Commercial fishermen have reported to Vineyard Wind representatives that Mackerel, Whiting, and, more recently, Butterfish are also targeted in the MA WEA; though Squid are the predominant landing from the Squid, Mackerel, Butterfish Fishery Management Plan.

Gillnet vessels in the MA WEA land primarily Monkfish, skates, and Spiny Dogfish (*Squalus acanthias*), as well as some species from the Summer Flounder, Scup and Black Sea Bass fisheries. Commercial fishermen have reported to Vineyard Wind that pot fisheries are active in MA WEA, however, landings and revenue from activity within MA WEA is characterized as low. For example, of the annual average revenue of over $212 million for Lobster harvested between 2007 and 2012, approximately $175,000 per year was harvested from the MA WEA (Kirkpatrick 2017). As mentioned before however, the data for the location of the lobster fishery is lacking.

Table 7.6-6 identifies the number of permits and revenue, by gear type, potentially exposed to development of the MA WEA. According to Kirkpatrick (2017), gear categories presented below are not mutually exclusive and an individual fisherman can be represented in multiple gear categories. The "unmanaged" category indicates revenue generated from species that are not included in a NMFS Fisheries Management Plan. The primary commercial fishing gear used in the MA WEA, by average annual revenue, are gillnet, bottom trawl, and dredge. Dredge gear is generally either scraping or hydraulic dredges and are most often used to harvest bivalves; in the Project Region dredge fishermen

typically target Scallops, Atlantic Surf Clam, and Ocean Quahog. Most dredge revenue is landed in either Massachusetts or Rhode Island, while most bottom trawl revenue is landed in Rhode Island (Kirkpatrick et al., 2017).

Table 7.6-6 Number of Permits and Revenue, by Gear, Exposed to Development of the MA Wind Energy Area, 2007–2012 (Kirkpatrick et al. 2017)

Gear	Permits	Average Annual Revenue	Average Annual Revenue from MA WEA	Percent Revenue from MA WEA	Top 4 FMPs	Top 5 Port Groups
Dredge	88	$486,160,813	$1,057,372	0.2	Surfclam, Ocean Quahog;[a] Sea Scallop;[b] Monkfish[c] Small Mesh Multispecies[b]	New Bedford, MA; Warren, RI; Cape May, NJ; Stonington, CT; Barnegat, NJ
Gillnet	95	$34,164,385	$447,819	1.3	Monkfish;[c] Skate;[b] Spiny Dogfish;[c] Summer Flounder, Scup, Black Sea Bass[a]	New Bedford, MA; Chatham, MA; Fairhaven, MA; Little Compton, RI; Newport, RI
Hand	24	$8,339,830	$2,772	~0	Unmanaged;[d] Summer Flounder, Scup, Black Sea Bass;[a] Highly Migratory Species;[e] Large Mesh Multispecies[b]	South Kingstown, RI; Narragansett, RI; South Yarmouth, MA; Montauk, NY; Washington County, RI
Long-line	7	$7,399,976	$23,349	0.3	Golden Tilefish;[a] Spiny Dogfish;[c] Large Mesh Multispecies;[b] Summer Flounder, Scup, Black Sea Bass[a]	Montauk, NY; Hampton Bays, NY; Barnegat, NJ; Narragansett, RI
Pot	33	$11,071,430	$5,525	0.1	Summer Flounder, Scup, Black Sea Bass;[a] Unmanaged;[d] Red crab;[b] Large Mesh Multispecies[b]	Westport, MA; New Bedford, MA; Barnstable, MA; Little Compton, RI; Narragansett, RI
Lobster Pot	114	$213,321,675	$282,692	0.1	Unmanaged;d Summer Flounder, Scup, Black Sea Bass;c Small Mesh Multispecies;b Large Mesh Multispeciesb	New Bedford, MA; Newport, RI; Narragansett, RI; Sandwich, MA; Westport, MA

Table 7.6-6 Number of Permits and Revenue, by Gear, Exposed to Development of the MA Wind Energy Area, 2007–2012 (Kirkpatrick et al. 2017) (Continued)

Gear	Permits	Average Annual Revenue	Average Annual Revenue from MA WEA	Percent Revenue from MA WEA	Top 4 FMPs	Top 5 Port Groups
Bottom Trawl	234	$174,094,198	$1,032,021	0.6	Small Mesh Multispecies;[b] Squid, Mackerel, Butterfish;[a] Summer Flounder, Scup, Black Sea Bass;[a] Large Mesh Multispecies[b]	Narragansett, RI; Montauk, NY; New Bedford, MA; Tiverton, RI; Newport, RI
Mid-water Trawl	21	$21,384,152	$182,118	0.9	Atlantic Herring;[b] Squid, Mackerel, Butterfish;[a] Unmanaged;[d] Small Mesh Multispecies[b]	New Bedford, MA; Gloucester, MA; Fall River, MA; Narragansett, RI; North Kingstown, RI

[a] MAFMC; [b] NEFMC; [c] Joint NEFMC and MAFMC management; [d] Unmanaged species; [e] Atlantic Highly Migratory Species management

7.6.2.4 Baseline Economic Value of Fishing Activity in the Vineyard Wind Lease Area

As noted above, the 306.01 km^2 (118.15 mi^2) WDA encompasses only 45.3 percent of the entire Lease Area. Determining a precise allocation of fishery revenue exposure within the WDA can be reasonably estimated and is anticipated to be a fraction of the value estimated for the Lease Area.

DEM conducted a study in response to concerns by the Rhode Island fishing industry that the economic values of the fisheries were underestimated by BOEM, particularly as they related to the New York Call Area, because the data used to describe commercial fishing activity were said to be inadequate. DEM conducted a separate analysis of the New York Wind Energy Area (NY WEA) and further refined the methodology of that analysis to produce a more comprehensive analysis referred herein as the Livermore (2017) study.

The Livermore study made use of VMS data for a larger portion of the North Atlantic, as well as VTRs and landings data for New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey for the years of 2011 through 2016. Livermore (2017), acknowledging certain limitations of VTR-based analysis of fishing effort, notably the potential for imprecise location attributes, conducted the analysis of the MA WEA such that VMS, VTR, and commercial landings datasets were linked. The combined data were additionally subsetted by fishery (species, gear, state and port landings) and mapped as a raster of fishing density by year. In addition to providing more robust locational information

through the incorporation of the VMS dataset, Livermore (2017) was able to scale the landings based on the density of fishing activity within the MA WEA during a given year, thereby providing a unique estimate of fishery revenue within specific geographic areas of the MA WEA, including the Vineyard Wind Lease Area.

Livermore (2017), assuming all fishing activity is not equal and by using the fishing density maps described above, was able to scale commercial landings by the amount of fishing activity within the Lease Area per trip. Each individual fishing location point within a trip was weighted by the fishing density map for that fishery that year, placing higher weights on points where the fishing density was higher. According to Livermore (2017), this strategy makes the assumption that fishermen target areas that are most profitable (i.e. where species abundances are higher).

Table 7.6-7 Estimated Annual Landings from Lease Area by State (2011-2016; Livermore [2017])

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total in Lease Area
Connecticut	$35,943.23	$23,679.76	$36,764.79	$19,297.48	-	$51,530.60	$167,215.86
Massachusetts	$112,425.43	$987,431.20	$551,972.38	$199,069.54	$247,676.22	$675,235.18	$2,773,809.95
New Jersey	-	$3.64	-	$498.63	$19,335.96	$49,531.51	$69,369.74
New York	$3,439.51	$13,965.63	$26,489.39	$673.67	$10,819.09	$166,145.53	$221,532.81
Rhode Island	$56,401.42	$53,035.97	$159,040.67	$257,132.80	$245,168.64	$1,142,581.23	$1,913,360.73

Notes: (-) = no landings.

Livermore identified 24 ports with landings from the Lease Area, though only four of those ports had non-confidential landings from the Lease Area. Those ports and the associated landings are identified in Table 7.6-8, below. Livermore found that between 2011 and 2016, fishing activity in the Lease Area results in landings primarily in New Bedford, Massachusetts and Point Judith, Rhode Island. For the six years of data analyzed, vessels landed an estimated annual average value of $407,160 in New Bedford and $313,847 in Point Judith from the Lease Area. Estimated annual landings, by state, from the Lease Area are presented in Table 7.6-7. Again, the WDA encompasses less than half of the Lease Area and estimates of landings from the WDA should be reduced accordingly.

Table 7.6-8 Estimated Annual Landings by Port (2011-2016; Livermore [2017])

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total in Lease Area
Chatham, MA	$65,332.05	$97,471.16	$37,237.08	$21,321.88	C	C	$221,362.17
Montauk, NY	C	C	$24,372.87	C	$9,067.00	$118,652.10	$152,091.97
New Bedford, MA	$37,705.15	$884,492.00	$513,661.67	$177,570.24	$215,194.22	$615,985.94	$2,444,609.22
Point Judith, RI	$54,172.29	$52,724.30	$150,418.90	$257,070.74	$245,168.64	$1,111,489.95	$1,871,044.82

Notes: (C) = confidential landings. The 69 reports of confidential landings for all 24 ports during the years studied are $451,152.08.

Recognizing the importance of certain species and/or Fisheries Management Plans to specific ports within the Project Region, namely Squid and Sea Scallops, Table 7.6-9 identifies the estimated annual landings of those species from the Lease Area. Livermore, however, identifies landings from a total of 21 species and/or Fishery Management Plans from within the Lease Area.

Table 7.6-9 Estimated Annual Landings by Fishery Management Plan (2011-2016; Livermore [2017])

Fishery Management Plan	2011	2012	2013	2014	2015	2016	Non-Confidential Total in Lease Area
Sea Scallop	C	$860,827.35	$486,967.00	$123,920.84	$42,903.90	$3,768.44	$1,518,387.53
Squid, Mackerel, Butterfish	$19,589.39	$21,041.07	$78,916.33	$74,834.90	$133,944.37	$1,381,315.24	$1,709,641.30

Notes: (C) = confidential landings. The 38 reports of confidential landings for all 21 species/Fisheries Management Plans during the years studied total less than $66,626.23.

Finally, Livermore identified six different gear types with landings from within the Lease Area. Only three of those gear types had non-confidential landings, which are shown in Table 7.6-10, below.

Table 7.6-10 Estimated Annual Landings by Gear Type (2011-2016; Livermore [2017])

Fishery Management Plan	2011	2012	2013	2014	2015	2016	Non-Confidential Total in Lease Area
DREDGE, SCALLOP	C	$860,813.02	$487,985.38	$123,480.82	$42,929.62	C	$1,515,208.84
GILL NET, SINK	$72,630.77	$105,557.14	$48,131.90	$21,447.60	$41,888.11	$67,574.28	$357,229.80
OTTER TRAWL, BOTTOM, FISH	$114,166.51	$109,599.42	$226,370.35	$331,493.73	$438,182.18	$1,981,018.41	$3,200,830.60

Notes: (C) = confidential landings. The 9 reports of confidential landings for all gear types during the years studied total $72,019.83.

Relative annual fishing vessel density, as calculated by DEM, for the Squid, Mackerel, Butterfish Fishery Management Plan between 2011 and 2016 are provided as Figures 7.6-24 to 7.6-30. Figure 7.6-30 depicts the cumulative density of fishing vessels for the same years within that Fishery Management Plan. Consistent with the NROC and MARCO data, relative vessel density within the Lease Area for each year analyzed was low, with the highest densities occurring outside and to the north of the WDA. Portions of the OECC south traversed areas of medium and high vessel density in 2013 and 2014 south of Muskeget Channel.

Relative annual fishing vessel density, as calculated by DEM, for vessels operating within the Sea Scallop Fishery Management Plan between 2011 and 2016 are provided as Figure 7.6-31 to figure 7.6-37. Figure 7.6-37 depicts the cumulative fishing vessel density for the same years within that Fishery Management Plan. In each year analyzed, limited areas of low relative vessel density in this fishery were identified within the WDA and along the OECC. Based on the parameters of this analysis, certain portions of the WDA and OECC did not register vessel density in this fishery.

Relative annual fishing vessel density, as calculated by DEM, for vessels operating within the Northeast Multispecies Fishery Management Plan between 2011 and 2016 are provided as Figure 7.6-38 to figure 7.6-44. Figure 7.6-44 depicts the cumulative fishing vessel density for the same years within that Fishery Management Plan. In each year analyzed, limited areas of low relative vessel density in this fishery were identified within the WDA and along the OECC. Based on the parameters of this analysis, certain portions of the WDA and OECC did not register vessel density in this fishery.

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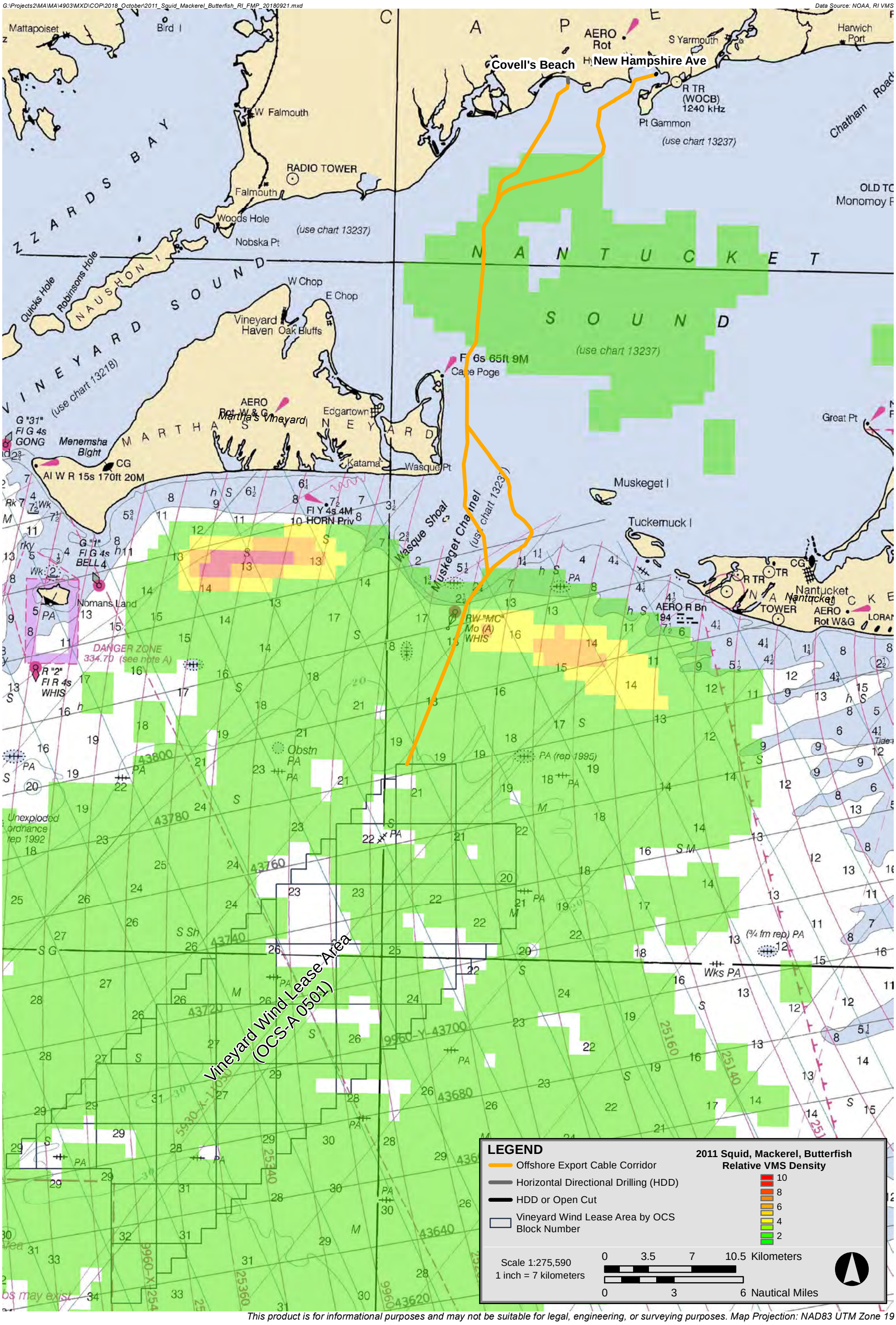
Data Source: NOAA, RI VMS



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Vineyard Wind Project

VINEYARD WIND

Figure 7.6-24

DEM – Squid, Mackerel, Butterfish 2011 Commercial Fishing Density

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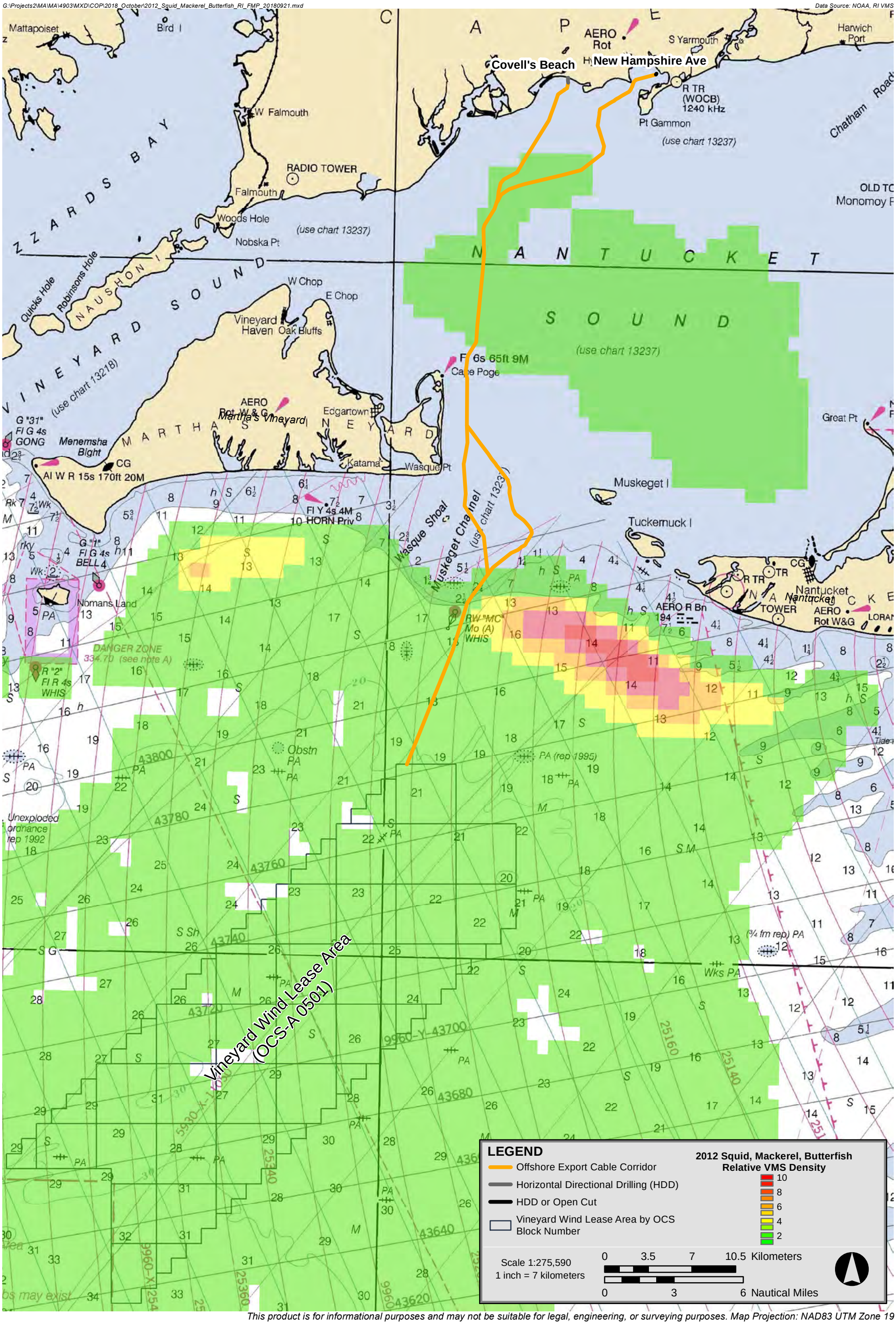
Data Source: NOAA, RI VMS



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Vineyard Wind Project

VINEYARD WIND

Figure 7.6-25

DEM – Squid, Mackerel, Butterfish 2012 Commercial Fishing Density

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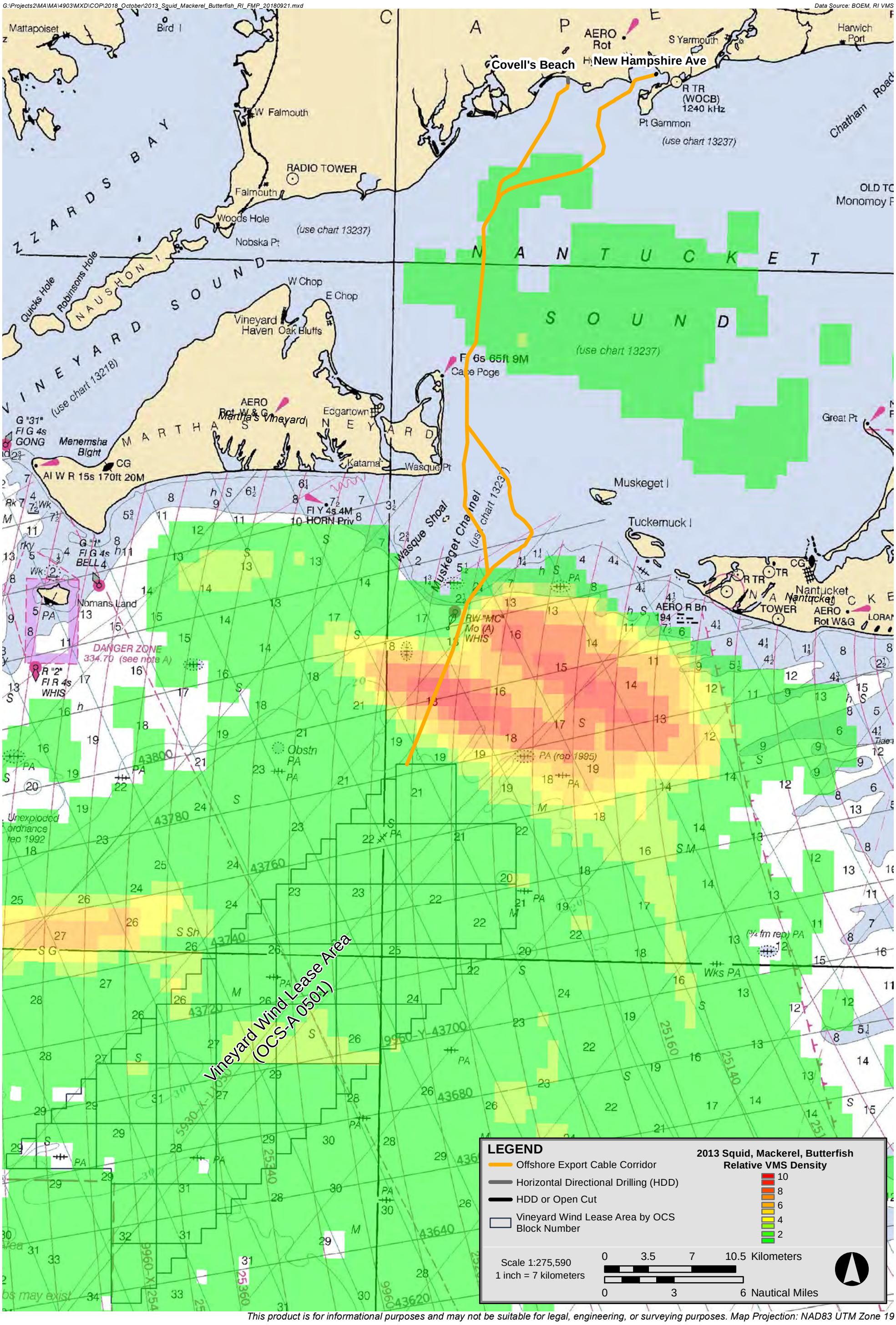
Data Source: BOEM, RI VMS



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Vineyard Wind Project

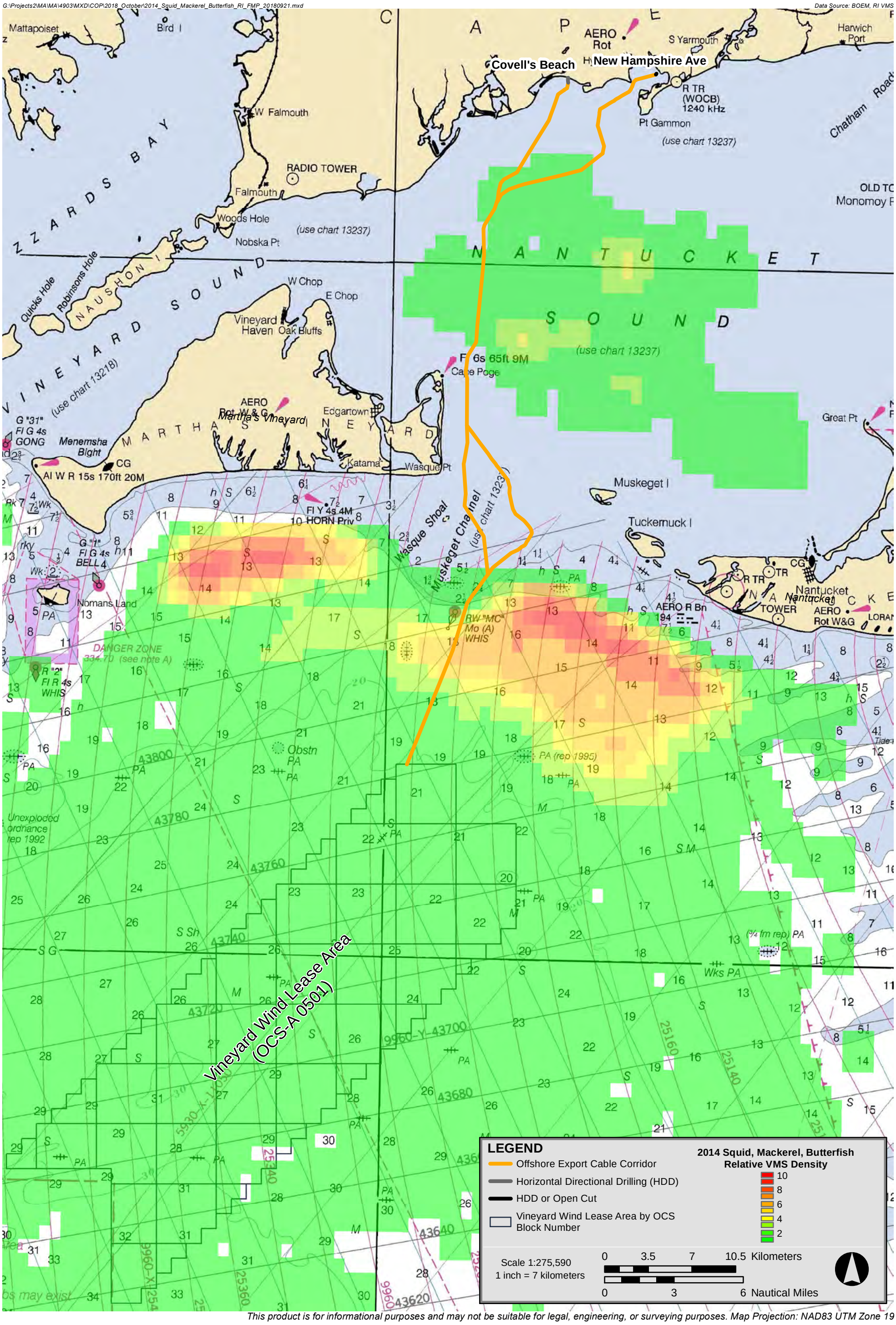
VINEYARD WIND

Figure 7.6-26

DEM – Squid, Mackerel, Butterfish 2013 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2014_Squid_Mackerel_Butterfish_RI_FMP_20180921.mxd

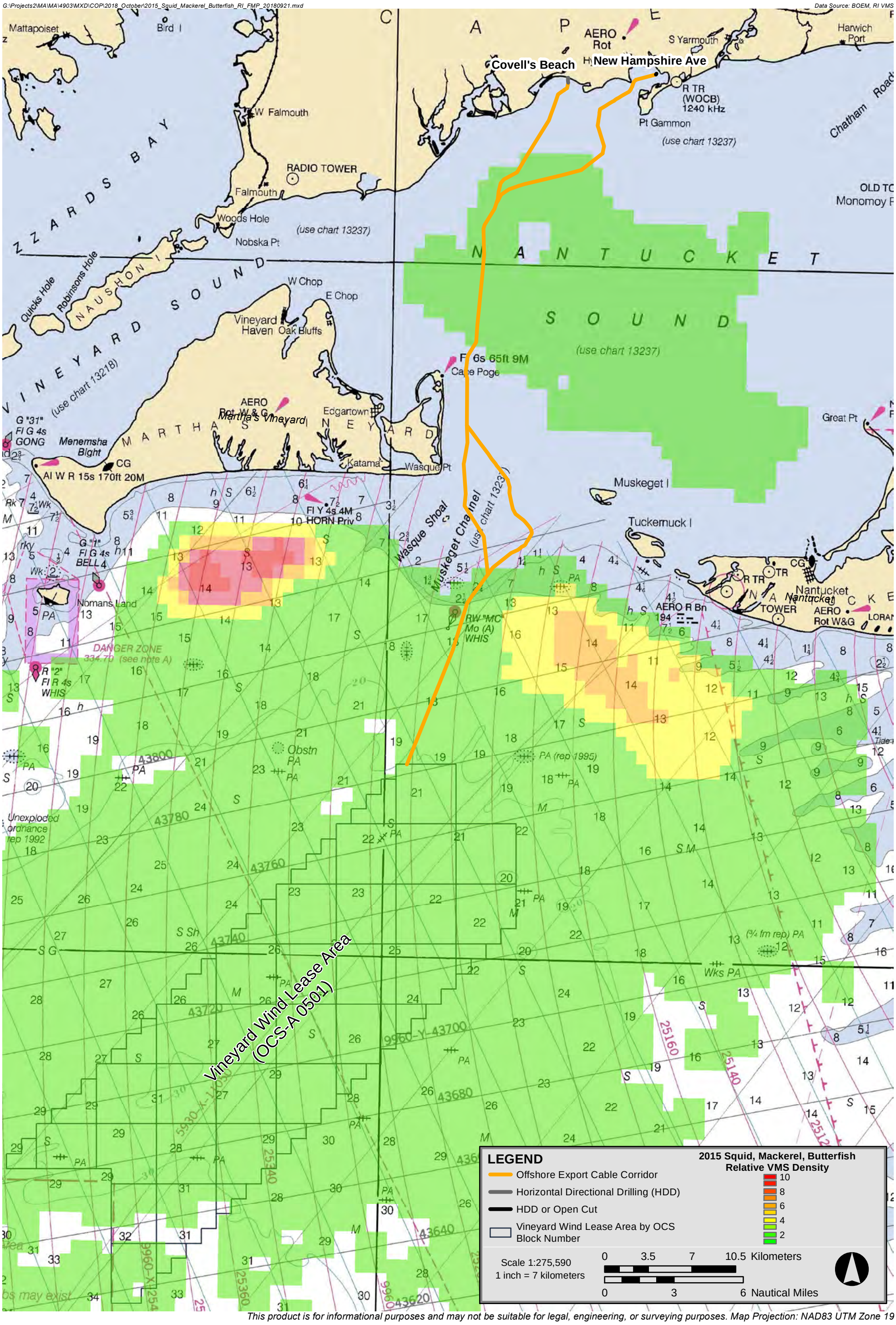
Data Source: BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2015_Squid_Mackerel_Butterfish_RI_FMP_20180921.mxd

Data Source: BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

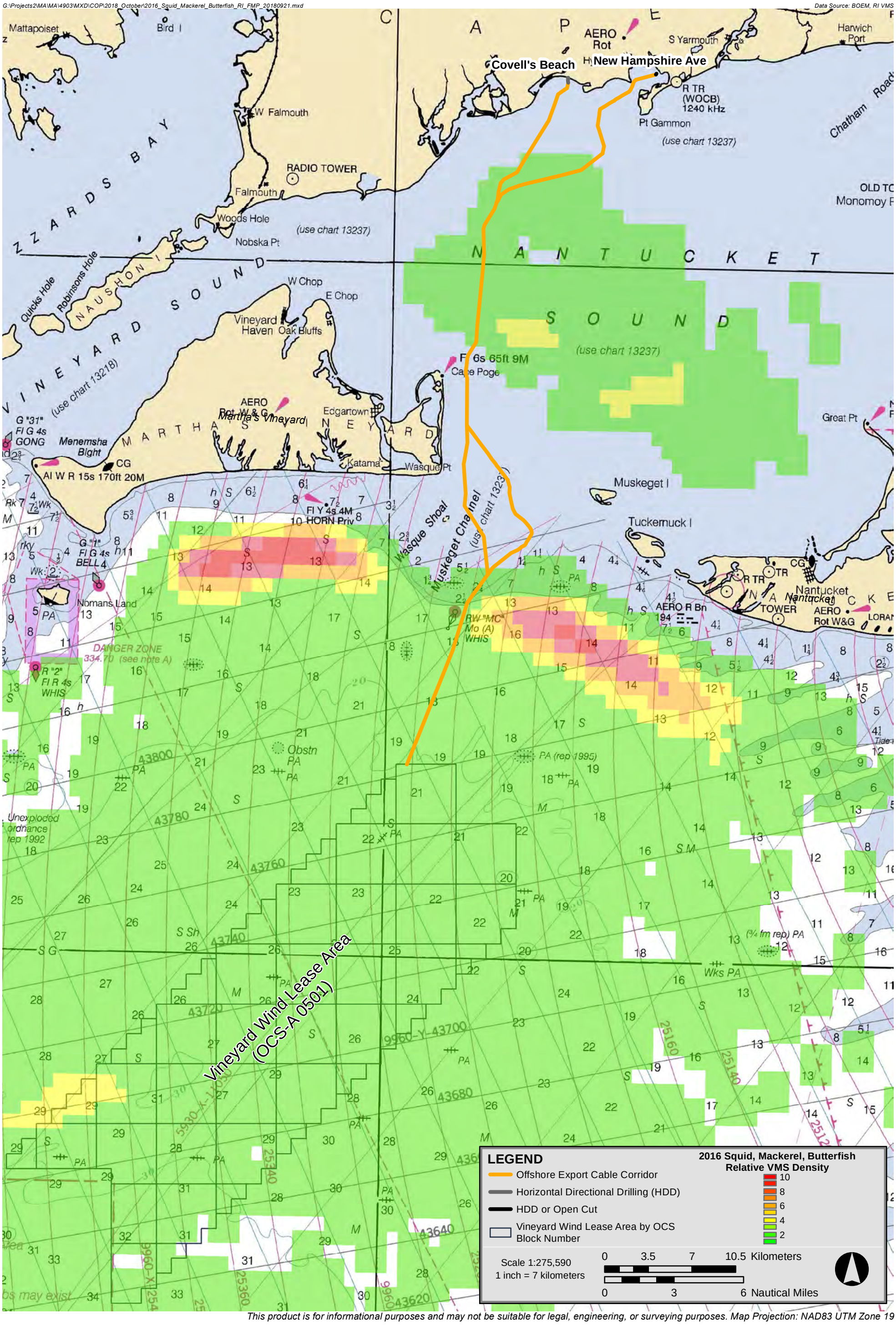
VINEYARD WIND

Figure 7.6-28

DEM – Squid, Mackerel, Butterfish 2015 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2016_Squid_Mackerel_Butterfish_RI_FMP_20180921.mxd

Data Source: BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

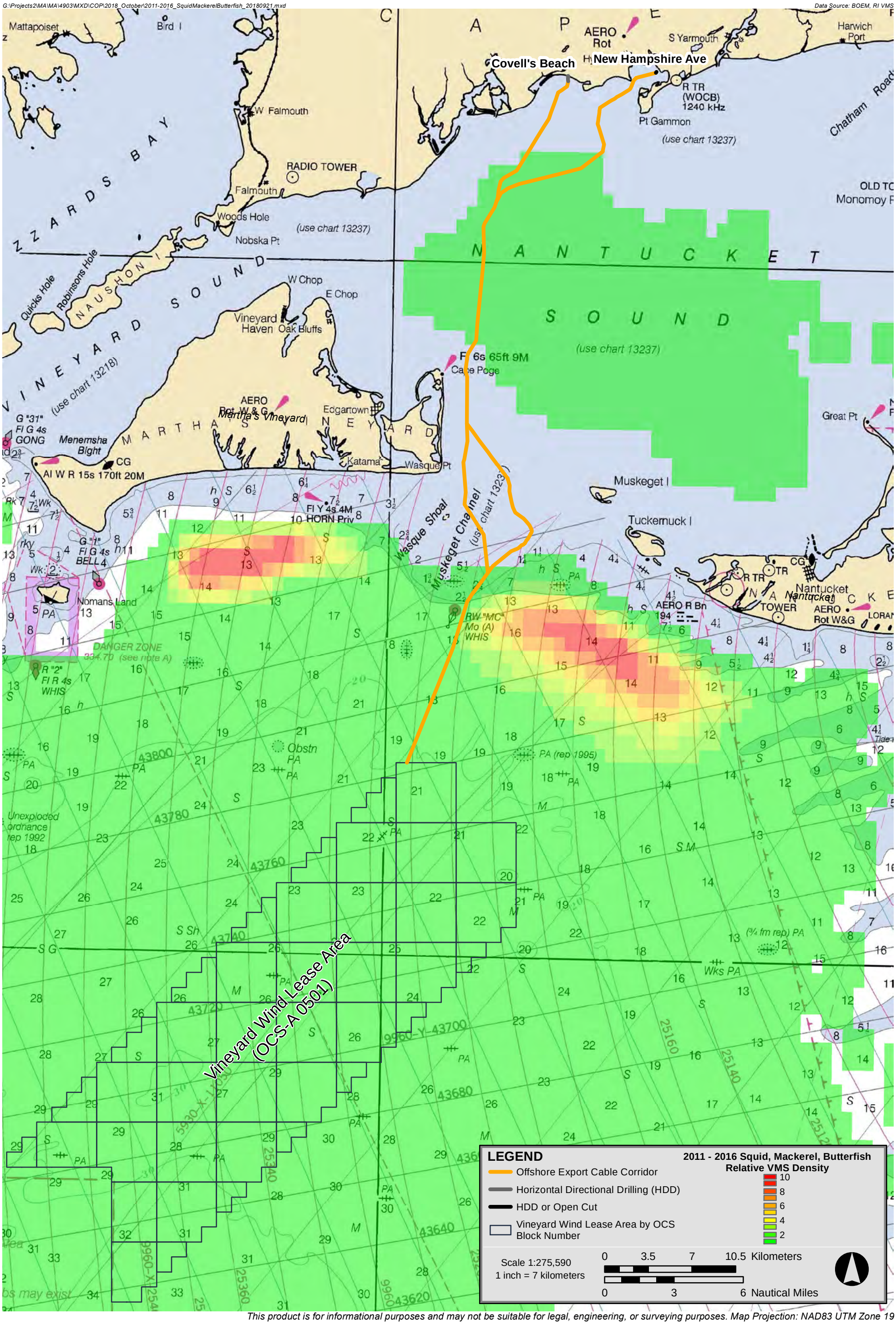
VINEYARD WIND

Figure 7.6-29

DEM – Squid, Mackerel, Butterfish 2016 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2011-2016_SquidMackerelButterfish_20180921.mxd

Data Source: BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

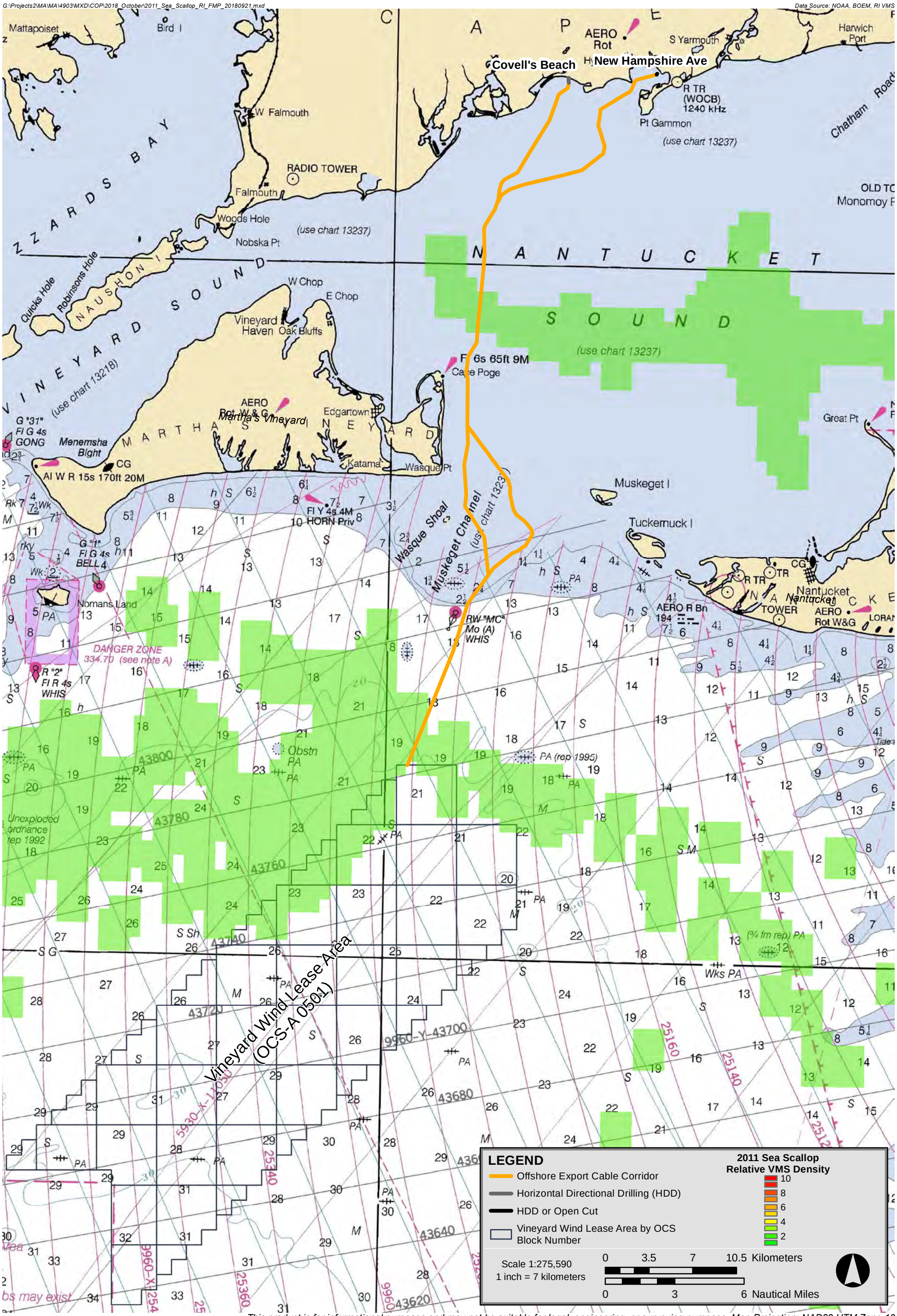
VINEYARD WIND

Figure 7.6-30

DEM – Squid, Mackerel, Butterfish 2011-2016 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2011_Sea_Scallop_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2012_Sea_Scallop_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS

Covell's Beach

New Hampshire Ave

Vineyard Wind Lease Area (OCS-A 0501)

LEGEND

Offshore Export Cable Corridor

Horizontal Directional Drilling (HDD)

HDD or Open Cut

Vineyard Wind Lease Area by OCS Block Number

2012 Sea Scallop Relative VMS Density

10

8

6

4

2

Scale 1:275,590
1 inch = 7 kilometers

0 3.5 7 10.5 Kilometers

0 3 6 Nautical Miles

This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

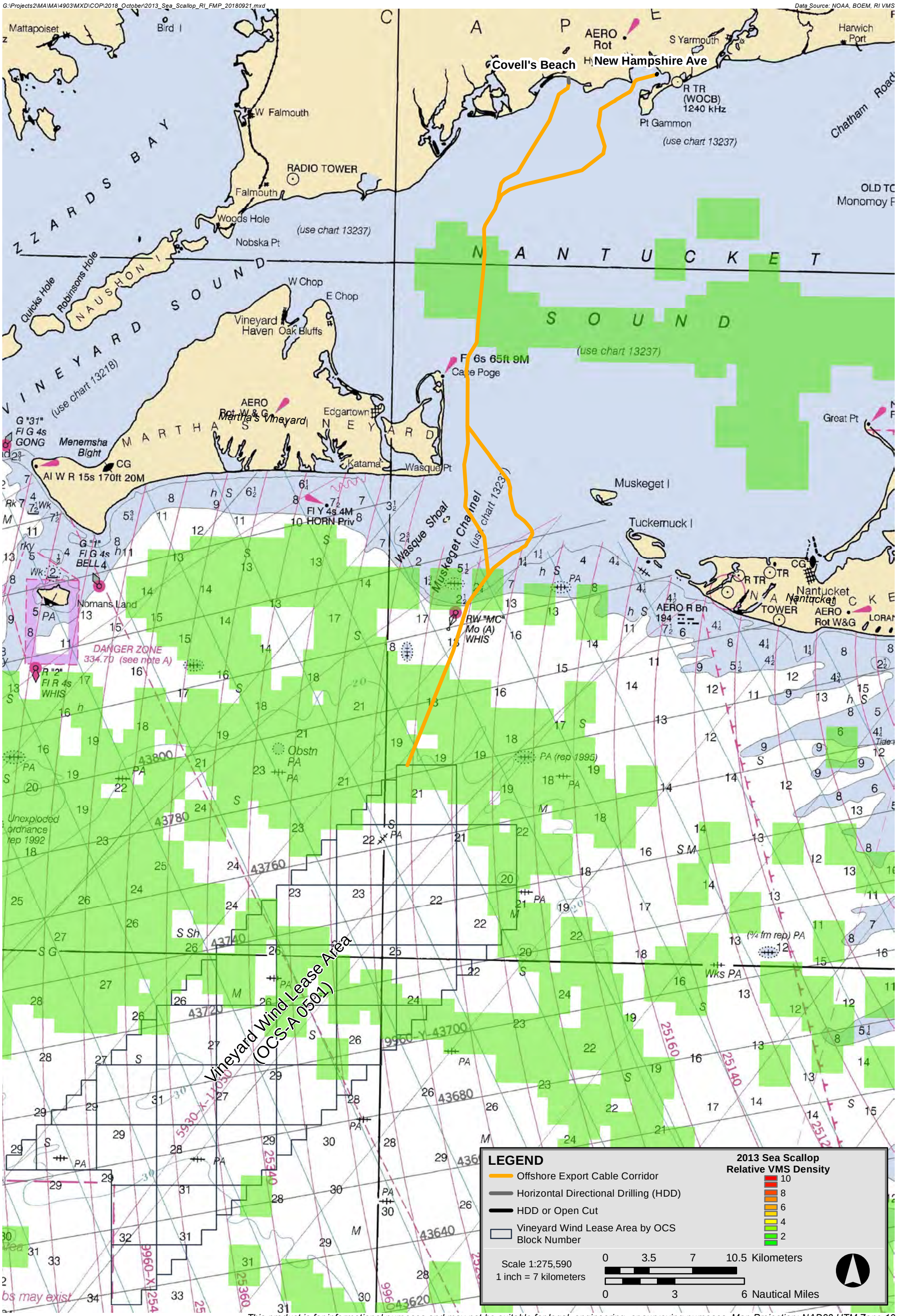
VINEYARD WIND

Figure 7.6-32

DEM – Sea Scallop 2012 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2013_Sea_Scallop_RI_FMP_20180921.mxd

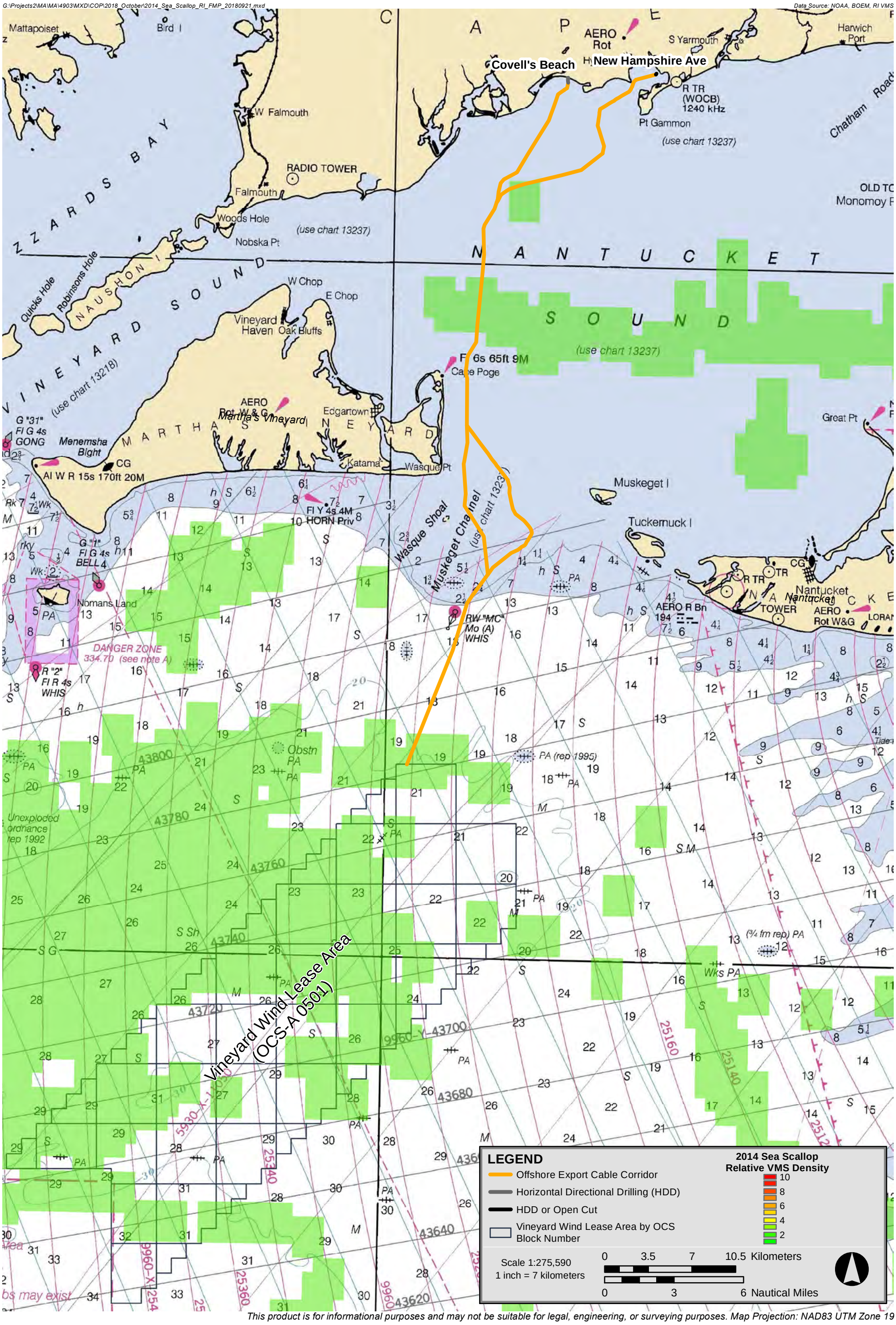
Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2014_Sea_Scallop_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

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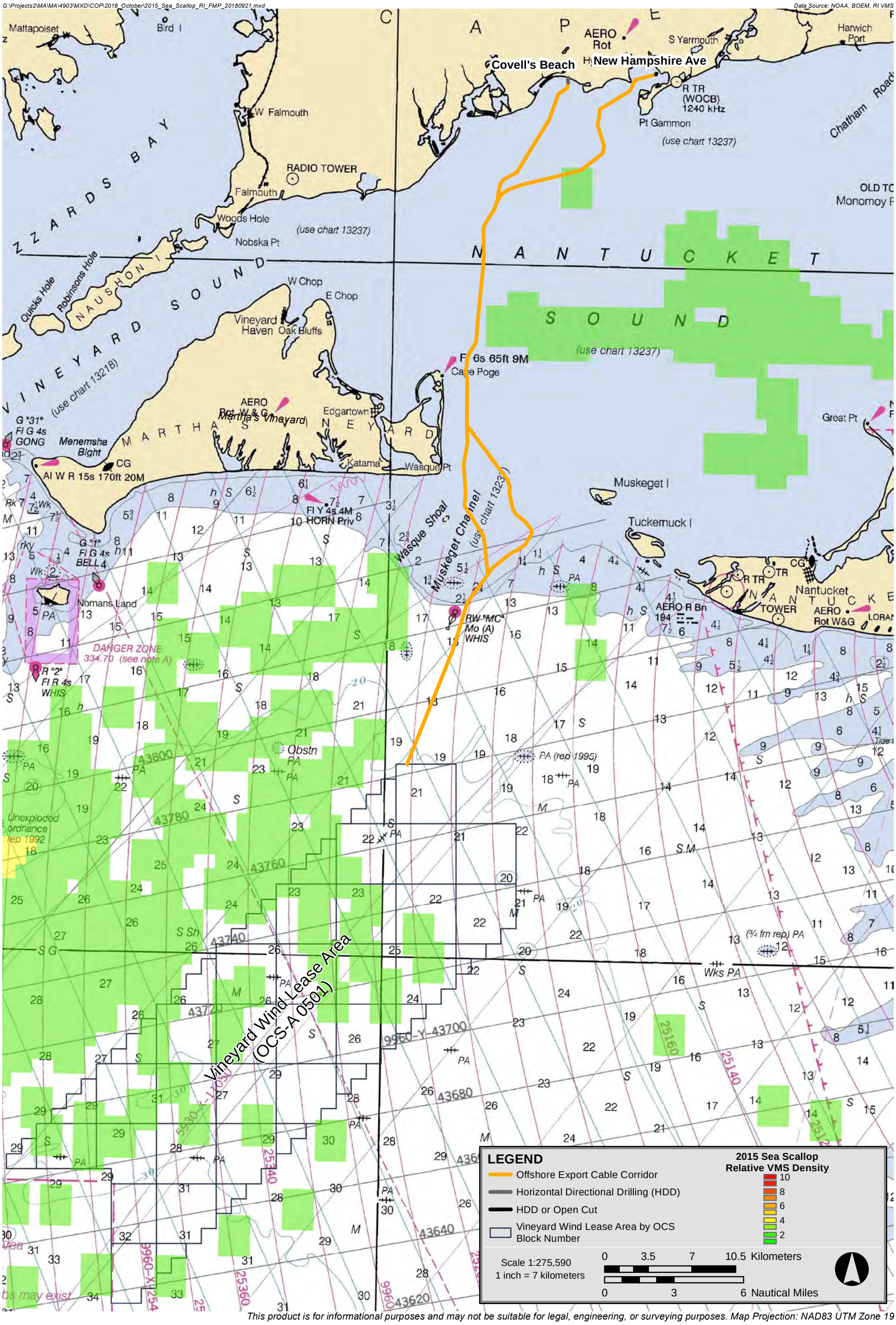
Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

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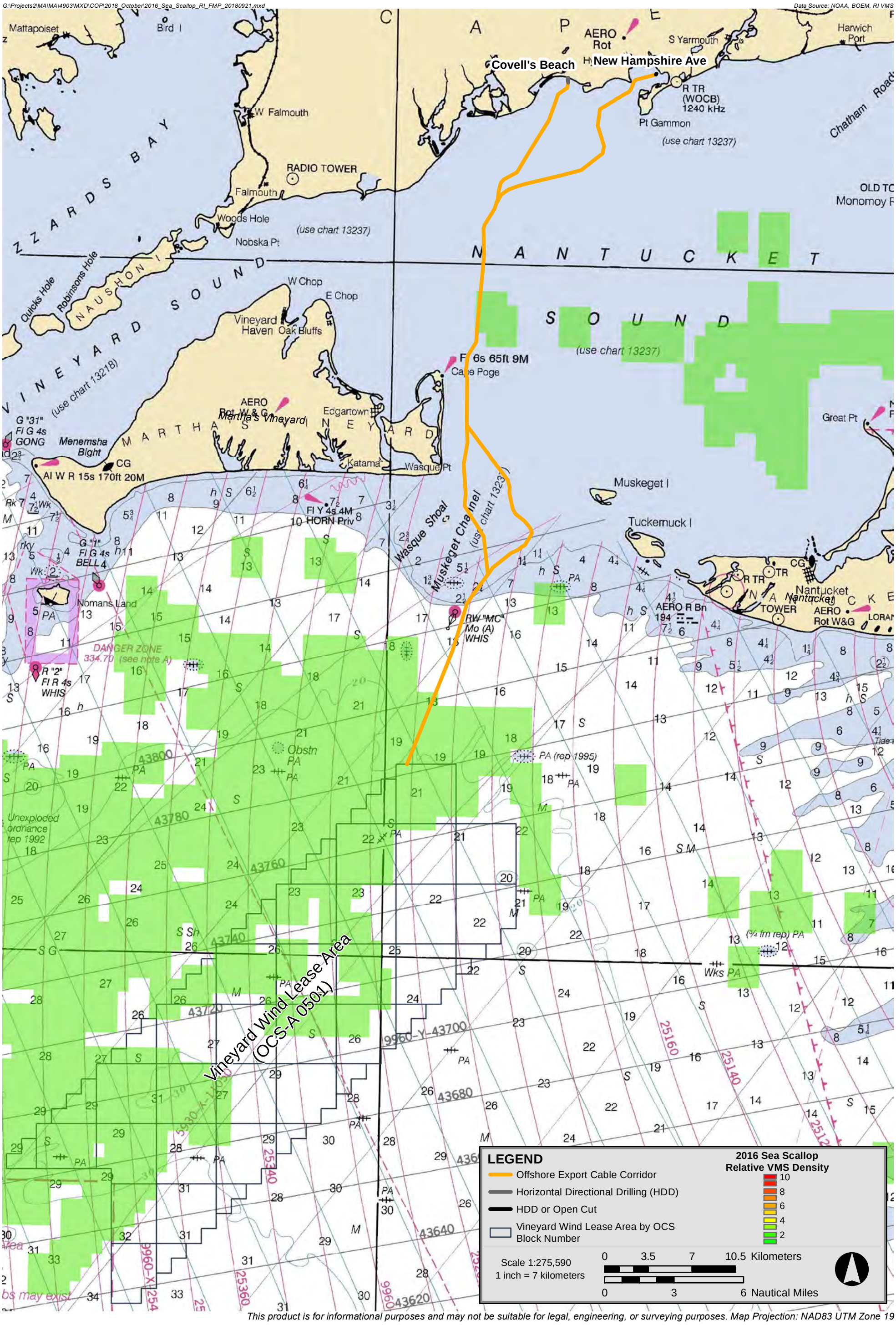
Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

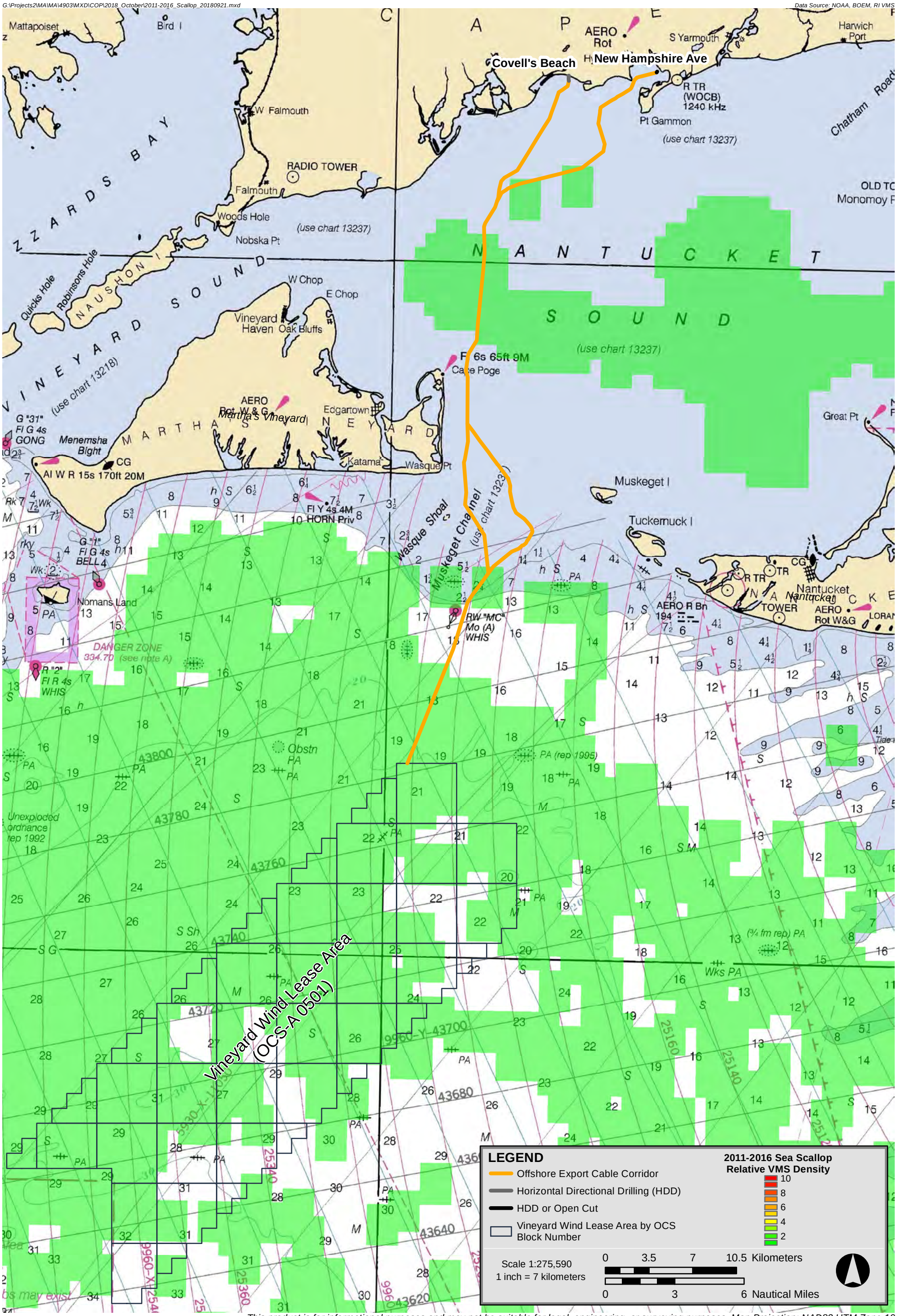
VINEYARD WIND

Figure 7.6-36

DEM – Sea Scallop 2016 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2011-2016_Scallop_20180921.mxd

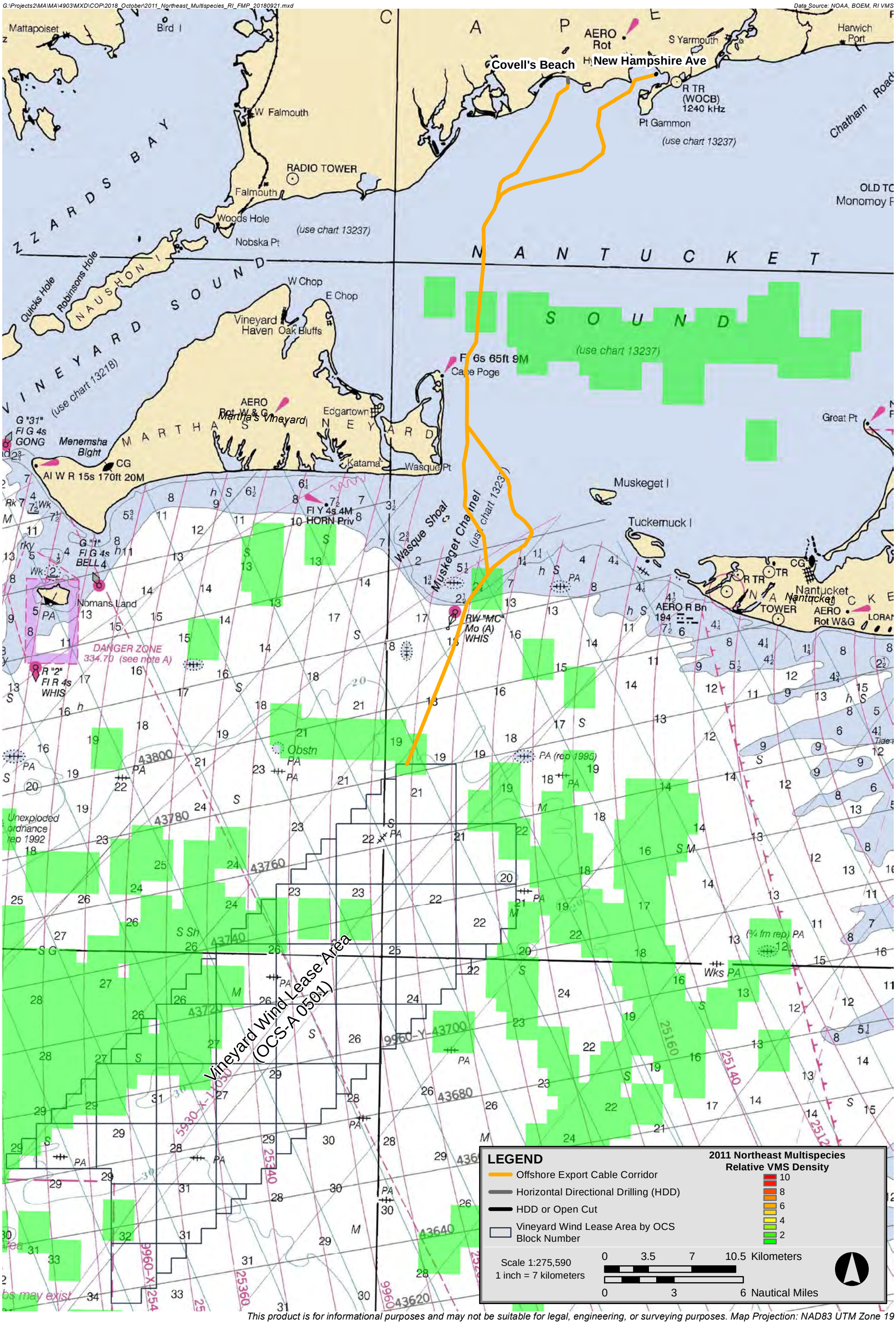
Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2011_Northeast_Multispecies_RI_FMP_20180921.mxd

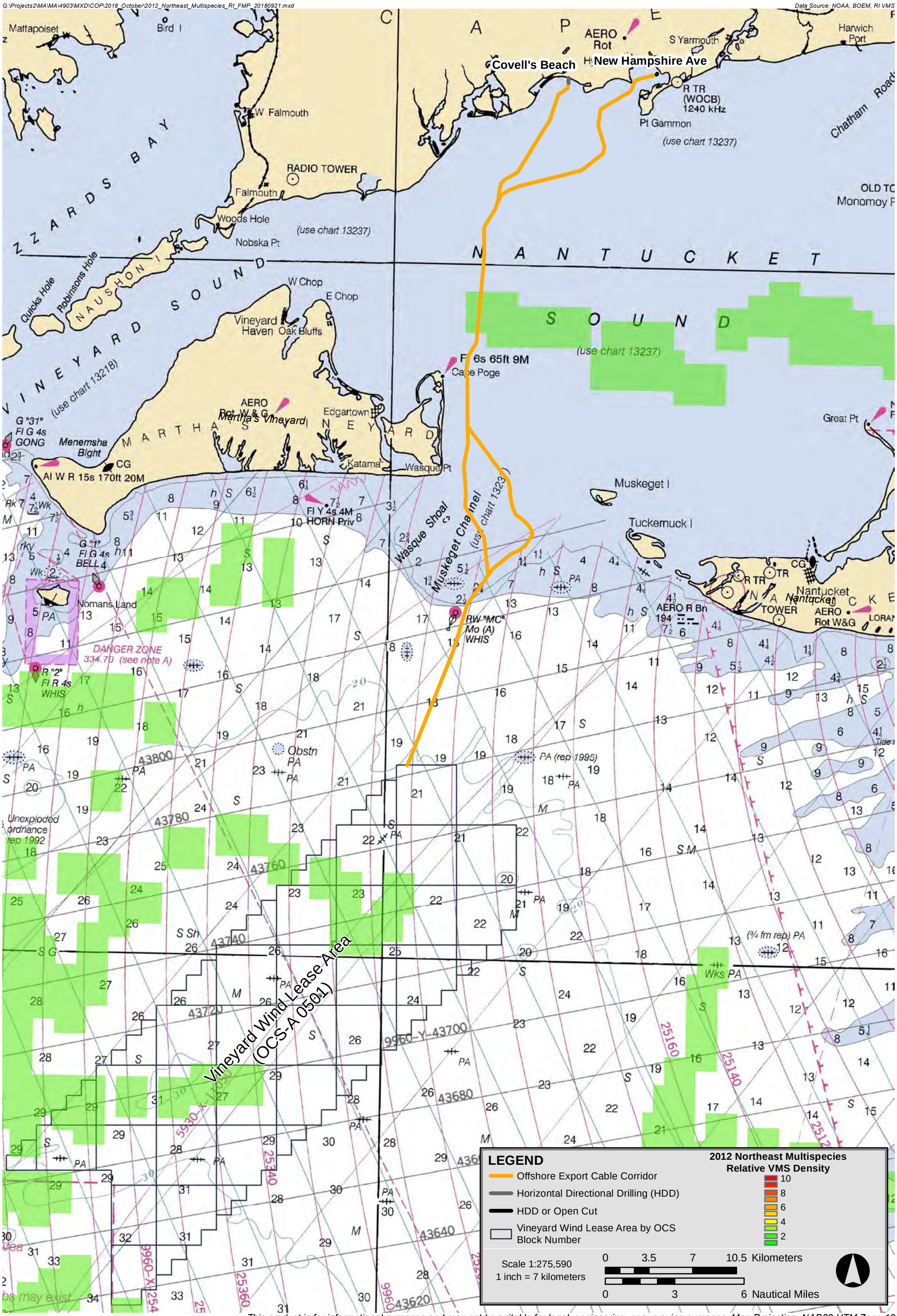
Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2012_Northeast_Multispecies_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

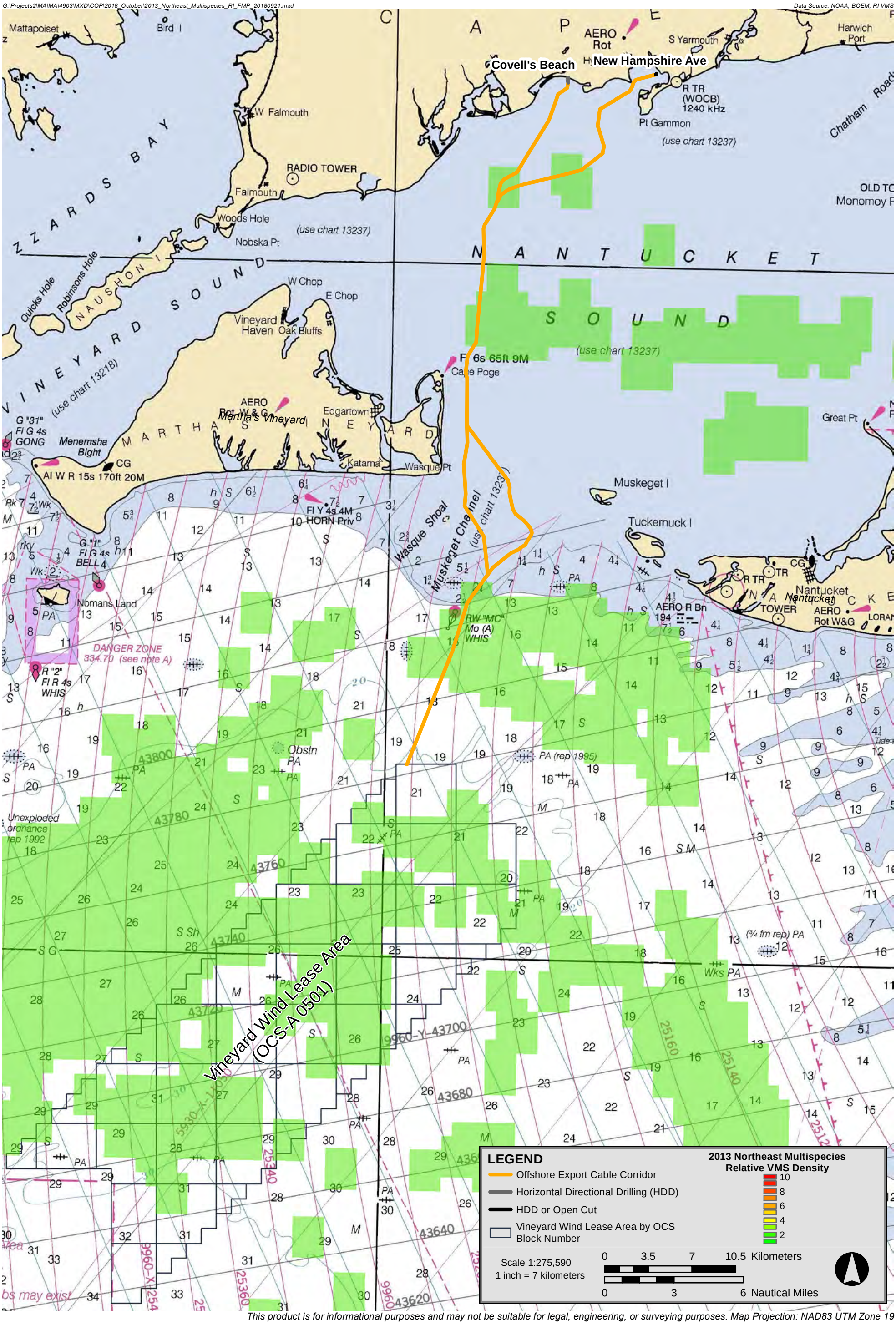
VINEYARD WIND

Figure 7.6-39

DEM – Northeast Multispecies 2012 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2013_Northeast_Multispecies_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

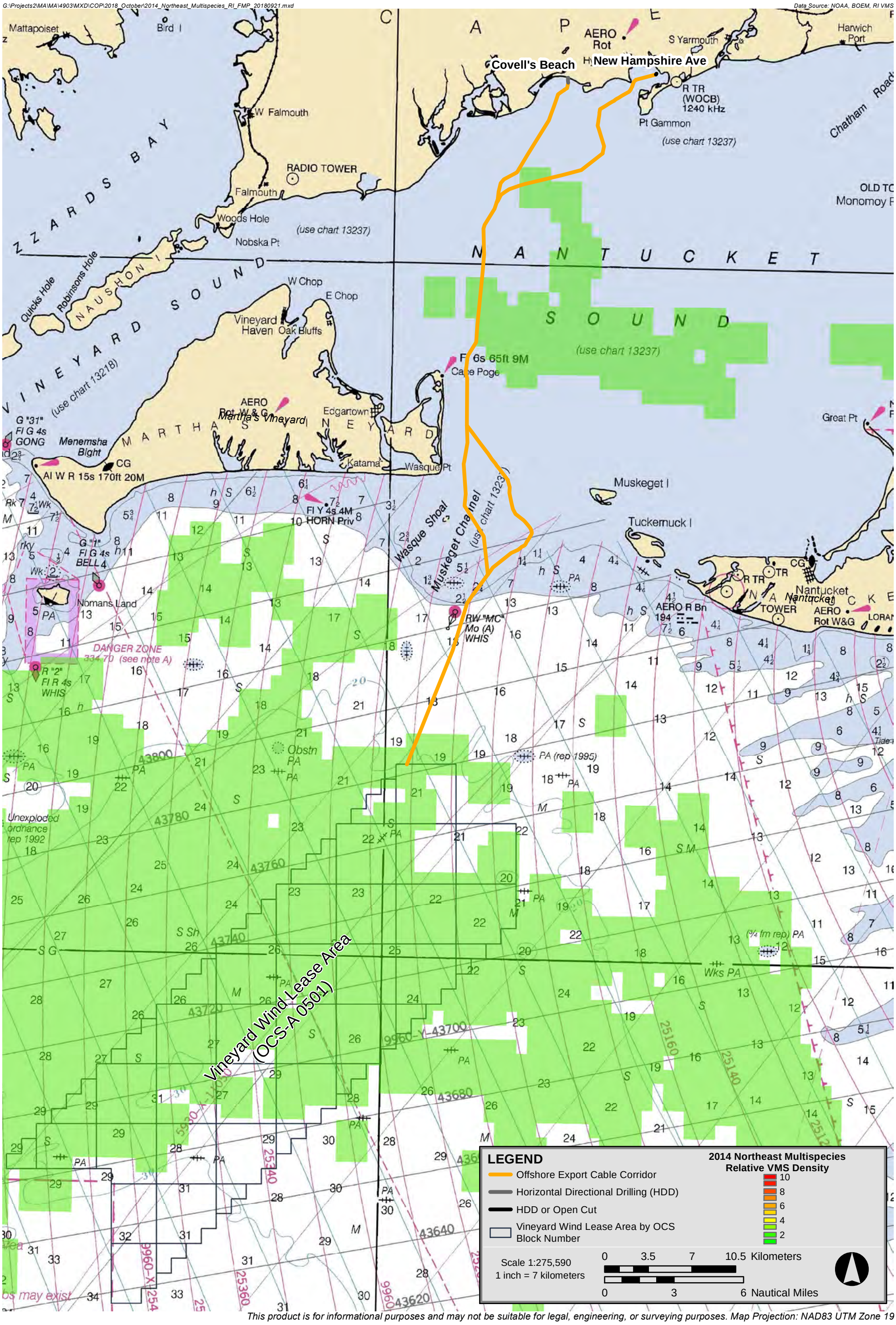
VINEYARD WIND

Figure 7.6-40

DEM – Northeast Multispecies 2013 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2014_Northeast_Multispecies_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

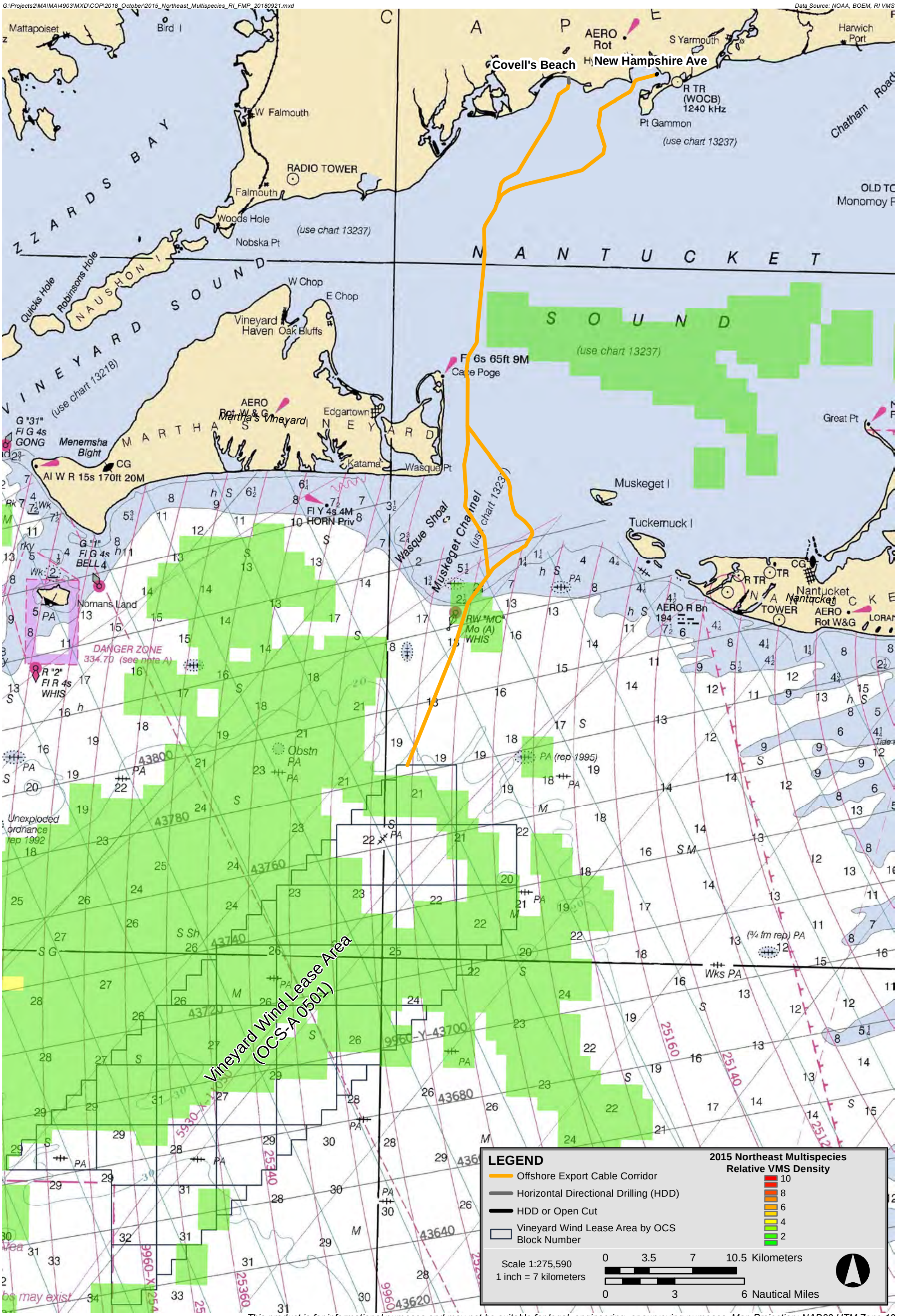
VINEYARD WIND

Figure 7.6-41

DEM – Northeast Multispecies 2014 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2015_Northeast_Multispecies_RI_FMP_20180921.mxd

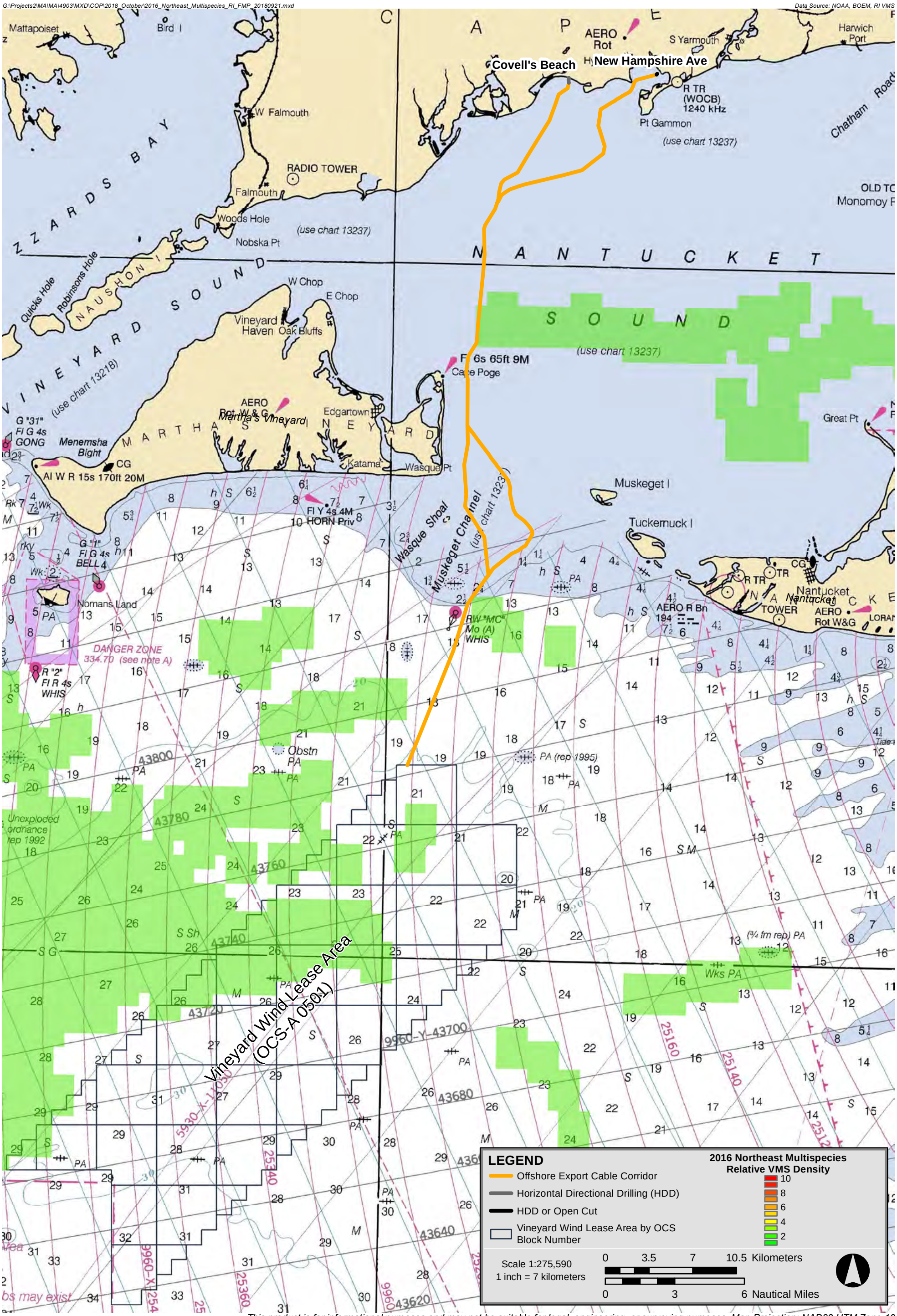
Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2016_Northeast_Multispecies_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



LEGEND

- Offshore Export Cable Corridor
- Horizontal Directional Drilling (HDD)
- HDD or Open Cut
- Vineyard Wind Lease Area by OCS Block Number

2016 Northeast Multispecies Relative VMS Density

10
8
6
4
2

Scale 1:275,590
1 inch = 7 kilometers

0 3.5 7 10.5 Kilometers

0 3 6 Nautical Miles

This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

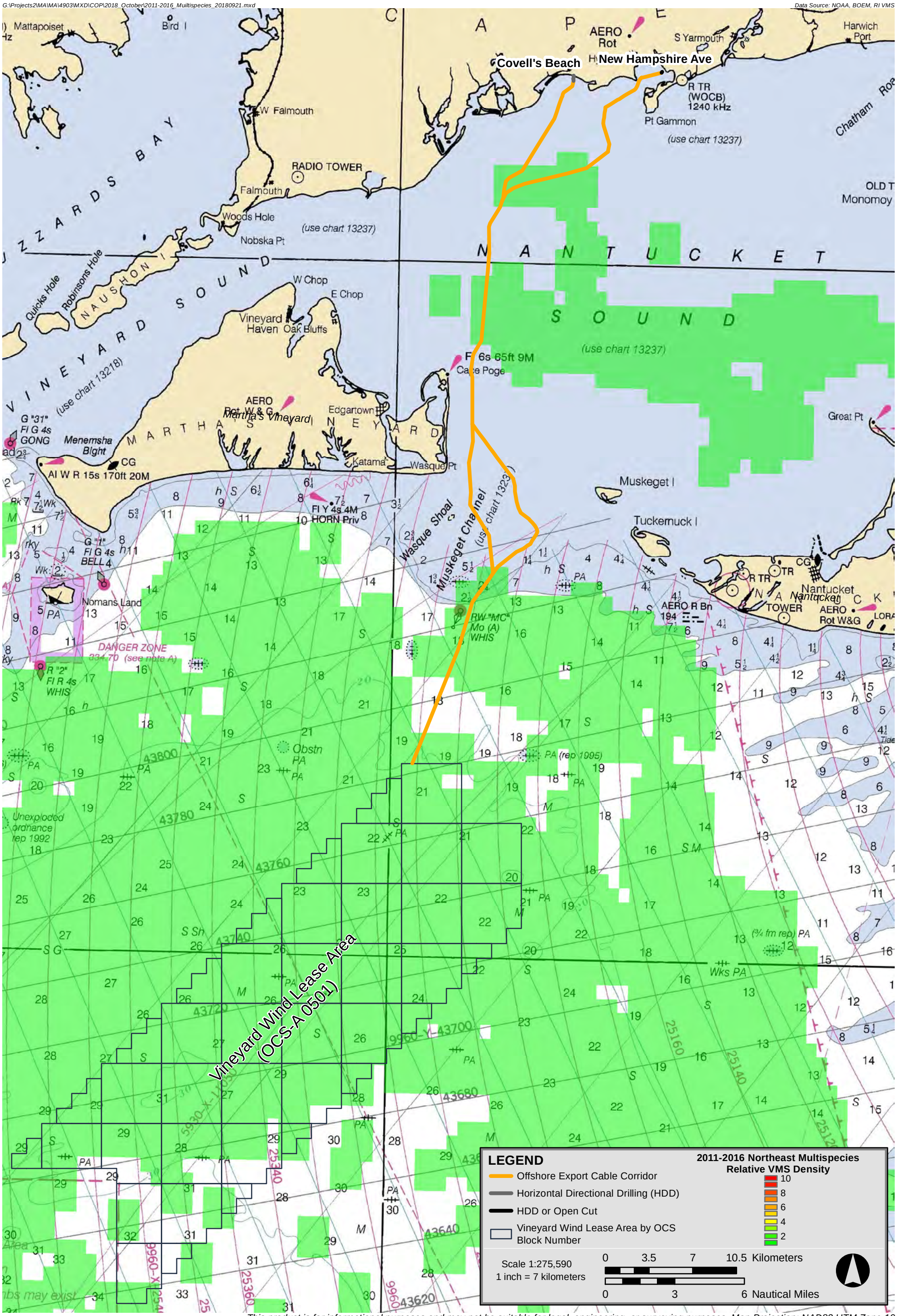
VINEYARD WIND

Figure 7.6-43

DEM – Northeast Multispecies 2016 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2011-2016_Muiltispecies_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

VINEYARD WIND

Figure 7.6-44

DEM - Northeast Multispecies 2011-2016 Commercial Fishing Density

Relative annual fishing vessel density, as calculated by DEM, for vessels operating within the Monkfish Fishery Management Plan between 2011 and 2016 are provided as Figure 7.6-45 to figure 7.6-51. Figure 7.6-51 depicts the cumulative fishing vessel density for the same years within that Fishery Management Plan. With the exception of 2016, limited areas of low relative vessel density in this fishery were identified within the WDA and along the OECC. In 2013, a small area of elevated vessel density was reported along the OECC south of Muskeget Channel.

7.6.3 Fishery Impacts in and Around the Wind Development Area

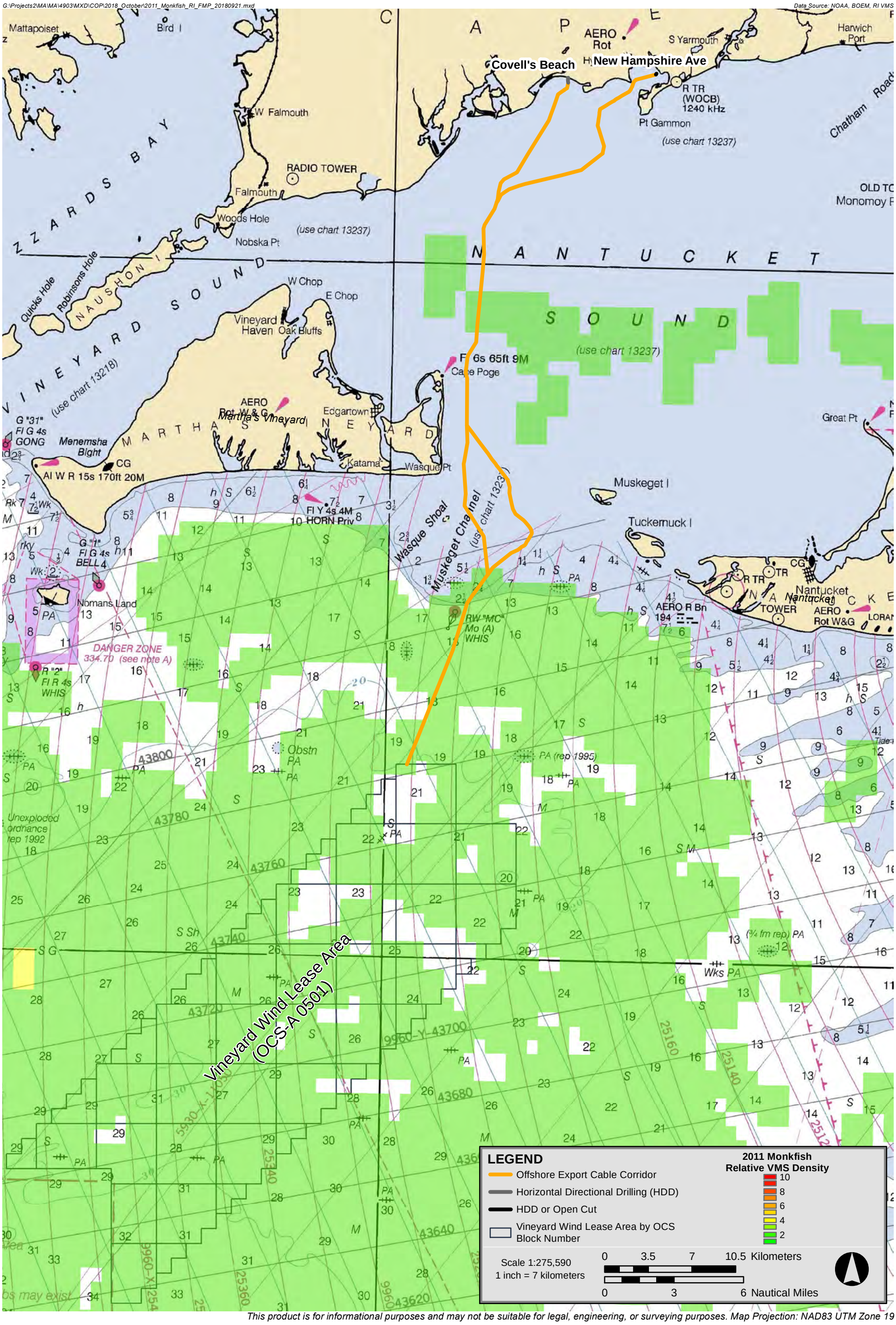
As described in Section 6.6.2, impacts to finfish and invertebrates, including those species targeted by commercial fishermen within the WDA, are expected to be short-term and localized during the construction and installation phase of the Project. Given that construction and installation activities will occur within very limited and well-defined areas of the WDA and no vessel restrictions are proposed other than those imposed by the US Coast Guard ("USCG") in the immediate vicinity of the construction and installation vessels, the majority of the WDA will remain accessible to commercial fishing vessels throughout the construction and installation process and, indeed, throughout the anticipated lifespan of the Project.

It should be noted that the existing low total fish biomass within the WDA, coupled with the high species richness in the Offshore Project Area reduces the relative impact of the Project on commercially harvested species within the WDA. Low biomass within the WDA, suggesting decreased efficiencies within certain fisheries, may preclude productive harvesting from within the WDA even before construction and installation activities commence. Nonetheless, the species that may be impacted by construction and installation activities are anticipated to quickly recover following any potential disturbances, as described in Section 6.6.2. Additionally, the Project's efforts to limit habitat disturbance further minimizes impacts to commercial fishing activities. For those species that may be impacted by habitat alteration, the total area of alteration within the WDA due to foundation and scour protection installation, jack-up vessel use, inter-array and inter-link cable installation, and potential cable protection installation, as those activities may relate to fisheries impacts, is 1.59 km^2 (393 acres), only 0.5% of the entire WDA.

Impacts to mobile pelagic fish and invertebrate species may include localized and short-term avoidance behavior. Mobile pelagic and invertebrate species targeted by commercial fishing vessels, and known to overlap with the WDA, include herring, mackerel, butterfish, whiting, and squid. These species will be able to avoid construction areas and are not expected to be substantially impacted by construction and installation. Abundance of mobile pelagic and invertebrate species, therefore, would not be affected. However, availability of these species in proximity to construction and installation activities may decrease, potentially resulting in increased catch per unit effort outside the WDA.

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2011_Monkfish_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



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Vineyard Wind Project

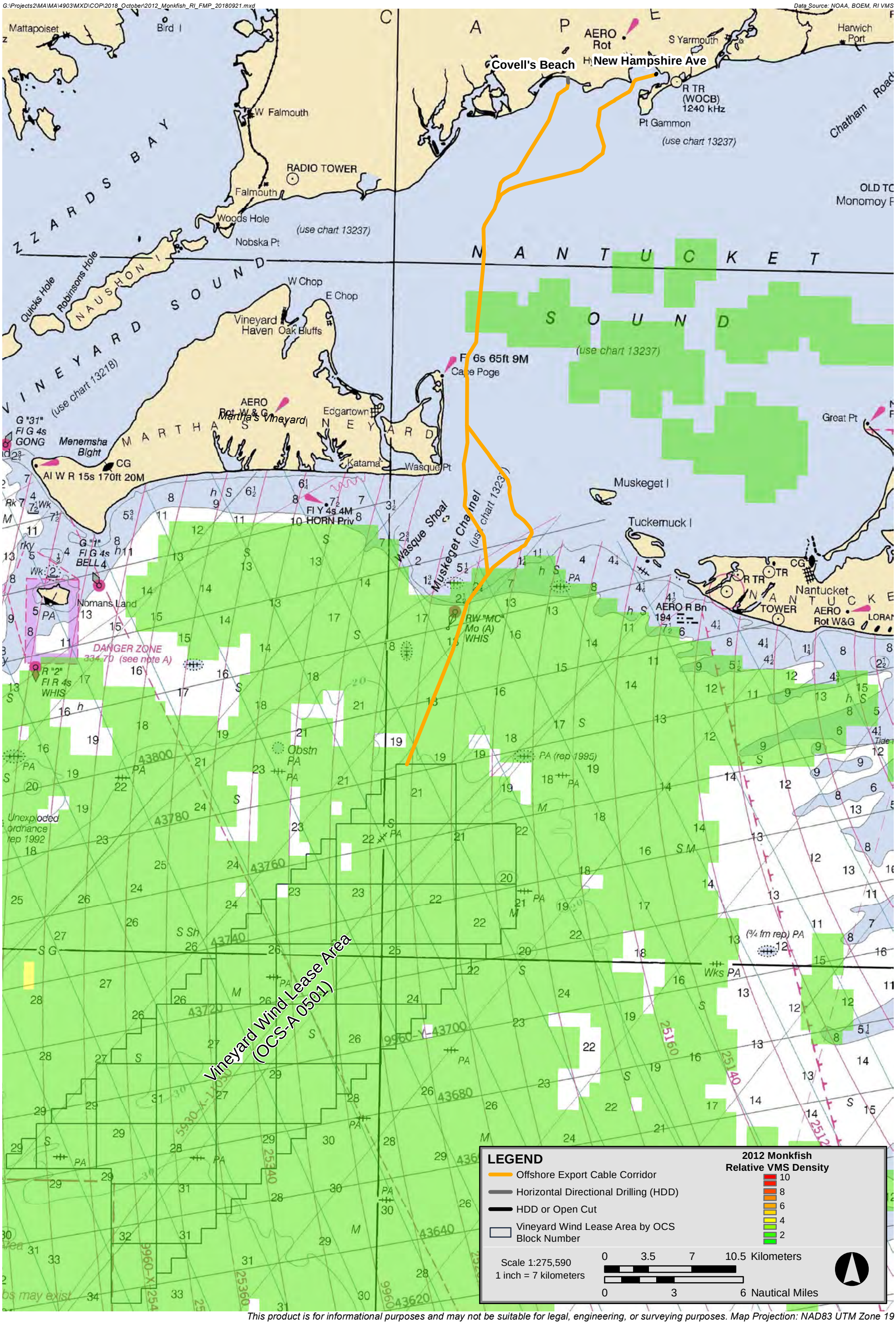
VINEYARD WIND

Figure 7.6-45

DEM – Monkfish 2011 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2012_Monkfish_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



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Vineyard Wind Project

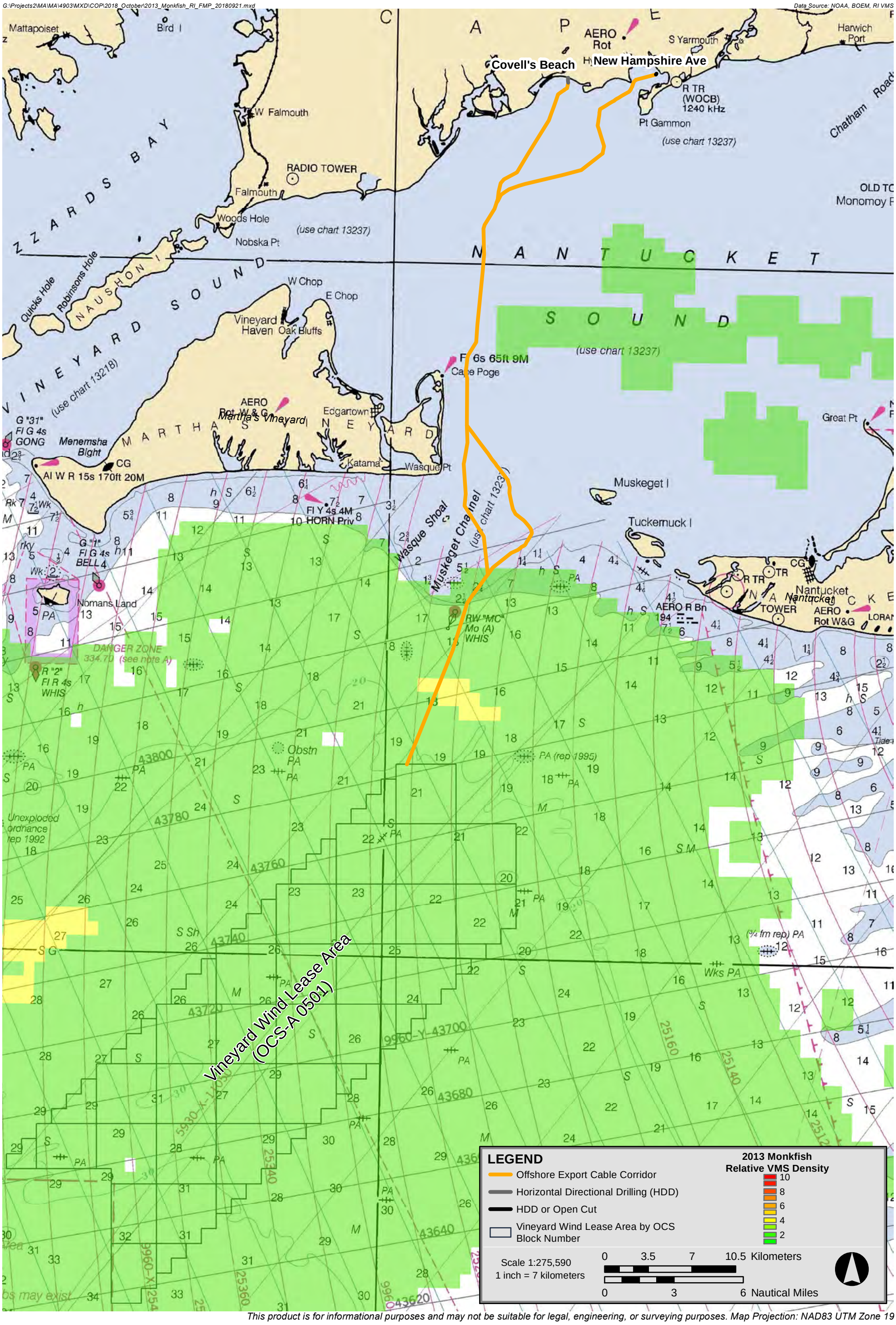
VINEYARD WIND

Figure 7.6-46

DEM – Monkfish 2012 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2013_Monkfish_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



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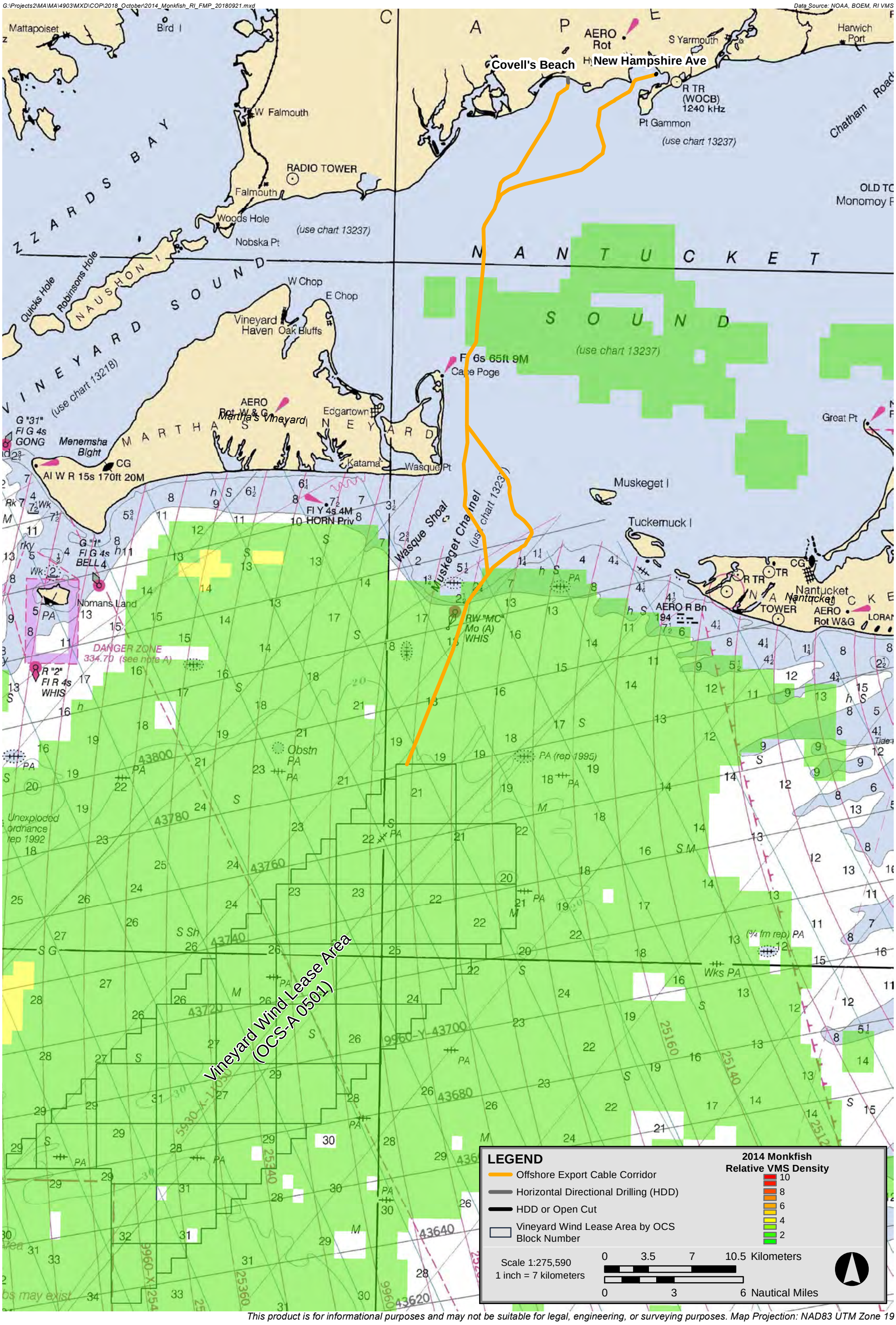
Data Source: NOAA, BOEM, RI VMS



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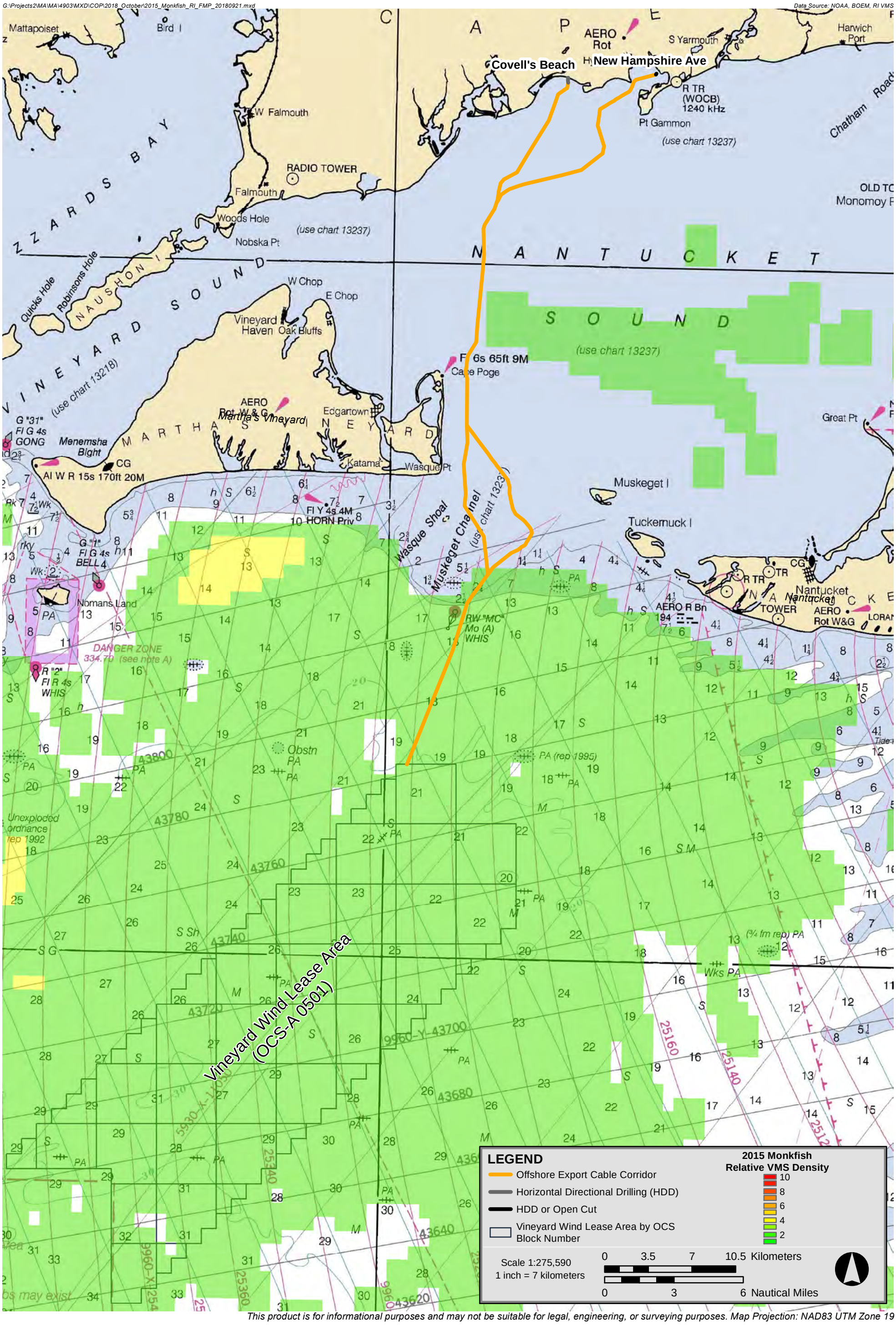
G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2015_Monkfish_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



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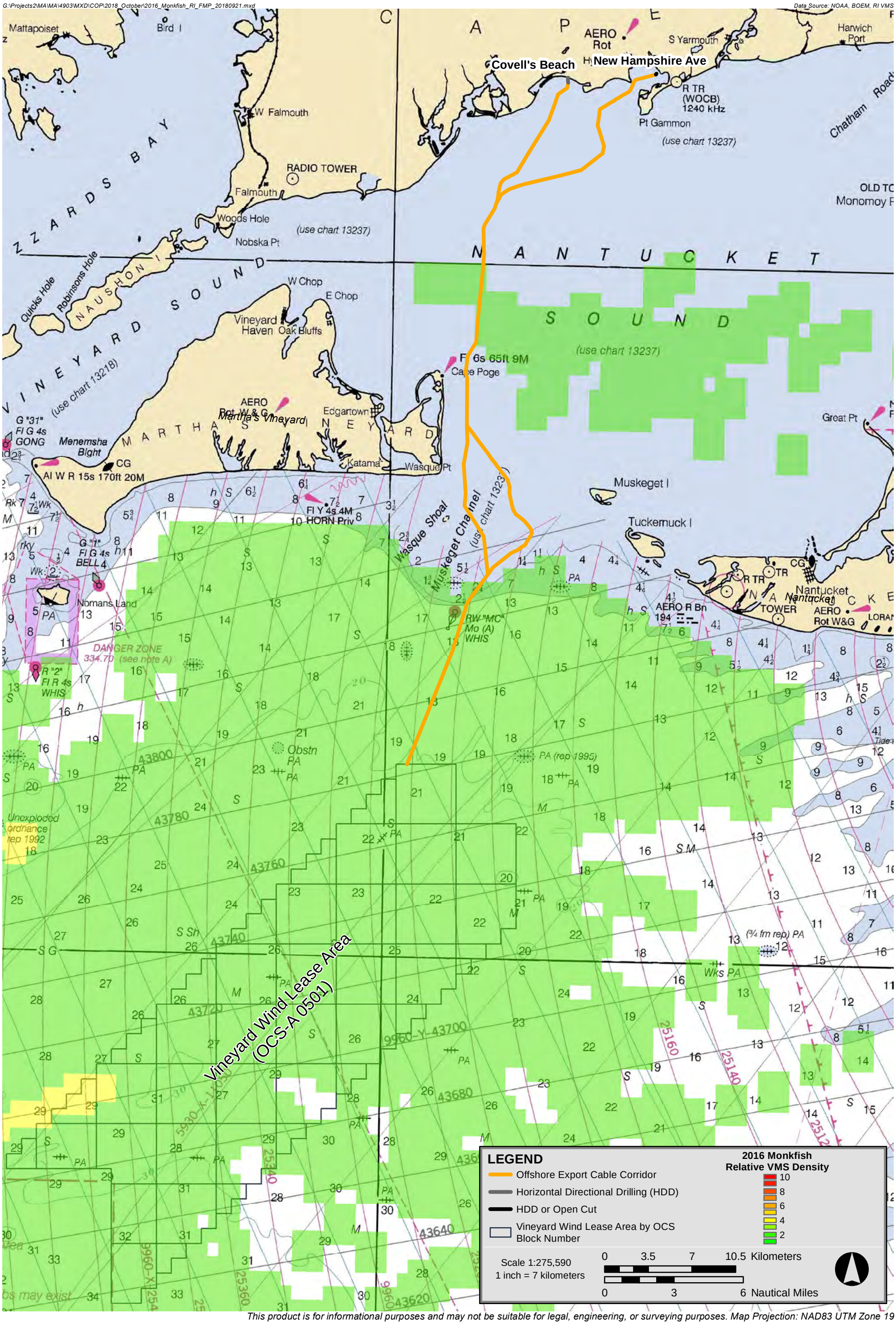
G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2016_Monkfish_RI_FMP_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

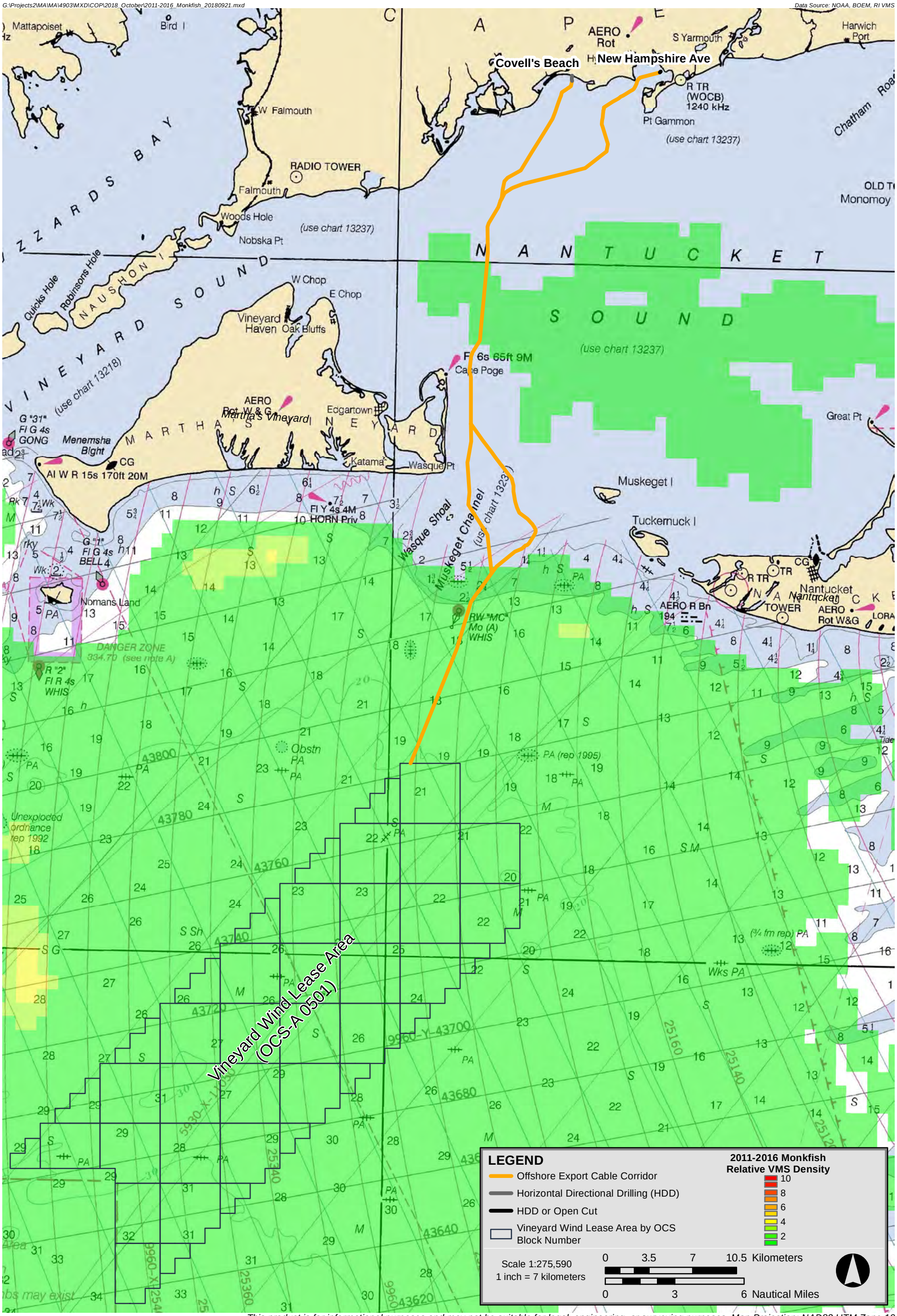
VINEYARD WIND

Figure 7.6-50

DEM – Monkfish 2016 Commercial Fishing Density

G:\Projects2\MA\MA\4903\MXD\COP\2018_October\2011-2016_Monkfish_20180921.mxd

Data Source: NOAA, BOEM, RI VMS



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

VINEYARD WIND

Figure 7.6-51

DEM - Monkfish 2011-2016 Commercial Fishing Density

As described in Section 6.6.2.1., burial and mortality of some demersal eggs (fish [e.g., Atlantic Herring], squid [e.g., Longfin Inshore Squid (*Doryteuthis pealeii*)]), and whelk species) may occur during cable installation activities. Such impacts are confined to small, localized areas in the WDA and OECC where sediment deposition from dredging and cable installation may be greater than one millimeter. Since the impacted area is only a small portion of the available habitat in the area and because most of these species produce millions of eggs each year, population level impacts are highly unlikely. Notwithstanding potential construction and installation impacts, availability of these species is consistently elevated in fishing grounds outside the WDA, as described in Section 7.6.2, and validated by Livermore (2017) and Kirkpatrick (2017). Increases in commercially important species, such as Atlantic Cod and whiting have been observed near deep water wind farms (Hille Ris Lambers & Ter Hofstede, 2009; Løkkeborg et al., 2002) and abundance and availability of these species could increase within the WDA.

Characterization of vessels targeting sea scallop and surf clam in Section 7.6.2, and presumably all dredge gear vessel, suggests that relative fishing effort for this gear type is quite low within the WDA. Nonetheless, construction and installation related impacts may result in direct and indirect mortality events for sea scallop and surf clam, resulting in their decreased availability within the WDA. Habitat conversion, though limited, may also decrease availability of these species within the WDA and along the OECC over the expected life of the Project.

Mobile benthic invertebrates, such as lobsters and crabs, would be temporarily displaced by construction and installation activities, but are likely able to avoid the associated sediment deposition areas. Conversion of soft bottom habitat associated with installation of WTGs and scour protection may increase abundance and availability of those species upon completion of construction and installation activities.

Electromagnetic fields ("EMF") would be generated by inter-array cables connecting WTGs in the WDA and from cables along the OECC. As described in Section 6.6.2.2.3, although electrosensitivity has been documented in elasmobranchs (sharks, skates, and rays) and some teleost fish species (ray-finned fishes), research investigating habitat use around energized cables found no evidence that fish or invertebrates were attracted to or repelled by EMF emitted by cables (Love et al., 2017).

7.6.3.1 Impacts on Fishing Activity Within the WDA

This section presents information to help interpret the extent of potential economic impacts associated with disruptions in certain fishing conventions during the operational phase of the Project that were identified by fishermen, such as "gentlemen agreements" between mobile and fixed gear fishers which are used to prevent space/use conflicts and risks of gear loss. As noted above, construction and installation activities will occur within very limited and well-defined areas of the WDA and no vessel restrictions are proposed other than in the immediate vicinity of the construction and installation vessels. Meaning, the majority of the

WDA will remain accessible to commercial fishing vessel operations throughout the construction and installation process and, indeed, during the entire anticipated lifespan of the Project.

Current agreements regarding the placement of mobile and fixed gear within the WDA, as they may be observed, could remain in effect once WTGs are in place should vessel operators so desire. If the proposed WTG layout presents inefficiencies that make such arrangements undesirable, the grid pattern of the WTG provides opportunity for adjustments to extant gear placement protocol. The largely uniform spacing of WTGs creates "lanes" oriented in the northwest-southeast direction. This is intended, in part, to facilitate the deployment mixed gear-types in several different potential arrangements. Under one such arrangement, fixed gear and mobile gear could be deployed in alternating lanes. Such arrangements may, in the short-term, modestly increase idle and/or steaming time for those vessels that operate within the WDA.

Separately, vessels towing mobile gear in the WDA may choose to exit the WDA before retrieving gear or reversing course for a subsequent tow through the WDA, thereby extending the amount of time fishing gear is deployed and/or more frequent retrieval and deployment if gear. It is possible that vessels electing to exit the WDA in these scenarios may incur additional costs or downtime associated with additional gear handling and increased steaming distances. In certain situations, longer periods of gear deployment may result in increased landings. Nonetheless, as noted in Appendix III-I, based on International Maritime Organization (IMO) resolution MSC.137(76) Standards for ship maneuverability, and (Maritime Safety Council (MSC) Circ.1053, explanatory notes for the standards for ship maneuverability, the largest fishing vessels known to operate in proximity to the WDA are expected to have sufficient room to maneuver, including a complete round-turn, within the proposed 1 nm navigation corridor.

Should vessels elect to fish outside the WDA, they may spend additional time either steaming to alternate fishing areas or search for target species. Suitable fishing areas in proximity to the WDA, however, suggests these choices would have only modest impacts to cost and revenue.

The use of pots and traps, predominantly deployed along the OECC within Nantucket Sound, is not expected to be impacted by the Project. Although bottom trawl gear typically interacts with the sea floor, target burial depths of inter-array and offshore cables will allow for safe deployment of such gear. Should cable protection be required, it will be designed to minimize impacts to fishing gear and fishermen will be informed of the areas where protection is used. Fixed gear fishermen have suggested the use of consistent transit lanes for construction vessels during the installation phase to reduce conflicts and minimize or eliminate loss of gear. Vineyard Wind will implement such an approach with the Marine Coordinator and Fisheries Liaison.

7.6.3.2 Impacts to Fishing Activities Outside the Wind Development Area (WDA)

The previous section described the exposure of commercial fishing values within the WDA to impacts from WDA activities and the likely range of those impacts. The WDA could also affect the economic value of fishing outside the WDA if the fishing vessels don't use the most direct routes between ports and fishing grounds or between fishing grounds.

Figure 7.6-52 and Table 7.6-11 illustrate the likely range of these potential steaming cost impacts. Figure 7.6-52 shows the proximity of the WDA to fishing ports and fishing areas. Table 7.6-11 identifies the steaming distances between port and fishing area, and distances between fishing areas using two alternative vessel routes; the most direct route and a route around the WDA. (No values are shown in Table 7.6-11 if the most direct route does not cross through the WDA.)

Figure 7.6-52 and Table 7.6-11 represent only a few combinations of fishing ports and fishing areas that could be affected by the WDA, but they are representative of likely transit routes to fishing areas from the selected ports. The analysis shows, for example, that in situations where the WDA is located on the most direct route, as may be the case with vessels transiting from Montauk, New York to Asia Rip. For a vessel electing to transit around the WDA, in this scenario, steaming distance increases by 0.6 nm. At a steaming speed of 10 knots this would add approximately 3.6 minutes per direction of travel, which means the trip might be very slightly longer, but there would be no expected losses in available fishing time. For a fishing vessel that burns 50 gallons per hour at 10 knots, this would result in 3.0 additional gallons of diesel fuel burned in transit (one way) which, at a dockside price of $3.00 per gallon, would increase round trip costs by an average of $18.00. A more detailed assessment of fishing vessel characteristics and fishing activity in the vicinity of the WDA would be required to determine potential fleet-wide steaming cost impacts.

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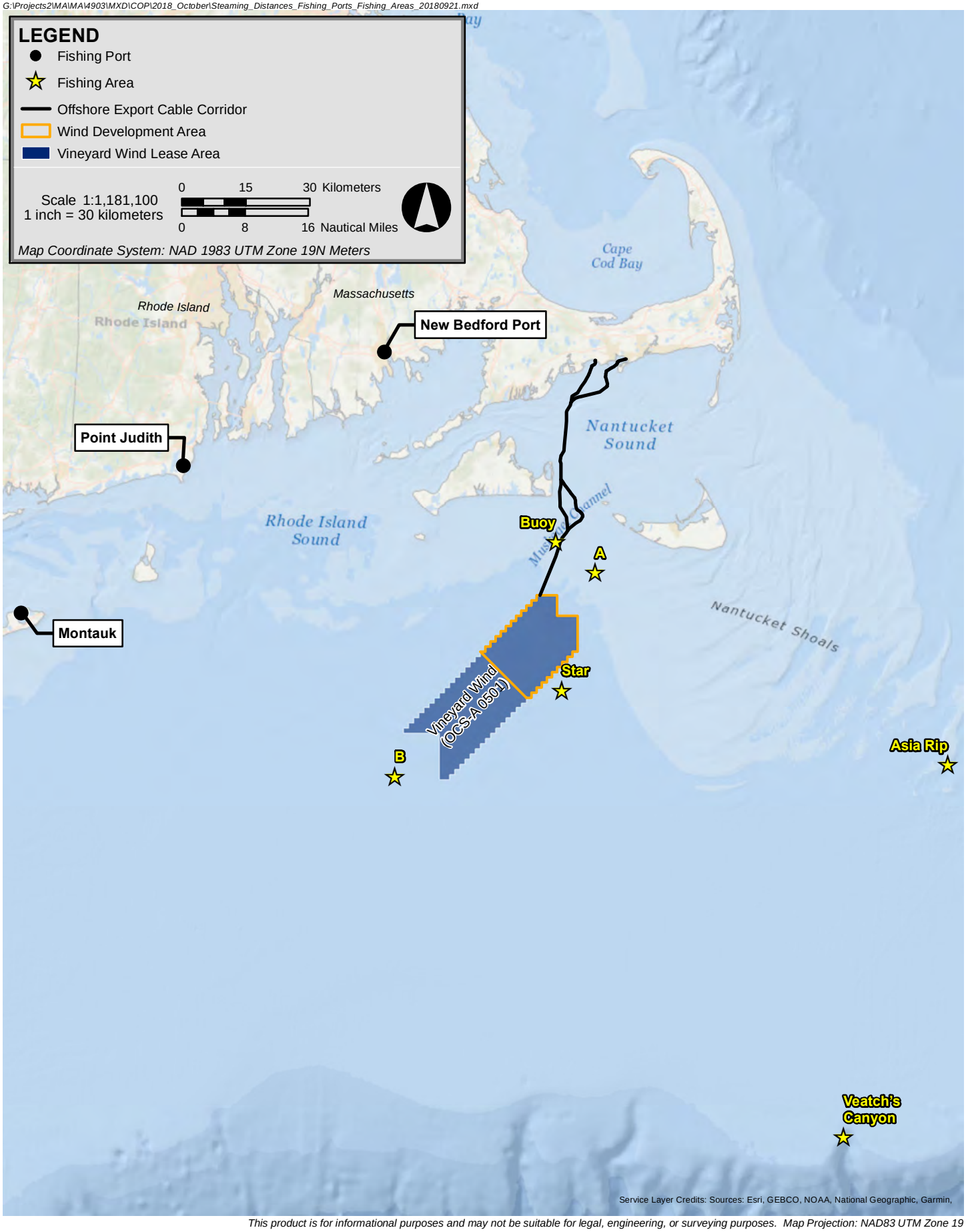

This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

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Figure 7.6-52

Steaming Distances and Time from Fishing Ports to Fishing Areas

Table 7.6-11 Estimated Transit Route Distances for Select Fishing Ports

Fishing Area A			
Port	Direct Route (nm)	Route Around WDA (nm)	Difference (nm)
New Bedford, Massachusetts	52	NA	-
Point Judith, Rhode Island	54	NA	-
Montauk, New York	73	NA	-
Fishing Area B			
Port	Direct Route (nm)	Route Around WDA (nm)	Difference(nm)
New Bedford, Massachusetts	55	NA	-
Point Judith, Rhode Island	48	NA	-
Montauk, New York	52	NA	-
Veatch's Canyon			
Port	Direct Route (nm)	Route Around WDA (nm)	Difference (nm)
New Bedford, Massachusetts	119	NA	-
Point Judith, Rhode Island	119	NA	-
Montauk, New York	123	NA	-
Asia Rip			
Port	Direct Route (nm)	Route Around WDA (nm)	Difference (nm)
New Bedford, Massachusetts	99.3	NA	-
Point Judith, Rhode Island	103.37	103.42	0.05
Montauk, New York	119.2	119.8	0.6
Fishing Area A to Fishing Area B			
	Direct Route (nm)	Route Around WDA (nm)	Difference (nm)
	18.9	**19.6**	**0.7**
Buoy to Star			
	Direct Route (nm)	Route Around WDA (nm)	Difference (nm)
	36	**38.5**	**2.5**

7.6.3.3 Potential Impacts to Port Facilities

Project-related vessel traffic during the construction and installation phase of the Project is not anticipated to cause impacts to either commercial or for-hire recreational fisheries as they operate in each of the ports described in Section 7.1.1.1 and Section 7.1.1.2. Modest increases in vessel traffic in these ports may occur. Potential impacts to navigation as they relate to commercial fishing are evaluated in Appendix III-I.

7.6.3.4 Avoidance, Minimization, and Mitigation Measures

The original siting of the MA WEA by BOEM included a significant public engagement process. Through this process, and in response to stakeholder concerns, the MA WEA was extensively modified. BOEM excluded areas of high fisheries value to reduce potential conflict with commercial and recreational fishing activities. This careful siting of MA WEA, which includes the WDA, will avoid many impacts to commercial and for-hire recreational fisheries. In addition, WTG layout is a result of input from numerous stakeholders, including the USCG and fishermen who use or transit the Project Area. The original WTG layout was designed to optimize energy development, which requires that the WTGs be scattered and closer together, not aligned in a grid pattern with large separation distances. Understanding the need for transit corridors and separation distances that allow the area to be fished, the Project layout was modified to address competing fishing interests. Of particular concern was the potential impact of the Project on the scallop fishery out of New Bedford, which according to NOAA data, has an annual average value of over $281 million. The orientation of the transit corridor through the Project was specifically designed to allow passage through the Project to fishing areas, and the wide distances between the turbines allows for mobile and fixed gear fishing to coexist within the Project Area.

Finally, Vineyard Wind has proposed a mitigation option for the layout that eliminates spare WTG positions to create requested east-west fishing passage. This option is further described in Appendix III-R.

To further minimize impacts, Vineyard Wind will implement a comprehensive communications plan with the various port authorities; federal, state, and local authorities; and other key stakeholders, including recreational fishermen and boaters, commercial fishermen, harbormasters, marine pilots, and other port operators. The current version of the Fisheries Communication Plan is included as Appendix III-E. As described in the Fisheries Communication Plan, both Fisheries Liaisons (FL) and Fisheries Representatives (FR) are already engaged to ensure effective communication between the Project and the fishermen. More information on the FL and FR roles can be found in Appendix III-E. In addition, based on feedback from stakeholders, including commercial fishing interests, Vineyard Wind is developing a program to manage fishing-specific communications regarding Project activities and impacts. It is anticipated that the program will provide a single point-of-contact for fishermen to report problems and concerns with construction and installation activities and to report gear loss or damage from project components and

activities. Vineyard Wind is committed to developing an easy-to-use, accessible, and responsive protocol that equitably addresses impacts to fishing activities and gear as they may arise from construction and installation activities. The various fishing communities will be invited to participate in the development of this program.

Vineyard Wind has developed a framework for a pre- and post-construction fisheries monitoring program to measure the Project's effect on fisheries resources. Vineyard Wind is working with the Massachusetts School for Marine Science and Technology (SMAST) and local stakeholders to inform that effort and design the study. The duration of monitoring will be determined as part of the initial effort to determine the scope of the study, but it is anticipated to include the pre-construction period and at least one year of post-construction monitoring. In addition, post-construction monitoring will be conducted to document habitat disturbance and recovery (see Benthic Habitat Monitoring Plan in Appendix III-D).

To minimize hazards to navigation, all Project-related vessels, equipment, and appurtenances will display the required navigation lighting and day shapes. Offshore Wind Marine Updates and Notices to Mariners ("NTMs") will be distributed by Vineyard Wind and the USCG to notify recreational and commercial vessels of their intended operations to/from and within the WDA. WTGs will be widely-spaced in the WDA so that the foundations and associated scour protection, along with the ESPs, inter-link cables, and inter-array cables, only occupy a minimal portion of the WDA. Ultimately, a large portion of the WDA will remain undisturbed, thereby minimizing impacts to commercial and for-hire recreational fisheries and improving navigational ability throughout the WDA.

Temporary safety zones may be established around work areas during the construction and installation phase to improve safety in the vicinity of active work areas. This proposed safety zone would be adjusted as construction work areas change within the WDA, allowing fishermen and other stakeholders to make use of the portions of the WDA not being used for construction and installation activities. It is anticipated that the majority of the WDA will remain open to non-Project related vessels throughout the construction and installation phase.

In an effort to provide fishermen with the most accurate and precise information on work within the WDA and along the OECC, Vineyard Wind is currently providing and will continue to provide portable digital media with electronic charts depicting locations of Project-related work activities and Project-related information to fishermen.

Impacts associated with scheduled, periodic maintenance activities during the operations and maintenance phase will be adequately mitigated through the implementation of BMPs where feasible. To aid mariners navigating the WDA, WTGs and ESPs will be lit, painted, and marked with high-visibility paint, reflecting panels, and unique identification lettering

and numbering. The WTGs will also be maintained as Private Aids to Navigation. Additional details on proposed aids to navigation within and in proximity to the WDA are provided in the Navigational Risk Assessment (see Appendix III-I)[27].

7.6.4 Summary

The following section summarizes results of the analysis and presents "sensitivity" tests which suggest how fishery-related economic impact estimates respond to worst-case assumptions (e.g., higher than average fish abundance in the WDA when it is closed to fishing) as opposed to assumptions based on expected conditions (e.g., typical fish abundance in the WDA which is not closed to fishing).

As noted above, the relative size of the WDA with respect to the MA WEA, and the proximity of the WDA to important fishing ports and fishing areas is a significant consideration when estimating potential effects on commercial fishing operations that may occur near the WDA. The BOEM fisheries study (Kirkpatrick, 2017) estimated the average annual value of fish taken in the MA WEA between 2007 and 2012 to be $3.03 million, and the DEM fisheries study (Livermore, 2017) estimated the average annual value of fish taken in the Lease Area between 2011 and 2016 to be $0.858 million. DEM's estimate is 28.3 percent of BOEM's estimated value for the entire MA WEA, which was based on data for a few years earlier. Geographically scaled to the WDA, the 2017 BOEM fisheries study indicates that the average annual revenue exposed within the WDA during the years studied is approximately $308,450. Accounting for differences in the sample years, the results of the two studies validate one another and suggest that the economic value of fishing could be uniformly distributed across the MA WEA at $1,000 to $1,200 per km^2, with the average value of annual catches from the WDA between 2007 and 2016 estimated to be approximately $348,450.

An estimate of landings from the WDA is presented in Table 7.6-12. Assuming fishing could be uniformly distributed across the MA WEA, as above, Table 7.6-12 presents Livermore's (2017) estimated annual revenue by state from the Lease Area proportionally scaled to the smaller geographic area of the WDA (i.e., the value for the WDA is 45.3% of the value for the Lease Area). Economic exposure estimates for Rhode Island and Massachusetts fisheries are provided in Appendix E and F of the COP Addendum, respectively.

[27] The Project's lighting and marking scheme is being refined through ongoing consultations with USCG.

Table 7.6-12 Estimated Annual Landings from Wind Development Area by State (2011-2016)

State	Annual Value, Vineyard Wind Lease Area						Ave. Annual Value, Lease Area	Estimated Annual Average in Wind Development Area	% of total
	2011	2012	2013	2014	2015	2016			
Connecticut	$35,943	$23,680	$36,764	$19,297	$0	$51,531	$27,869	$12,627	3.2%
Massachusetts	$112,425	$987,431	$551,972	$199,070	$247,676	$675,235	$462,302	$209,462	53.9%
New Jersey	$0	$4	$0	$499	$19,336	$49,532	$11,562	$5,238	1.3%
New York	$3,440	$13,966	$26,489	$674	$10,819	$166,146	$36,922	$16,729	4.3%
Rhode Island	$56,401	$53,036	$159,041	$257,133	$245,169	$1,142,581	$318,893	$144,486	37.2%

Many factors, both environmental and regulatory, contribute to productive commercial fishing areas, and as a result, the location of commercial fishing effort, and to a lesser extent for-hire recreational fishing activities, are variable. Vineyard Wind will continue to meet with fishermen to solicit additional information on fishing effort in the WDA, and to ensure that the most accurate and relevant information regarding each of the fisheries in the Project Region is incorporated into the Project's operations plans.[28]

During the construction/installation of the Project, temporary and permanent habitat alteration or loss is expected in limited areas for several commercially valuable species, and some alteration of non-structured habitat to structured habitat in the WDA may change species assemblages in that area by attracting more structure-oriented species. Pelagic and invertebrate species identified within the WDA which may also be targeted by commercial fishing interests have been represented to include squid, mackerel, and butterfish. NROC and MARCO's characterization of relative fishing vessel density and estimates of revenue exposure by BOEM and DEM within those fisheries, as described in Section 7.6.2, suggest that commercial fishing effort and revenue for those species within the WDA is, in fact, quite modest. Though, in certain years increased commercial fishing vessel density may occur within the WDA, an increase likely associated with the squid fishery. Landings from the Squid, Mackerel, Butterfish Fishery Management Plan from the entire Lease Area, for example, as reported by Livermore (2017) over the six years of the analysis, averaged $292,235.64 per year. Again, assuming the economic value of this fishery is uniformly distributed throughout the Lease Area, approximately $132,383 of revenue from that Fishery Management Plan is sourced from the WDA.

[28] Vineyard Wind has received and seen various data and representations of activity from fishermen directly that include, but are not limited to, thumb drives with Wind Plot data, printouts of vessel tracks, and hand drawn maps of preferred fishing areas. We are working to analyze the information as it comes in, as well as confirm that it is representative of the broad fishing interests within the region. However, our preliminary review suggests the information is consistent with the analysis herein.

In a worst-case scenario, if commercial vessels targeting squid or another species from that management plan elect not to fish within the WDA during the entire construction and installation phase, those commercial vessels could forgo revenue for up to two seasons. Worst case estimates of fishery-related economic impacts based on scenarios in which abundance of certain species within the WDA exceed average landings, suggest modest impacts to commercial fishing revenue, even if landings from within the WDA were to double or triple under some hypothetical scenario. Given the proximity of the WDA to known, productive fishing grounds, any forgone revenue is likely to be offset by additional fishing effort in adjacent water and/or through potential vessel operating cost reductions.

As noted elsewhere, post-construction monitoring through the Project's Benthic Habitat Monitoring Plan and partnerships with research and other organizations will also be conducted to document habitat disturbance and recovery. To further avoid and minimize impacts to commercial fishing activities, Vineyard Wind will implement a comprehensive communications plan with the various port authorities, federal, state, and local authorities, and other key stakeholders, including recreational fishermen and boaters, commercial fishermen, harbormasters, marine pilots, and other port operators.

Vineyard Wind has developed and implemented a Fisheries Communication Plan and the Project management team will continue to develop and utilize communications plans to ensure relevant and accurate information regarding the Project is disseminated to the various commercial fishing communities during each stage of the Project. As additional information on commercial and for-hire recreational fishing are made available, Vineyard Wind may make adjustments to operating procedures and other practices in an effort to avoid, minimize, and mitigate Project-related impacts to these fishing communities.

7.6.5 For-Hire Recreational Fishing

For-hire recreational fishing is an important activity throughout the Project Region. An estimated 601 vessels based out of ports in Connecticut, Rhode Island, and Massachusetts provide for-hire recreational fishing opportunities in the Project Region. Of these vessels, approximately 430 were home ported in Massachusetts (Steinback & Brinson, 2013). In 2016, 49,969 angler trips were estimated to occur in state and federal waters off the coast of Massachusetts (NOAA MRIP, 2017).

The entire near-coastal region and numerous offshore locations within the Project Region may host species targeted by for-hire recreational fishing operations. For-hire recreational fishing activities have been reported to occur in portions of the MA WEA or nearby, notably at "The Dump," the approximately 260 square meter (100 square mile) Dumping Area identified on NOAA charts near the southerly end of the MA WEA, abutting the WDA. Other notable recreational fishing areas as identified by Captain Seagull's Nautical Sportfishing Chart, "Offshore: Canyon chart off MA, RI, CT, NY" include "The Owl" along the 20 fathom line, and "The Star" and "Gordon's Gully" along the 25 fathom line are within the WDA. The "FM Hole" is another popular spot in the Vineyard Wind Lease Area

but outside of the WDA. These are popular locations for vessels targeting highly migratory and other recreational species. According to the Salty Cape website (www.saltycape.com), a popular regional website for recreational fishermen, "Gordon's Gully" and "the Owl" are best known for late June/early July bluefin tuna, mako and thresher sharks. White marlin can be found at both locations as well. "The Star" has historically be a spot for yellow fin tuna. "The Dump" is best known for catching yellowfin tuna, albacore tuna and mahi mahi. Both the 20 and 30 fathom lines cross the WDA from west to east. Along the Offshore Export Cable Corridor ("OECC"), shoals and other structure may provide productive fishing grounds for the for-hire recreational fishing industry. Notable recreational fishing areas along the OECC as identified by Captain Seagull's Nautical Sportfishing Chart, "Offshore: Nantucket Shoals and Georges Bank, MA" include "The Hooter", which is location named for the fairway buoy, that makes a "hooting" sound, and is a marker for the end of Muskeget Channel south west of Martha's Vineyard. The Salty Cape website categorizes this area as a shoal that attracts striped bass and blue fish in mid-May as well as bonito and false albacore. Bluefin tuna is also "fairly common" in this area. Other popular areas, according to Captain Seagull's, along or close to the OECC include "Mutton Shoal" in Muskeget Channel, "Hawes Shoal", north of Muskeget Channel, and "Eldridge Shoal" "Wreck Shoal" and "Colliers Ledge", the last three being located in Nantucket Sound. It is common knowledge amongst for-hire recreational charter fishing captains with whom Vineyard Wind spoke that the most popular species to catch in these areas would be striped bass, bluefish, false albacore, and bonito as well as summer flounder, black sea bass and scup.

NOAA's Marine Recreation Information Program data for 2016 indicate that Cod and Hake, Striped Bass (*Morone saxatilis*), and Mackerel were the most caught species within the Massachusetts for-hire recreational fishery. Black Sea Bass, Scup, and Summer Flounder were the most caught species within the Rhode Island for-hire recreational fishery.

The for-hire recreational fishing fleets contribute to the overall economy in the Northeast, not just through direct employment, income, and gross revenues of the for-hire businesses, but also through spending on products and services to maintain and operate their vessels, triggering further indirect multiplier effects that are dependent upon the initial demands of the for-hire fleet (Steinback & Brinson, 2013).

7.6.5.1 Impacts to For-Hire Recreational Fisheries

Impacts to species targeted by for-hire recreational fishermen during construction will be similar to those described for commercial fishing resources in Section 7.6.2, above. The proximity of the WDA to numerous other productive fishing areas utilized by for-hire recreational fishermen suggests that the localized impacts of construction and installation activities will have only minor impacts to recreational species.

Operation and maintenance of the Project may have positive impacts to for-hire fisheries though temporary, short-term restricted navigation areas around crew support vessels and WTGs undergoing maintenance may be necessary to ensure the safety of maintenance personnel and mariners.

WTGs may become fishing locations, and for-hire recreational fishing activities may increase in the WDA. Anglers' interest in visiting the WDA may also lead to an increased number of fishing trips out of nearby ports which could support an increase in angler expenditures at local bait shops, gas stations, and other shoreside dependents (Kirkpatrick et al., 2017).

The Project management team will continue to develop and utilize their communications plans to ensure relevant and accurate information regarding the Project is disseminated to the recreational fishing and boating communities throughout the construction and installation process. As additional data on commercial and for-hire recreational fishing are made available, Vineyard Wind may make adjustments to operating procedures and other practices in an effort to avoid, minimize, and mitigate Project-related impacts to these fishing communities.

7.7 Land Use and Coastal Infrastructure

The following sections describe the existing land uses and coastal infrastructure in the Project Region. Vineyard Wind anticipates that each phase of the Project will generate few impacts on extant land use patterns and coastal infrastructure.

7.7.1 Description of the Affected Environment

Attributes of county land use and coastal infrastructure for each county are provided below. Because of the highly localized nature of Project-related impacts, additional detail of town-level land use patterns and coastal infrastructure are also provided.

7.7.1.1 Massachusetts

Onshore facilities may be located in the City of New Bedford in Bristol County; the Towns of Barnstable and Yarmouth in Barnstable County; and Vineyard Haven in Dukes County. Land use and coastal infrastructure are described as they exist in those communities

7.7.1.1.1 Barnstable County

Barnstable County comprises approximately 1,020 square kilometers ("km^2") (394 square miles ["mi^2"]) of land and approximately 2,362 km^2 (912 mi^2) of watersheet. The county encompasses all of Cape Cod, the geographic cape extending into the Atlantic Ocean from the southeastern corner of mainland Massachusetts, just west of the Cape Cod Canal. Barnstable County borders Plymouth County, located to the northwest. Located off Barnstable County's southern shore are Dukes County and Nantucket County.

Major overland transportation arteries in Barnstable County include US Route 6, and State Routes 28 and 6A. Both Route 28 and Route 6 are considered major arteries in the Towns of Barnstable and Yarmouth. US Route 6 continues eastward through Cape Cod, from Bourne to Orleans, as a freeway. North of Orleans to its terminus in Provincetown, US Route 6 is a surface road. Combined, these three major arteries comprise less than 6% of Cape Cod's roads by mileage. Over 80% of the roadways on Cape Cod are local roadways (CCC, 2015).

Barnstable County has a number of public transportation options. The Cape Cod Regional Transportation Authority ("RTA") operates the Hyannis Transportation Center which serves as a bus terminal, a maintenance facility, and the RTA office. Regional and intercity bus services, the Cape Cod Rail Line, commercial service airports, and ferry routes provide connections from Falmouth (Falmouth Harbor and Woods Hole), Hyannis (Hyannis Harbor), Provincetown (Fisherman's Wharf), and Harwich Port (Squatucket Harbor) to Martha's Vineyard, Nantucket, Boston, and Plymouth, all serve Barnstable County.

Barnstable County has substantial open space resources. The CCC (2012) estimates that 42% of the County's land is considered developed, while 29% is protected, 13% is wetlands, and the remaining 16% of land is eligible for development. The County includes approximately 209 km^2 (51,758 acres) of protected conservation and recreation lands. The Cape Cod National Seashore, alone, contains more than 109 km^2 (27,000 acres) of natural, scenic, and recreational resources spread across six Barnstable County towns. The Commonwealth of Massachusetts also holds in trust large areas of protected open space including Nickerson State Park in Brewster, Hawksnest State Park in Harwich, Crane Wildlife Management Area in Falmouth, and the Hyannis Ponds in Barnstable. Through the use of land banks, conservation easements, and other land preservation mechanisms, towns throughout the County have established more than 16 km^2 (4,000 acres) of open space (CCC, 2012).

As described above, seasonal use of the County's open space resources, particularly the area's beaches, play a significant factor in the County's economic productivity. For example, approximately 4.5 million people visit the Cape Cod National Seashore each year (Chamber of Commerce, 2017). The Association to Preserve Cape Cod (2014) estimates 17 km^2 (4,250 acres) of Barnstable County are categorized as farm lands and an additional 2.4 km^2 (600 acres) of shellfish cultivation occurs on aquaculture grants. There are approximately 235 aquaculture license holders throughout the County, though 70% of the aquaculture acreage is in the coastal waters of Wellfleet and Barnstable (Beauchamp & Geist, 2011).

The Association to Preserve Cape Cod estimates that approximately 40% of the land-based agriculture is cranberry bogs, while another 35% percent is general farming activity. The remaining 25% of land-based agriculture consists of wood lots, tree farms, garden centers and greenhouses.

Joint Base Cape Cod, a military installation encompassing approximately 78 km^2 (30 mi^2) of land, is located adjacent to the Cape Cod Canal in the towns of Bourne, Mashpee, and Sandwich. The installation hosts the Massachusetts Air National Guard's Otis Air National Guard Base, the US Coast Guard's Air Station Cape Cod, the Veterans Administration Cemetery, the US Air Force's Cape Cod Air Force Station, and the Massachusetts Army National Guard's Camp Edwards. Barnstable County hosts three prominent research and education institutions; Barnstable Community College, the Massachusetts Maritime Academy, and the Woods Hole Oceanographic Institution.

Town of Barnstable

The Town of Barnstable is the largest community on Cape Cod both in land area and population, and also serves as the County seat. Most of the Town's residential development has occurred in the last 40 years. During this period of substantial residential growth, wastewater, water supply, transportation improvements, recreational amenities, schools and other government services were developed (Barnstable, 2010). Figure 7.7-1 depicts land uses in the Town of Barnstable.

The Town of Barnstable land use policy directs growth to the downtown Hyannis area, a major seasonal tourist destination and an active recreational boating harbor. Hyannis is also the second largest commercial fishing port on Cape Cod. Hyannis contains important regional assets, including two ferry terminals with service to Nantucket and Martha's Vineyard, the region's largest commercial airport, the Cape Cod Mall and other commercial areas on Route 132, and the region's primary medical facility, Cape Cod Hospital (Utile, 2010). Barnstable's road network consists of three major regional east-west roads – Route 6A, Route 6 and Route 28, and four regional roads that connect to the east-west roads - Willow Street, Route 132, Phinney's Lane and Route 149.

Barnstable consists largely of open space, including inland and coastal wetlands, forest, and freshwater features. Substantial areas of low- to medium-density residential development surround corridors of commercial and industrial uses. Barnstable has 3 km^2 (49 acres), approximately 2% of its land area, that claim Massachusetts General Laws Chapter 61A current use tax status as active agricultural or forest use.

Working waterfronts are a signature feature of Barnstable County, and long-established water-dependent uses have activated deep-water harbors in support of traditional fishing activities and the recreational boating public.

The Town of Barnstable has approximately 160 kilometers ("km") (100 miles ["mi"]) of coastline, more coastline than any other town in Massachusetts. The Town of Barnstable also has extensive salt-water wetland areas which, including Great Marsh south of Sandy Neck, accounts for approximately 27% of the County's salt marsh (Barnstable Comprehensive Plan, 2010). No Project-related actives will occur proximate to Barnstable's

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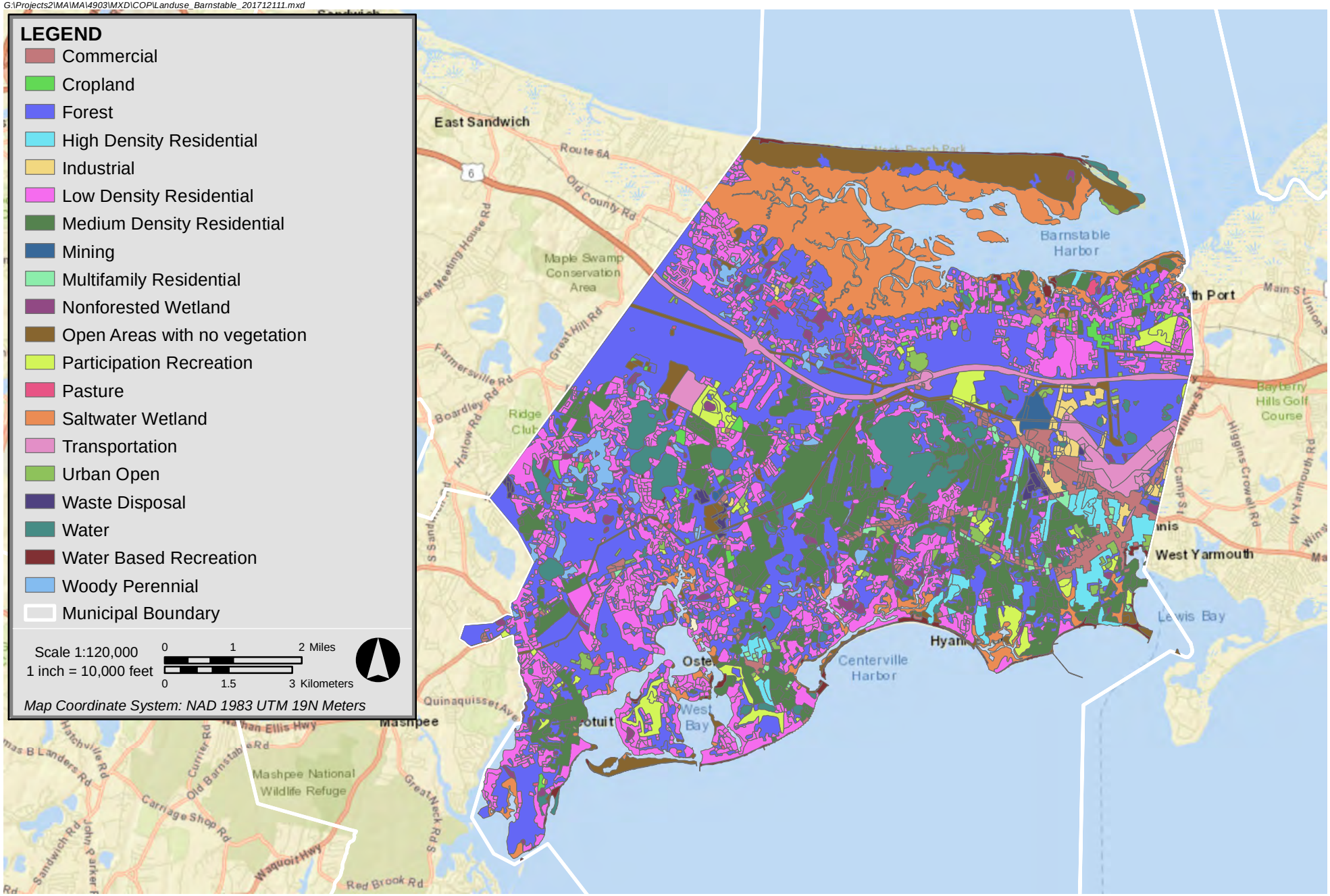

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong

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Figure 7.7-1

Land Use, Barnstable

northerly coastline fronting Cape Cod Bay. The following section, therefore, focuses on coastal infrastructure along the Town's southerly coastline; primarily the 95 km (59 mi) of coastline from the Osterville and Three Bays area to the Hyannis and Hyannis Port area of the western portions of Lewis Bay.

Hyannis Harbor consists of an Outer Harbor, a Middle Harbor (known as Lewis Bay), and an Inner Harbor. The Inner Harbor, typical of working waterfronts, is developed with timber and steel sheetpile bulkheads to the extent of filled tidelands. Piers, wharves, docks, and other facilities are located along the perimeter of the Inner Harbor.

The Town of Barnstable operates two marinas in Hyannis Harbor; the Bismore Park Marina and the Gateway Marina and boat ramp. These facilities also provide dockage for the commercial fishing vessels. The Town's facilities provide dockage for tourist day boats and other recreational vessels. The Town of Barnstable manages an estimated 2,460 mooring permits issued to individual mooring permit holders. The Barnstable Harbormaster also operates land-based, semi self-service pump-out facilities and a pump-out vessel. Several private marina operators offer dockage, fuel, and servicing within the Harbor. Hy-Line Cruises and The Nantucket Steamship Authority, both passenger vessel and ferry service operators, have facilities located within the Inner Harbor.

The USACE maintains a Federal Navigation Project ("FNP") within Lewis Bay. The FNP provides for: a 357 m (1,170 ft]) long stone breakwater lying approximately 1.1 km (0.7 mi) offshore; an anchorage area dredged to -4.7 m (15.5 ft) MLLW in a protected area behind the breakwater; an entrance channel dredged to -3.9 m (-13.0 ft) MLLW from deep water in Nantucket Sound to the entrance of the inner harbor area; a -3.9 m (-13.0 ft) MLLW and 4.5 m (15 ft) wide channel and a -3.9 m (-13.0 ft) MLLW deep turning basin in the inner harbor area; and a 45 m (150 ft) wide channel dredged to -3.7 m (12.0 ft) MLLW and adjoining the -3.9 m (13.0 ft) MLLW deep entrance channel in the outer harbor area. The FNP provides for two additional anchorage areas, 3.7 m (12.0 ft) MLLW anchorage adjacent to the inner harbor turning basin. The FNP also includes a 305 m (1,000 ft) long riprap jetty extending south from Dunbar Point. The US Coast Guard maintains a series of aids to navigation delineating the Harbor approach, channel, and obstructions.

A Confined Aquatic Disposal ("CAD") cell was created outside of Hyannis Harbor in 1998. The Hyannis CAD cell is located beneath the former harbor entrance channel adjacent to the outer Harbor anchorage area southwest of the Lewis Bay. The suitable material removed during cell construction was placed on the beaches at Great Island and within the dikes built the previous year on Dunbar Point behind Kalmus Beach. Approximately 57,600 cubic meters ("m^3") (2.03 million cubic feet ["ft^3"]) of silty material from the Inner Harbor basin was disposed in the CAD cell from December 1998 to March 1999. The cell was capped with clean sand from a prior Lewis Bay channel deepening project in March 1999. The OECC does not interact with the Hyannis CAD cell.

Four marinas and five marine services businesses are located to the west of Lewis Bay, including Prince Cove Marina, a facility owned and operated by the Town of Barnstable.

The relatively shallow depth of water throughout much of this area limits navigational capacity. Navigable depths appear to be maintained in marked channels; however, shoaling is often reported and the Town of Barnstable has sponsored periodic maintenance dredging activities in these areas (CRMP, 2009). Much of this area is characterized by small villages, marinas, and mooring areas set in coves and along marsh and beaches areas. Public access facilities, including parking, pedestrian access, and boat ramps, launch areas and mooring access points are extremely limited and in heavy demand during the summer boating season, a common issue in the State's coastal communities. The Town of Barnstable operates 16 boat launch ramps and associated facilities, seven of these are coastal facilities located in the area west of Lewis Bay.

The Town of Barnstable maintains and operates four public beaches within proximity to Lewis Bay. Craigville Beach and Covell's Beach, in Centerville Harbor; Sea Street – Keyes Beach and Kalmus Beach in the Outer Harbor; and Veterans Beach in the Middle Harbor/Lewis Bay. These facilities also include public amenities and may be staffed on a seasonal basis.

The Town of Barnstable also hosts electric transmission and distribution infrastructure necessary to accommodate the Project. This infrastructure includes the West Barnstable Substation and the Barnstable Switching Station. The Project is evaluating these locations as points of interconnection with the Cape Cod bulk power grid.

Town of Yarmouth

The Town of Yarmouth is comprised three villages: South Yarmouth, West Yarmouth and Yarmouth Port. Barnstable County's three major east-west transportation corridors, Route 6A, Route 6, and Route 28 bisect the Town.

The Town of Yarmouth is substantially built-up, though development is largely low- to medium-density residential with commercial corridors built along Route 6 and Route 28. Retail, industrial, institutional, and commercial uses comprised the largest square footage of development (Local Comprehensive Plan, 1997). Of the approximately 18.6 km^2 (4,600 acres) of land in the Town of Yarmouth, 6.9 km^2 (1,700 acres) are devoted to conservation, including land for the protection of public water supplies. An additional 6 km^2 (1,500 acres) are considered protected from development due to various ownership and conservation restrictions. Figure 7.7-2 depicts land uses in the Town of Yarmouth

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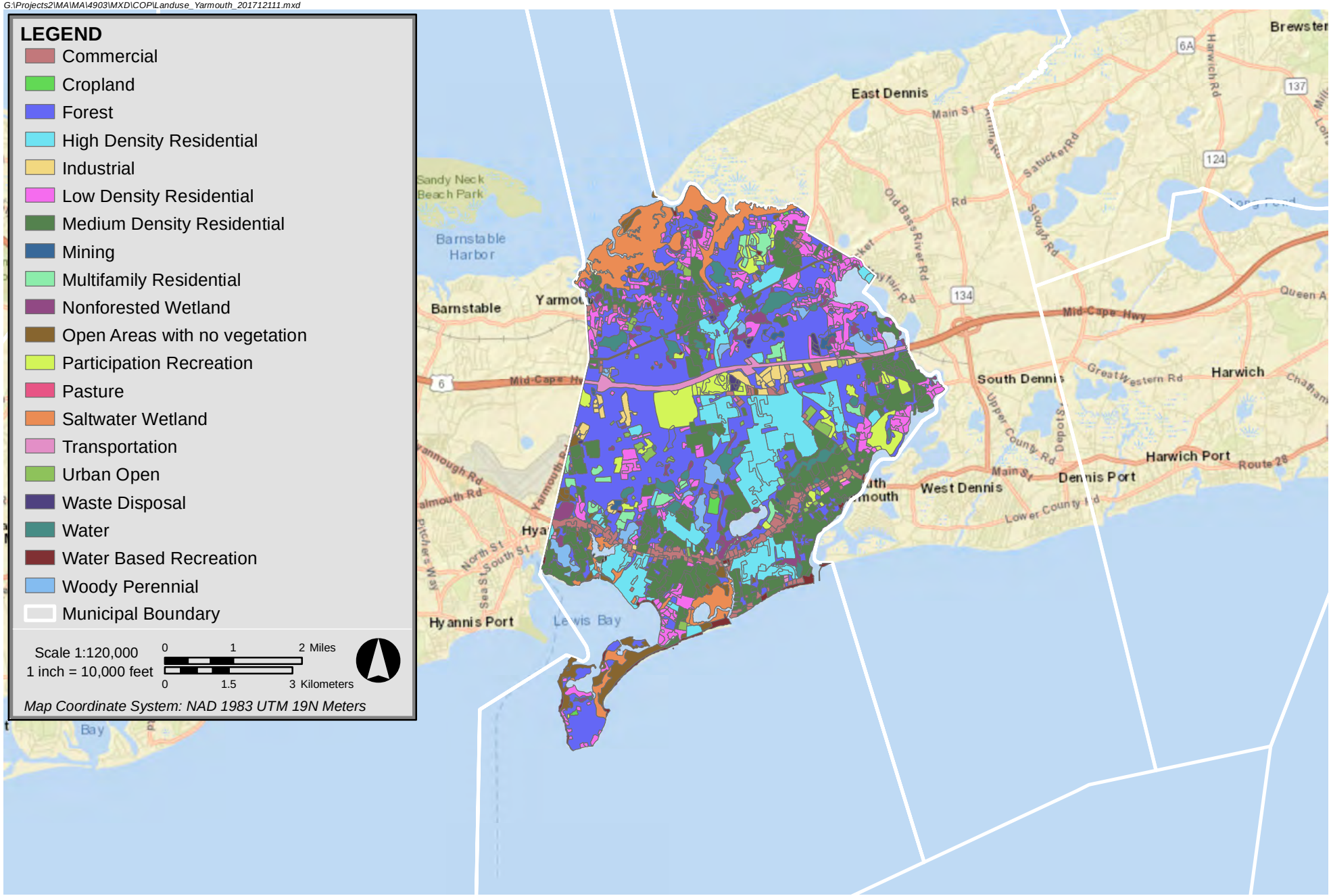

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Vineyard Wind Project

VINEYARD WIND

Figure 7.7-2

Land Use, Yarmouth

Freight rail service through the Town of Yarmouth is operated by the Massachusetts Coastal Railroad from the Barnstable town line to just west of Station Avenue south of US Route 6. A trash transfer station is located along the rail line and provides Cape area refuse and transfer services to Covanta's Southeastern Massachusetts Resource Recovery Facility, a waste-to-energy facility in Rochester, MA.

No Project-related actives will occur proximate to Town of Yarmouth's northerly coastline fronting Cape Cod Bay. The following section, therefore, focuses on the limited coastal infrastructure along the Town of Yarmouth's southerly coastline. Large sections of the Town of Yarmouth's coastline fronts Lewis Bay, Great Island, and the Parker River estuary. This coastline is characterized by low- to medium-density residential development and recreational and conservation open space

The Town of Yarmouth operates four marina facilities: Packet Landing, Colonial Acres, Englewood Beach, and Bass Hole providing slips for recreational and commercial vessels.

The Town of Yarmouth Harbormaster Department currently maintains and monitors 60 navigational markers in Bass River, Lewis Bay, and Nantucket Sound. Channel markers, swim buoys, and hazard markers are set seasonally by the Town of Yarmouth Harbormaster and Natural Resource staff.

The Town of Yarmouth is proposing to construct a "marine park" on a 22-acre site on Parker's River that was acquired with the intention of developing a marina and other recreational uses. The site currently hosts the Town of Yarmouth's shellfish propagation upweller facility.

The Town of Yarmouth maintains and operates eleven public beaches. Beaches along the Town of Yarmouth's southerly coast are: Colonial Acres Beach and Englewood Beach in Lewis Bay and Sea View Beach, South Middle Beach, Seagull Beach, Parker River Beach, and Bass River Beach on Nantucket Sound. Some of these beaches are staffed on a seasonal basis and offer additional public amenities, including boat launch facilities.

7.7.1.1.2 Bristol County

Bristol County comprises approximately 1,432 km^2 (553 mi^2) of land and approximately 357 km^2 (138 mi^2) of watersheet in the southeast region of the state. The County borders Norfolk County to the north, Plymouth County to the east, and Bristol County and the State of Rhode Island to the west. Bristol County is included in the South Coast region of the state which includes older industrial cities, and in some locations sprawling development. The South Coast communities of Fall River, New Bedford and Taunton are the only cities within 80 km (50 mi) of Boston not served by commuter rail.

The Interstates 95, 195, and 495 corridors, which frame Bristol County, exhibit high levels of development in the areas surrounding the larger cities, including New Bedford. Agriculture in the southeast region of the state, including Bristol County, however, remains a major industry.

With the exception of New Bedford, Fairhaven, and Fall River, Bristol County's coastline is characterized by low density residential development. The coastal regions of the Bristol County also have significant recreation resources such as beaches, harbors, and conservation land.

City of New Bedford

The City of New Bedford comprises 52 km^2 (20 mi^2) of land, including a bit less than one square kilometer (217 acres) of conservation land and 3.7 km^2 (921 acres) of recreational land. The City has 16.5 km (10.3 mi) of coastline and approximately four square miles of watersheet. The City has 15 neighborhood parks, more than 3.2 km (12 mi) of trails and bikeways, 26 acres of beaches, and numerous public and private athletic fields and facilities.

Figure 7.7-3 depicts the land use types in the City of New Bedford.

The City of New Bedford regulates land use through zoning regulations or ordinances that largely classify land uses as residential, commercial, or industrial. The City of New Bedford's Planning Department administers the local and state regulations affecting land use and land reuse. The Planning Department also provides staff support to the Planning Board, Historical Commission, Zoning Board of Appeals, the City Council, and other city departments, boards and commissions as needed. Waterfront development, infrastructure upgrades, dredging and other construction and repair projects on or over and adjacent to the Port of New Bedford watersheet are reviewed by the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs and their Office of Coastal Zone Management, the Department of Environmental Protection, the Massachusetts Department of Marine Fisheries, the Environmental Protection Agency ("EPA"), USACE, the New Bedford Harbor Development Commission, and local municipal conservation commissions, zoning and waterways management boards, and a variety of other federal, state and city officials.

New Bedford has significant transportation assets including an interstate highway, a regional airport, water ferry service, freight rail, and regional and interstate bus service.

Coastal infrastructure in New Bedford, particularly within the New Bedford/Fairhaven Harbor, is substantial. According to the New Bedford/Fairhaven Municipal Harbor Plan, roughly 70% of the approximately 3.8 km^2 (938 acres) of harbor land area is on the New Bedford side of the Harbor, with the remaining 30% in Fairhaven. Including coastal

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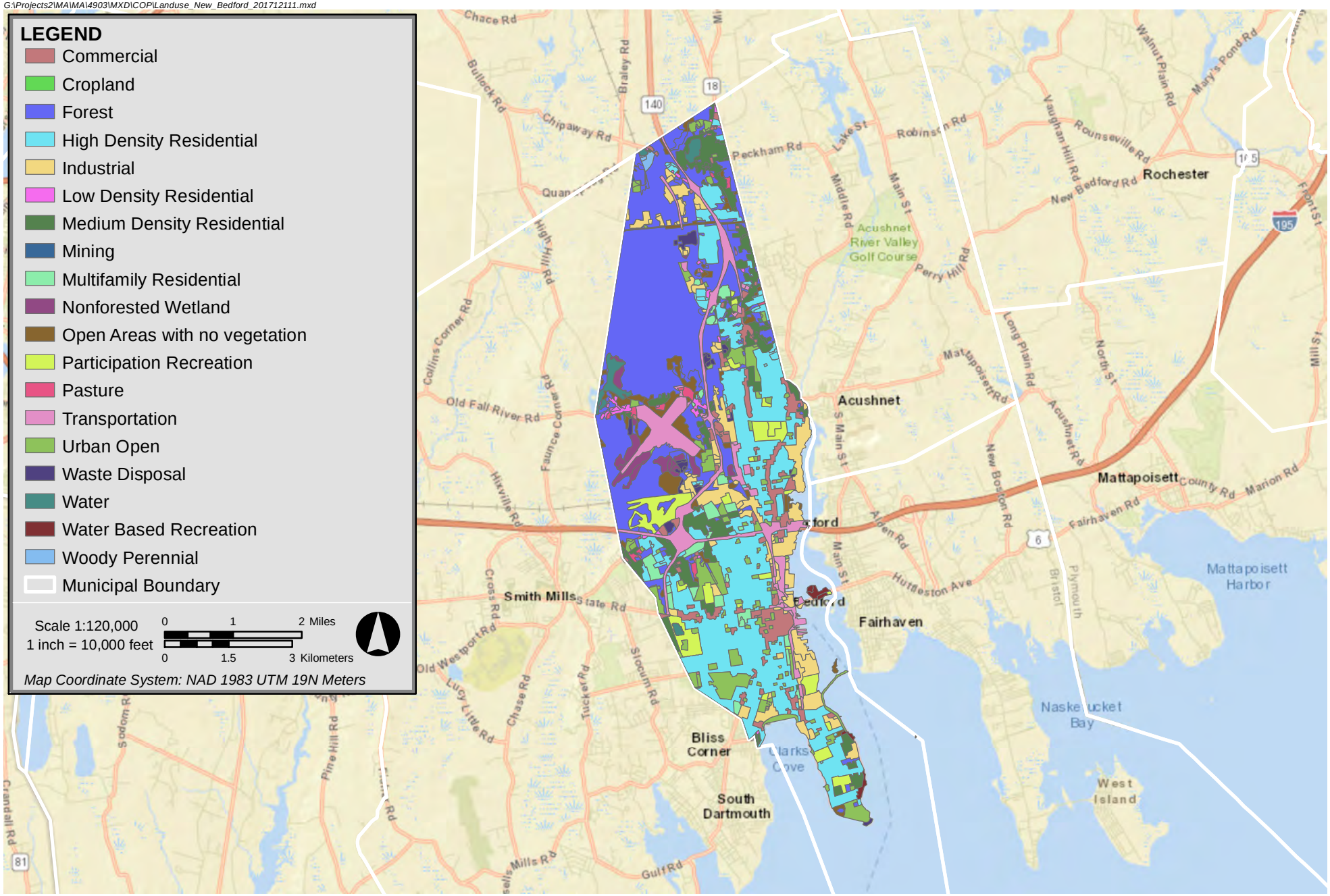

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Vineyard Wind Project

VINEYARD WIND

Figure 7.7-3

Land Use, New Bedford

infrastructure on the Fairhaven side of the Harbor, and inland areas with direct or indirect ties to the waterfront, approximately 1.2 km^2 (304 acres) of the harbor land area is currently used for industrial and seafood processing activities. Approximately 16% of harbor land is owned or directly control by municipal, county, state or federal government entities. Many of these holdings are leased for marine industrial uses. About 7% of harbor land is used by commercial businesses that indirectly support the marine industry and the remainder is open space, residential, parking and transportation services, and other businesses. Approximately 4% of harbor land was vacant in 2010. Generally, commercial and industrial activities are more densely clustered on the New Bedford side of the harbor, accounting for approximately 70% of harbor land uses (MHP, 2010).

The Port of New Bedford is a significant regional economic and cultural asset. It's a deep-water commercial port with direct access to important maritime corridors leading from the Massachusetts coast. The Port of New Bedford ("Port") is approximately 17 km (9 nm) from the Cape Cod Canal, 133.5 km (83 mi) south of Boston Harbor, and 267 km (166 mi) north of New York (HDC, 2017). By landed value, the Port is the primary fishing port in the nation; commercial fishing operations generate economic activity in excess of $9.8 billion and related employment of more than 36,000 people (NBHDC, 2016). The fishing fleet of approximately 500 vessels lands over 122 million pounds of product, annually leveraging $322 million in direct sales (HDC, 2017).

The USACE's New Bedford Hurricane Protection Barrier lies across entrance to the New Bedford and Fairhaven Harbor. The Hurricane Protection Barrier protects approximately 5.6 km^2 (1,400 acres) of land in New Bedford, Fairhaven, and nearby communities from tidal flooding associated with coastal storms. The Hurricane Protection Barrier is a 1.4 km (4,500 ft) long earthen fill dike with stone slope protection. It has a maximum elevation of 6 m (20 ft) above mean sea level and a 46 m (150 ft) wide gated opening to accommodate commercial and recreational navigation.

The USACE also manages and maintains the New Bedford and Fairhaven FNP. The FNP consists of a 350-foot wide navigation channel, dredged to -30.0 ft MLLW extending eight kilometers (5 mi) from Buzzards Bay to a point above the New Bedford-Fairhaven Bridge (i.e., US Route 6). Northwest of Palmer Island (along the New Bedford main waterfront) and above the New Bedford-Fairhaven bridge, the navigation channel has areas of increased widths for anchorage and maneuvering purposes. A second channel is dredged to -7.6 m (-25.0 ft) MLLW and from 61-76 m (200-250 ft) wide extending 320 m (1,050 ft) from the lower maneuvering area along the New Bedford waterfront to the vicinity of Fish Island and the swing bridge.

A separate channel along the Fairhaven waterfront extends approximately 1,128 m (3,700 ft) northward from Pierce and Kilburn. From Pierce and Kilburn Wharf to Old South Wharf, the channel is dredged to -4.5 m (-15.0 ft) MLLW and ranges from 45-122 m (150-400 ft) wide. From Old South Wharf to a point 304 m (1,000 ft) south of the old causeway pier, the

channel is -3 m (-10.0 ft) MLLW and 46 m (150 ft) wide. The US Army Corps also maintains a 0.66 km^2 (165 acre), triangular-shaped anchorage, dredged to -7.6 m (-25.0 ft) MLLW along the east side of the main channel and north of Palmer Island.

New Bedford's inner harbor and the main working port extends north from the Hurricane Barrier to a fixed highway bridge on Interstate-195. New Bedford harbor is up to 1,150 m (3,800 ft) wide and 3.62 km (2.25 mi) long, and is bisected by the Route 6 causeway and its three bridges. Two of the causeway bridges are fixed spans with vertical clearances of 1.8 m (6 ft) at Mean High Water. The third bridge is a swing span that crosses the main shipping channel. When the span is in the open position, the bridge provides access to the northern half of the inner harbor through two openings, each slightly less than 29 m (95 ft) in width. These openings restrict the size of vessels that can reach the Harbor's northern-most facilities.

Passenger ferry operations serving over 100,000 passengers each year operate from New Bedford Harbor. The Port of New Bedford supports a growing tourism sector; the Harbor is a port of call for American Cruise Lines and other locally owned harbor tour operators. A number of marine service operators are located in the Harbor. These facilities offer Travelift and marine rail launch/haul services for vessels up to 850-tons, along with comprehensive maintenance, repair, and refit services. The Harbor is a significant intermodal shipping center for the northern US market and offers Roll-on/Roll-off, including ship-to-rail; bulk, break-bulk, and containerized cargo facilities. The Harbor also has immediate access to approximately 127,400 m^3 (4.5 million ft^3) of cold storage, Foreign Trade Zone ("FTZ") #28, and direct links to the Interstate Highway System, and regional air and rail networks.

Six marinas in New Bedford Harbor are located in Fairhaven, and provide more than 580 boat slips for recreational vessels. The Fairhaven Harbormaster permits approximately 70 public and private moorings. The Town of Fairhaven also operates and maintains public boat ramp and dinghy dock a Pease Park.

7.7.1.1.3 Dukes County

Dukes County comprises approximately 267 km^2 (103 mi^2) of land and approximately 1005 km^2 (388 mi^2) of watersheet. Although the County consists of the island of Martha's Vineyard, including Chappaquiddick Island, the Elizabeth Islands (including Cuttyhunk), the island of Nomans Land, and other associated islets, the following section describes land uses and coastal infrastructure on the island of Martha's Vineyard. As described above, Vineyard Wind intends to use Vineyard Haven Harbor in Tisbury as a location for the Project's O&M Facilities.

According to the Martha's Vineyard Commission ("MVC"), Martha's Vineyard went through its biggest development surge in the 1980s. Conservation efforts, notably the establishment of the Land Bank Commission, resulted in more than 40% of the Island being conserved from development. Commercial activity has historically, and remains centered on the

traditional town and village centers, while residential development is more dispersed. Vineyard Haven, Oak Bluffs, and Edgartown are, in general terms, the commercial centers of the island. Community character and historic resources are significant factors influencing land use and development and development patterns on the island. Figure 7.7-4 depicts land uses on Martha's Vineyard.

The Steamship Authority carries more than two million passengers and almost 500,000 vehicles to and from Martha's Vineyard each year on ferries operating from Woods Hole to Vineyard Haven and Oak Bluffs. There are also close to 300,000 passenger trips on private passenger ferries linking Martha's Vineyard and Gosnold to various mainland ports.

There are two airfields on the Island. The Martha's Vineyard Airport (MVY) handles about 250,000 passenger trips and more than 25,000 aircraft operations in 2015 (FAA, 2017) while the Katama Airpark (1B2) handles an average of 7,200 aircraft operations in 2010 (MassDOT, 2010).

The Martha's Vineyard Transit Authority ("VTA") provides year-round public transit service to the six towns of Martha's Vineyard: Aquinnah, Chilmark, Edgartown, Oak Bluffs, Tisbury and West Tisbury. The VTA's transportation services consist of both fixed route and paratransit services. VTA fixed route service varies throughout the year, depending on the seasonal travel demand, but typically operates with 14 Island-wide routes during the peak season (VTA, 2017).

The waterfront communities of Edgartown and Oak Bluffs, and to a lesser extent Tisbury, are primarily comprised of tourism-oriented establishments, many of which close in the off-season. Year-round retail and office activities have begun to locate away from the historical commercial centers, most notably along and near Upper Main Street in Edgartown and Upper State Road in Tisbury (MVC, 2006). Other retail and office activities are located in smaller village centers including West Tisbury, Menemsha, and Chilmark's Beetlebung Corner. Industrial activities occur in various in-town and rural locations, though clustering of these activities occurs at the Airport Business Park alongside other commercial activities.

Martha's Vineyard has four primary harbors: Vineyard Haven Harbor, Menemsha Basin, Edgartown, and Oak Bluffs. The harbors are home to the Island's fishing fleet and commercial vessels that handle passenger and cargo services from the mainland. These harbors are important destination for tourists and recreational boaters, alike, and offer full-service facilities for recreation boaters.

As noted above, Vineyard Wind intends to use Vineyard Haven Harbor as a location for the Project's O&M Facilities. Vineyard Haven Harbor is considered the year-round working port and is home to most of the Martha's Vineyard boatyards. Vineyard Haven Harbor is located approximately four miles southeast of Woods Hole and 35 km (22 mi) southeast of New Bedford. Vineyard Haven Harbor is used regularly by small coastal tankers and ferries transporting freight, vehicles, and passengers.

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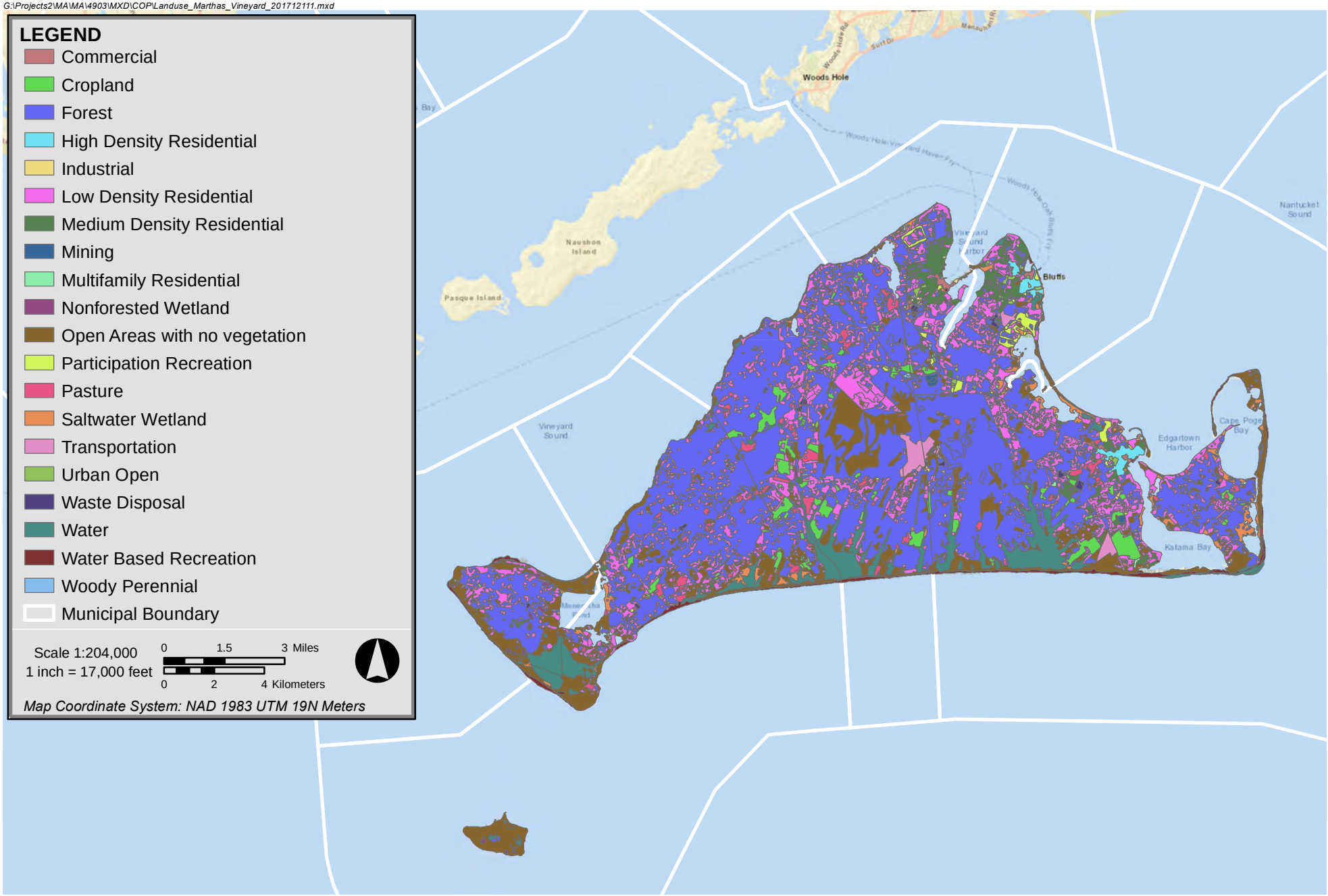

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Vineyard Wind Project

VINEYARD WIND

Figure 7.7-4

Land Use, Martha's Vineyard

The USACE maintains an FNP in Vineyard Haven Harbor. The FNP includes a navigation fairway at the head of the Harbor between Steamboat Wharf and a breakwater built and maintained by the Commonwealth of Massachusetts. This triangular-shaped area is dredged to -5 m (-17.0 ft) MLLW, is approximately 46-84 m (150-275 ft) wide, and 304 m (1,000 ft) long. The FNP also includes a -3.7 m (-12.0 ft) MLLW- anchorage behind the breakwater, immediately north of the fairway area, which hosts a mooring field operated by the Town of Tisbury. Areas of the inner harbor, to the south of the fairway have dockage at pile supported piers. Much of the inner Harbor, however, remains coastal beach and limited wharfing space is currently available. Additional marine services are available within Lagoon Pond, south of the inner harbor and the Beach Road causeway.

7.7.1.2 Rhode Island

Onshore facilities may be located in the City of Providence in Providence County, and in the Town of North Kingstown, in Washington County. Land use and coastal infrastructure are described as they exist in those communities.

7.7.1.2.1 Providence County

Providence County, encompassing the northern portion of the State of Rhode Island, consists of 1,062 km^2 (436 mi^2) of land and 67 km^2 (26 mi^2) of watersheet. Providence County borders the Commonwealth of Massachusetts to the north and east, the state of Connecticut to the west, Kent County to the south, and Bristol County to the southeast. With an estimated population of 631,344 residents in 16 cities and towns, Providence County is the most populous in the State of Rhode Island.

The southeasterly portions of Providence County are the most densely developed, particularly the communities located within the Interstate 295 corridor that bisects the County to the east and north of the City of Providence, the State capital. Interstate 95 also serves Providence County, along with regional rail, bus, and ferry services.

City of Providence

The City of Providence comprises 48 km^2 (18.5 mi^2) of land including 5 km^2 (2.1 mi^2) of watersheet spread over 25 distinct neighborhoods. The City of Providence is the most populous in the State of Rhode Island with an estimated population of 178,851. The City of Providence is also home to numerous top hospitals, colleges and universities, which are key factors in the city's economy. (Providence Tomorrow, 2014)

Figure 7.7-5 depicts the land use types in the City of Providence.

The City of Providence has a fixed land area of 46.6 km^2 (18 mi^2) and is characterized by its compact footprint. The City has limited land area available for new development, approximately a third of which is located existing residential neighborhoods. (Providence

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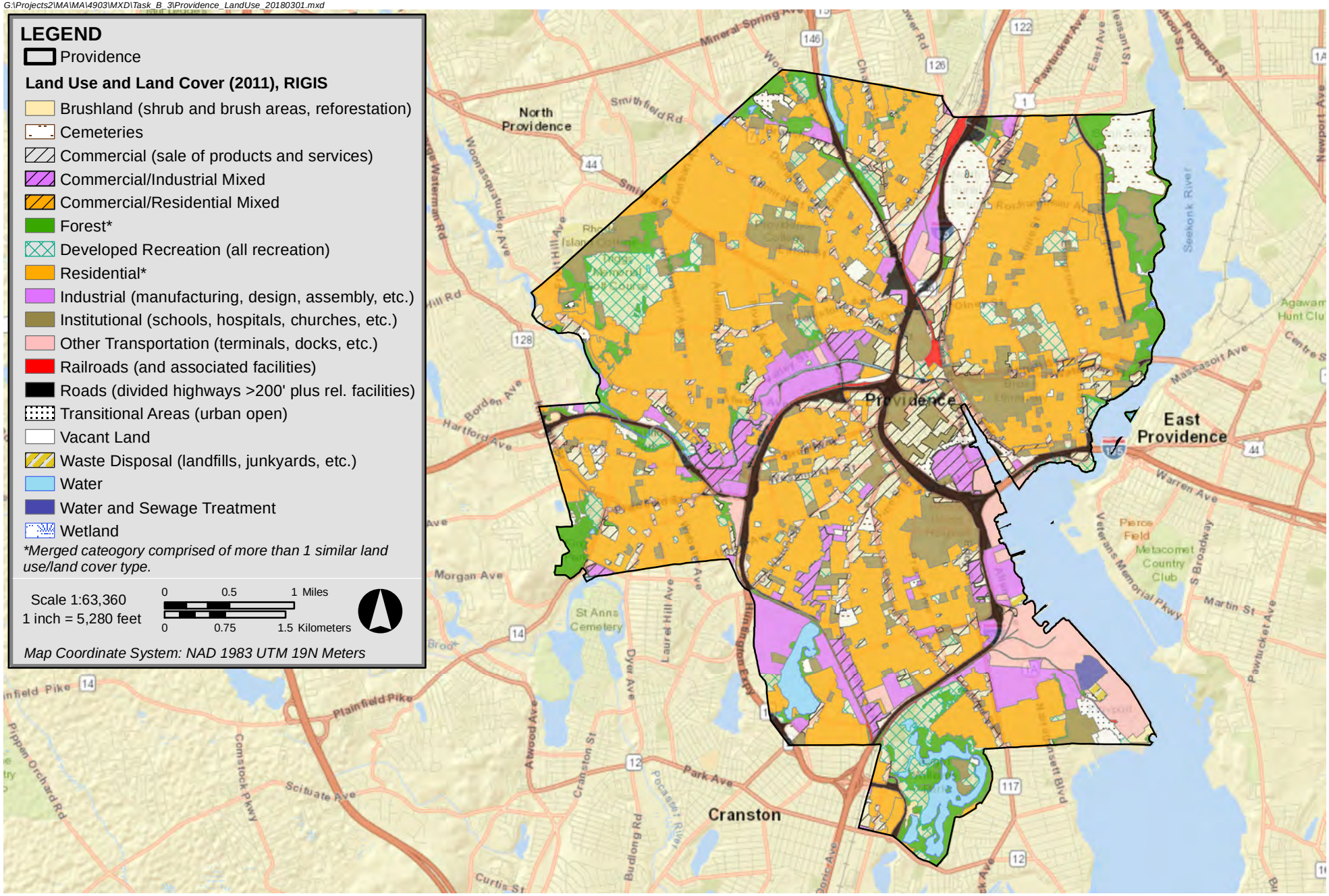

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Vineyard Wind Project

VINEYARD WIND

Figure 7.7-5

Land Use - City of Providence, Rhode Island

Tomorrow, 2014). Remnants of the City of Providence's industrial past remain in the form of underutilized mill building, though many of these vacant and underutilized parcels must be remediated to make the land safe for redevelopment. (Providence Tomorrow, 2014)

Providence has a diversified public park and recreation system that has continued to grow in size. Public amenities, such as Waterplace Park and the city's "riverwalks" are critical to the tourism and providing settings for events and destinations for visitors. (Providence Tomorrow, 2014)

As the State of Rhode Island's commercial and industrial center, the City of Providence also has areas of intense commercial and industrial activity, including areas of Providence River and the Port of Providence.

The Port of Providence is Rhode Island's principal commercial port, handling over 70 percent of the cargo entering Narragansett Bay. The Port of Providence is an intermodal port that offers interstate highway access as well as rail service that reaches inland to major connections throughout the US and is of particular importance, both locally and regionally, for its role in supplying energy products to southern New England.

Shipping operations into the Port of Providence make use of port facilities located in both Providence and East Providence. Most of the port's maritime activity is concentrated in ProvPort (a private port facility located in Providence), though these industries depend on support services provided by tugboat, shipyard, and other services located throughout Providence Harbor. (SAMP, 2011). ProvPort is a 115-acre facility that provide 1,280 m (4,200 ft) of berthing space, 12,077 m^2 (130,000 ft^2) of covered storage, and more than 20 acres of open lay down area. ProvPort also has on-dock rail service and quayside water depth to -12.2 m (-40 ft) MLW. (ProvPort, 2018)

Marine transportation into the Port of Providence is facilitated by a federally maintained navigational channel, which was recently dredged in 2005 to a -12.2 m (-40 ft) MLW, allowing the Port of Providence to accommodate deep-draft vessels. The deep draft channel—as well as its intermodal capabilities, connecting water, rail, and land transportation—together make the Port of Providence attractive to both domestic and international vessels (ProvPort 2009). Providence is also one of the few New England ports that can accommodate deep draft vessel while offering direct access to the interstate highway system (FXM Associates 2008).

7.7.1.2.2 Washington County

Washington County, locally referred to as "South County," has 126,319 residents in its nine towns: North Kingstown, South Kingstown, Exeter, Narragansett, Charlestown, Hopkinton, Richmond, Westerly, and New Shoreham. Washington County is largely undeveloped with communities ranging from rural farming enclaves to seasonal beach communities, and more typical New England village centers and low density residential development. With

approximately 30,651 residents, South Kingstown is the Washington County's largest town by population. Washington County is comprised of 852 km^2 (329 mi^2) of land and 606 km^2 (234 mi^2) of watersheet.

Washington County encompasses all of southwestern Rhode Island, from the Connecticut border to Narraganset Bay, including Block Island located approximately 16 km (10 mi) south of mainland Rhode Island, in Block Island Sound. Washington County's southerly shoreline is comprised largely of coastal beaches which provide numerous recreational and public access opportunities. The easterly shoreline, along Narraganset Bay, is comprised of rocky intertidal habitat though areas of sandy beach do exist.

Interstate 95 passes through the northwestern portion of the Washington County and US Route 1 largely follows the County's coastline. Regional passenger rail service is provided by Amtrak which makes stops in West Kingston and Westerly. Privately-owned Richmond Airport (08R), and the state-owned airports: Westerly (KWST), Block Island (KBID), and Quonset State Airports are located in Washington County. Ferry service to Block Island is operated from Point Judith in Galilee.

Town of North Kingstown

North Kingstown's town center, Wickford village, is the County's center of government and recreation-based maritime activities and the Towns more rural areas are comprised of preserved farmland and open space, residential and commercial development, and village centers.

Figure 7.7-6 depicts the land use types in the Town of North Kingstown.

Quonset Business Park (QBP), formerly known as the Quonset/Davisville Port and Commerce Park, is a 3,000-acre complex located on Narragansett Bay north of Wickford. QBP is the former location of the Quonset Naval Air Station, which was deactivated in 1974, and the Davisville Naval Construction Battalion Center which, until its recommended closure under the Defense Base Closure and Realignment Act of 1990, as amended, was operational until 1994. The QBP, operated by Quonset Development Corporation (QDC), a quasi-public agency, hosts industrial, office, research and development, retail, transportation, manufacturing, tourist, open space, and recreational uses. 500 acres of QBP are dedicated to the Quonset State Airport. Approximately 700 of the 2,500 acres of the business park remain available for development.

To the north of QBP is the Port of Davisville (Quonset), which currently provides 1,372 linear meters (4,500 linear feet) of berthing space at two 366 m (1200 ft) piers, a bulkhead, --9.74 m (-32 ft) controlling depth MLW, on-dock rail, and 58 acres of laydown and terminal storage. The Port of Davisville also has heavy lift capacity, including a 150 metric ton (MT) mobile harbor crane. Vessels access the Port of Davisville through a shipping channel with a 29-foot controlling depth that is not maintained by the U.S. Army Corps of Engineers.

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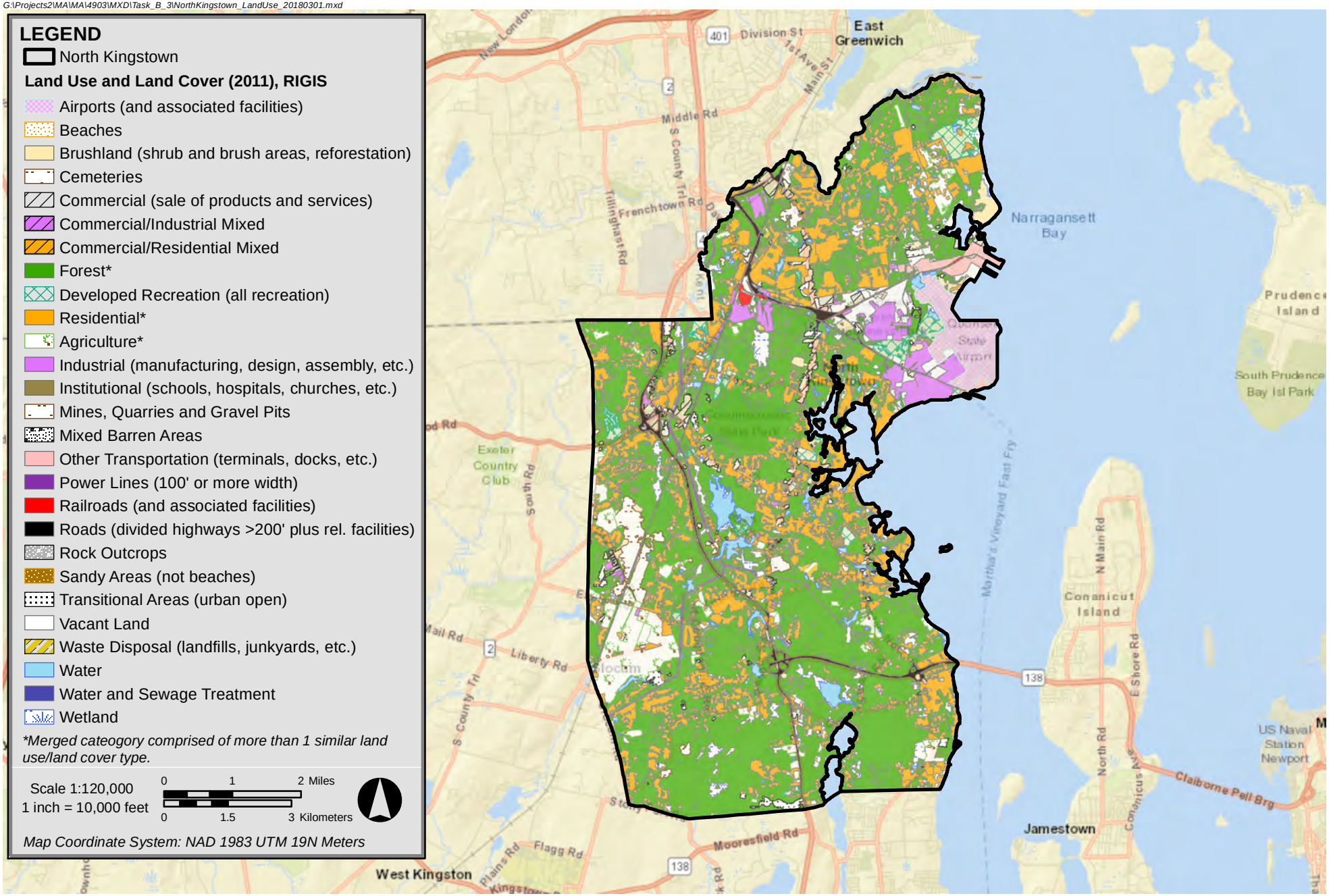

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Vineyard Wind Project

VINEYARD WIND

Figure 7.7-6

Land Use - Town of North Kingstown, Rhode Island

Vineyard Fast Ferry, which operates a seasonal ferry between Quonset Point and Martha's Vineyard, operates a small ferry terminal in the Quonset Business Park. Other current marine transportation-related uses at the Quonset Business Park include businesses such as Senesco Marine, a barge-building company, and General Dynamics Electric Boat, which builds components for the US Navy. (SAMP, 2011)

7.7.2 Potential Impacts of the Project

The potential impact-producing factors as they relate to specific Project elements are presented in Table 7.7-1, below.

Table 7.7-1 Impact-producing Factors for Land Use and Coastal Infrastructure

Impact-producing Factors	Wind Development Area	Offshore Export Cable Corridor	Construction & Installation	Operations & Maintenance	Decommissioning
Vessel Traffic	X		X		
Cable installation	X	X	x		
Dredging		X	x		
O&M Facilities			X	X	x
HDD		X	X		
Utility Duct Construction			x		

7.7.2.1 Construction and Installation

As described in Volume I, Project components will be installed in the onshore and offshore environments. Existing land uses and coastal infrastructure may experience temporary and short-term impacts during the construction and installation phase of the Project.

Each port facility in the Project Region is located within an existing industrial waterfront area and was selected for further evaluation, in part, based on the port's existing infrastructure and capacity to host construction and installation activities, including an extant skilled labor force. The use of one or more of these facilities may be contingent upon the site owner/lessor implementing site-specific improvements based on Vineyard Wind's fit-out requirements (see Section 3.2.5 of Volume I). The construction and installation phase requires port facilities with very high load bearing ground or deck capacity, adequate vessel berthing parameters, and suitable laydown and fabrication space. Site-specific modifications performed by the site owner/lessor may be required to meet those requirements.

Vineyard Wind has signed a letter of intent to the use the New Bedford Terminal to support Project construction and installation activities. The 26-acre New Bedford Terminal is located in the Port of New Bedford on the industrial waterfront. The New Bedford Terminal

serves as a multi-purpose, heavy-lift cargo facility designed to support the construction, assembly, and deployment of offshore wind projects. It is also designed to handle bulk, break-bulk, container shipping, and large specialty marine cargo. The New Bedford Terminal provides easy access to open water for both domestic and international shipping routes as well as interstate transportation networks for land-based logistics. Vineyard Wind plans to use the New Bedford Terminal to offload shipments of components, prepare them for installation, and then load components onto jack-up barges or other suitable vessels for delivery to the lease area for installation.

7.7.2.1.1 Impacts to Land Use

In the onshore environment, new utility duct bank located beneath and along public rights-of-way from the offshore export cable Landfall Site to the general vicinity of the Barnstable Switching Station. A section of existing rail right-of-way ("ROW") and a segment of existing utility ROW may be used for a portion of the route as well. HDD operations and other construction activity will also occur at the Landfall Site.

As noted above, during the construction and installation phase, the Project plans to establish O&M Facilities in Vineyard Haven. Vineyard Wind intends to use port facilities at both Vineyard Haven and the New Bedford Terminal to support O&M activities (see Section 3.2.6 of Volume I). Temporary construction-related impacts typical of the type of facility under consideration are anticipated.

The construction and installation process will make use of existing port facilities and modifications to those facilities are not anticipated to be necessary. Construction and installation activities in the WDA require the use of specialized construction and crew vessels, potentially aided by tug and barge services. These vessels will operate from existing port facilities, though, frequency of these vessels operating from the New Bedford Marine Commerce Terminal ("New Bedford Terminal") and the O&M Facilities will increase.

Installation of duct bank beneath paved roadways will require only minimal disturbance to the adjacent road shoulder and is expected to be completed without significant alteration to any land or infrastructure. Land uses are not anticipated to be impacted or altered upon completion of the construction and installation phase. At the Landfall Site, HDD operations, which are described in Section 4.2.3.8 of Volume I may result in minor, temporary impacts to seawalls, and/or parking and access facilities in the immediate vicinity of the Landfall Site.

Establishment of the Project's O&M Facilities may cause minor, temporary and short-term impacts in the immediate vicinity of the Facility. The Project's intended O&M Facilities and ports used for O&M activities are within areas of compatible water-dependent uses, ranging from commercial and retail marine operations to heavy marine-industrial uses.

7.7.2.1.2 Impacts to Coastal Infrastructure

Vessel operations will increase in the area surrounding the New Bedford Terminal, navigational channels, inshore traffic zones and any traffic separation scheme along the selected route to the WDA.

7.7.2.1.3 Avoidance, Minimization, and Mitigation Measures

Installation of the in-road underground cabling will be done so as to minimize traffic disruption and construction and installation activities will be adequately mitigated through the implementation of BMPs when practicable. Vineyard Wind's onshore construction schedule minimizes impacts to land uses and coastal infrastructure to the greatest extent practical during peak summer months and other times when demands on these resources are elevated.

See Section 7.1.2.1.3 for a description of additional measures that are expected to be implemented during this phase of the Project.

7.7.2.2 Operations and Maintenance

Impacts associated with operations and maintenance of the Project are not anticipated to have adverse effects on the surrounding communities and will not disrupt the communities' routine functions. Most of the Project's systems will be monitored from the O&M Facilities. Planned and unplanned maintenance and repairs will largely be staged from this location and, in the event that a repair is necessary, a crew would be dispatched to the identified location to complete repairs and/or restore normal operations.

7.7.2.2.1 Impacts to Land Use

Periodic maintenance, repair, or improvements to O&M Facilities, the Onshore Export Cable Route, and other onshore facilities may be necessary over the anticipated life of the Project.

Operations and maintenance of the onshore facilities are not expected to impact land use and coastal infrastructure.

7.7.2.2.2 Impacts to Coastal Infrastructure

System repairs typically involve work on transmission cables which are accessed through manholes at the installed splice vaults, or within the fenced perimeter of the substation, thus they can be completed within the installed transmission infrastructure without impacts to surrounding land uses or coastal infrastructure.

7.7.2.2.3 Avoidance, Minimization, and Mitigation Measures

Impacts associated with scheduled period maintenance activities during the operations and maintenance phase will be adequately mitigated through the implementation of BMPs when practicable.

7.7.2.3 Decommissioning

As currently envisioned, decommissioning of the Project is largely the reverse of the construction and installation process as described in Volume I. Vineyard Wind expects to implement a decommissioning plan that removes and recycles equipment and associated materials, thereby substantially returning the WDA and Onshore Project Area to pre-existing conditions

7.7.2.3.1 Impacts to Land Use

It is anticipated that equipment, vessel, and personal requirements for decommissioning will be similar to those utilized during construction and installation. The transition vaults and duct bank may be valuable infrastructure that could be available for future infrastructure projects. The O&M Facilities can be easily repurposed for continued use by Vineyard Wind or another site operator.

7.7.2.3.2 Impacts to Coastal Infrastructure

During the decommissioning phase, vessel operations will increase in the area surrounding the New Bedford Terminal, navigational channels, inshore traffic zones and any traffic separation scheme along the selected route to the Wind Development Area.

7.7.2.3.3 Avoidance, Minimization, and Mitigation Measures

As noted in Section 7.1.2.1.4 above, and elsewhere, Vineyard Wind will implement a comprehensive communications plan to keep the relevant parties informed throughout this phase of the Project.

7.8 Navigation and Vessel Traffic

This section describes Project activities that may affect navigation and vessel traffic within the Project Region, including within the Wind Development Area ("WDA"), the New Bedford Harbor and New Bedford Marine Commerce Terminal ("New Bedford Terminal") and other port facilities, and the Operation & Maintenance ("O&M") Facilities.

A detailed Navigational Risk Assessment ("NRA"), included as Appendix III-I, has also been conducted for the Project. The NRA conforms to the US Coast Guard ("USCG") guidance for Offshore Renewable Energy Installations contained in Navigation Vessel Inspection Circular 02-07, and incorporates information gained through consultation with the USCG and numerous marine trades and maritime transportation stakeholders.

7.8.1 Description of the Affected Environment

The following sections describe the maritime navigation and vessel traffic characteristics of the Project Region. Project-related activities that may impact navigation capacity and vessels operating to and from ports along the south coast of Massachusetts, Cape Cod and the Islands, and Rhode Island (this area is referred to as the "Project Region").

7.8.1.1 Navigation

Private aids to navigation ("PATONs"), federal aids to navigation ("ATONs"), and radar transponders are located throughout the Project Region. These aids to navigation consist of lights, sound horns, buoys, and onshore lighthouses. Most are marked on National Oceanic and Atmospheric Administration ("NOAA") nautical charts, and are intended to serve as a visual reference to support safe maritime navigation.

ATONs are developed, established, operated, and maintained by the USCG in order to assist navigators in determining their position, help navigators identify a safe course, and warn navigators of dangers and obstructions. Likewise, ATONs are used to facilitate the safe and economic movement of commercial vessel traffic.

The Project Region also includes several precautionary areas, which are defined areas within which ships must use particular caution and should follow the recommended direction of traffic flow. Precautionary areas may include a Traffic Separation Scheme ("TSS"), one of several routing measures adopted by the International Maritime Organization 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 creates separate traffic lanes reserved for unidirectional traffic, and are typically used by deep-draft vessels. A TSS is not necessarily marked by an ATON, but it is marked on NOAA nautical charts. Cargo vessels, tankers, cruise ships, and other deep-draft vessels approaching and departing New York, Boston, and ports in the Project Region are expected to use recommended vessel routes, including the TSS (NOAA, 2017f), although the use of a TSS is not mandated by federal regulations.

To the east of the island of Nantucket, the *Nantucket to Boston Harbor* TSS follows the deep bathymetry of the Great South Channel, a deep-water passage between Nantucket and Georges Bank. This TSS enables deep-draft vessels to safely travel south from Boston Harbor and northern waterways past Cape Cod and the dangerously shallow waters of the Nantucket Shoals. The *Nantucket to Boston Harbor* TSS inbound and outbound lanes, each

1.6 kilometers ("km") (0.8 ["nm"]) wide, are separated by a 3.2 km (1.7 nm) wide separation zone to enable vessels to safely enter and exit the TSS (NOAA, 2017f), although most vessels enter a TSS at its terminus.

A precautionary area with a radius of 25 km (1.5 nm) southeast of the Nantucket Shoals, at the southerly end of the Great South Channel, connects the *Nantucket to Boston Harbor* TSS with the *Nantucket to Ambrose* TSS, an east-west approach to Narragansett Bay, Buzzards Bay, and Long Island, New York coastal areas. An additional TSS services the approaches to Narragansett Bay and Buzzards Bay, and consists of four parts: two precautionary areas and two approaches- a Narragansett approach and a Buzzards Bay approach. The precautionary areas have radii of 8.7 km (4.7 nm) and 5.8 km (3.1 nm), and are located at the southerly ends of Narragansett Bay and Buzzards Bay, respectively (NOAA, 2017f).

7.8.1.2 Commercial Vessel Traffic

Commercial vessel traffic in the Project Region makes use of waterways, ports, and other coastal infrastructure to move goods and passengers, and is essential for the Project Region's economy and security. Commercial vessel traffic may include a variety of vessel types ranging from passenger cruise ships to articulated tug barges moving liquid petroleum. Each of these vessel types operate differently and may have operational and navigational requirements that present unique needs based on other uses and activities in the Project Region.

Vessel traffic within the Project Region was assessed by the NRA using Automatic Identification System ("AIS") data from 2016 and 2017, and through outreach to vessel operators and other stakeholders. Based on the NRA, commercial vessel traffic in the Project Region includes research, tug/barge, liquid tankers, cargo, military and search-and-rescue vessels, and commercial fishing vessels. AIS data for the Project Region was also queried for vessel activity within the WDA in order to establish a representative profile of seasonal and year-round activity within the WDA and along the Offshore Export Cable Corridor ("OECC"). Based on this assessment, the NRA established that the most common type of vessels transiting in the WDA are commercial fishing vessels. Detailed descriptions of commercial vessel traffic within the WDA is provided in Appendix III-I.

As described in Appendix III-I, commercial vessel traffic in the vicinity of the WDA is heaviest in four primary areas: 1) vessels approaching, entering, and exiting Narragansett Bay; 2) vessels entering and exiting Buzzards Bay; 3) vessels traveling from Hyannis to Nantucket; and 4), vessels traveling from Woods Hole to Vineyard Haven. A high volume of passenger ferry traffic occurs between Cape Cod and Nantucket and Martha's Vineyard. These vessels typically stay within 9.6 km (6 mi) of the shoreline while transporting passengers throughout Rhode Island and Massachusetts, but must cross Nantucket Sound and the OECC when transporting passengers to Martha's Vineyard and Nantucket. Both

seasonal and year-round service is provided by several ferry companies, with more than twenty-four daily trips between Hyannis and Nantucket during the peak of the summer season.

Commercial vessel traffic in the Project Region has also been characterized by the Northeast Regional Ocean Council ("NROC") as part of their regional ocean planning efforts. Their dataset is a series of maps created by using vessel density products from the NOAA Office for Coastal Management and raw AIS data provided by the USCG. The dataset provides vessel traffic density by general vessel type for each year between 2011 and 2013. Vessel types include cargo, passenger, tug-tow, and tanker. These maps do not identify the number of transits, but rather the relative density of vessels in a particular area over a year-long period. According to the Northeast Regional Planning Body, these data have been reviewed and validated by the USCG and by vessel owners, pilots, and port authorities in the region (Northeast Regional Planning Body, 2016).

NROC's analysis is particularly helpful in identifying major vessel routes within the Project Region, especially as each vessel type mapped by NROC may have different operating requirements within the Project Region. The Northeast Regional Planning Body (2016) notes that these routes are expected to stay relatively static in the foreseeable future. Nonetheless, future development of and changes to coastal infrastructure, operating parameters, equipment, and market demand are likely to affect the intensity of traffic traversing these routes (Northeast Regional Planning Body, 2016).

NROCs commercial vessel density maps for the Project Region are included as Figure 7.8-1, Cargo Vessel Density; Figure 7.8-2, Passenger Vessel Density; Figure 7.8-3, Tug-Tow Vessel Density; and Figure 7.8-4, Tanker Vessel Density.

7.8.2 Potential Impacts of the Project

7.8.2.1 Construction and Installation

The construction and installation phase of the Project will make use of both construction and support vessels to complete tasks in the WDA and along the OECC. Construction vessels will transit between the WDA and the New Bedford Terminal, however, vessels may operate from other port facilities in the Project Region, as needed.

During construction and installation of the 800 MW Project, it is anticipated that an average of approximately 25 vessels will operate during a typical work day in the WDA and along the OECC. Many of these vessels will remain in the WDA or OECC for days or weeks at a time, potentially making only infrequent trips to port for bunkering and provisioning, if needed. Therefore, although an average of ~25 vessels will be involved in construction activities on any given day, fewer vessels will transit to and from New Bedford Harbor or secondary port each day. During the most active period of construction, it is

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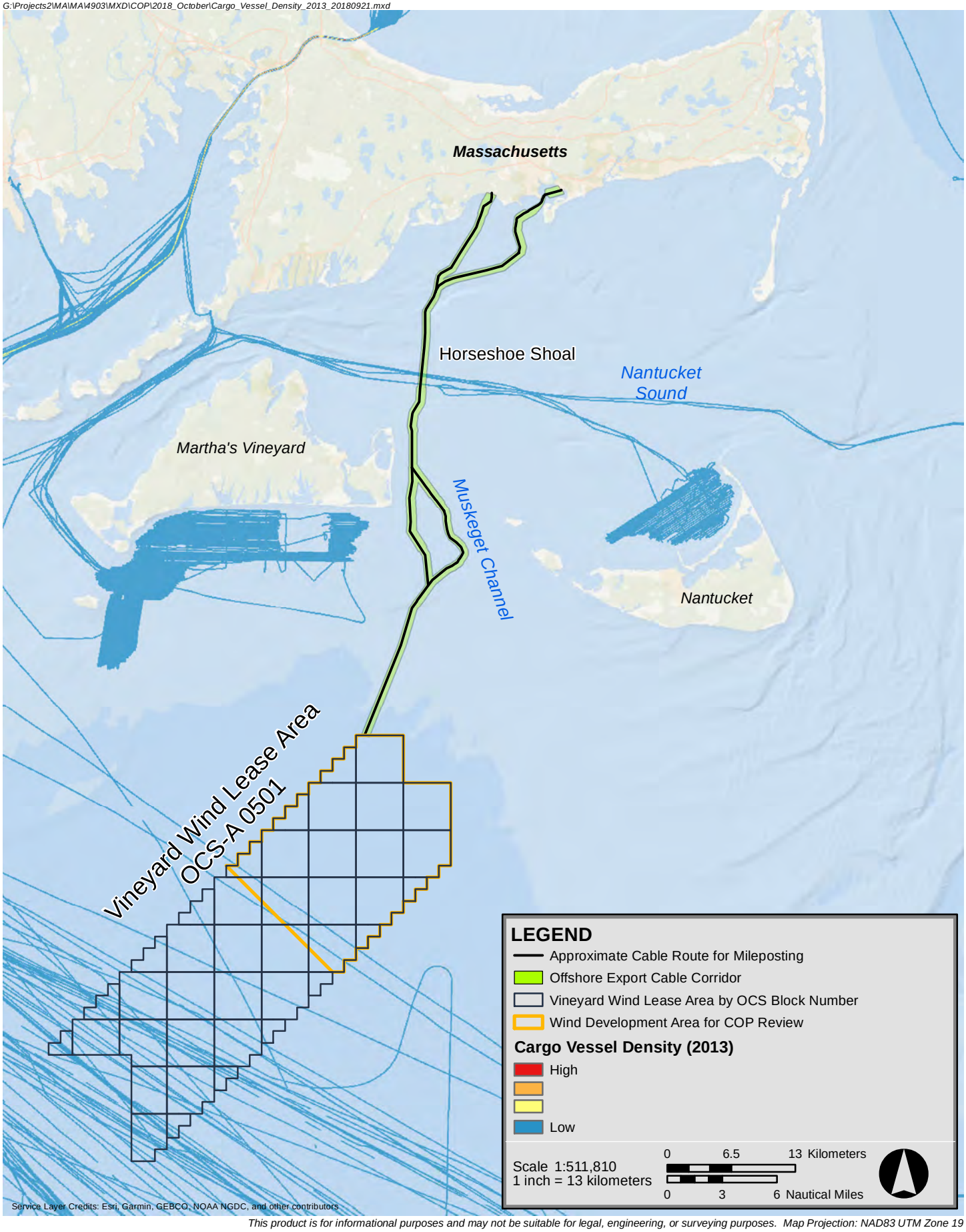

This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

VINEYARD WIND

Figure 7.8-1
2013 Cargo Vessel Density

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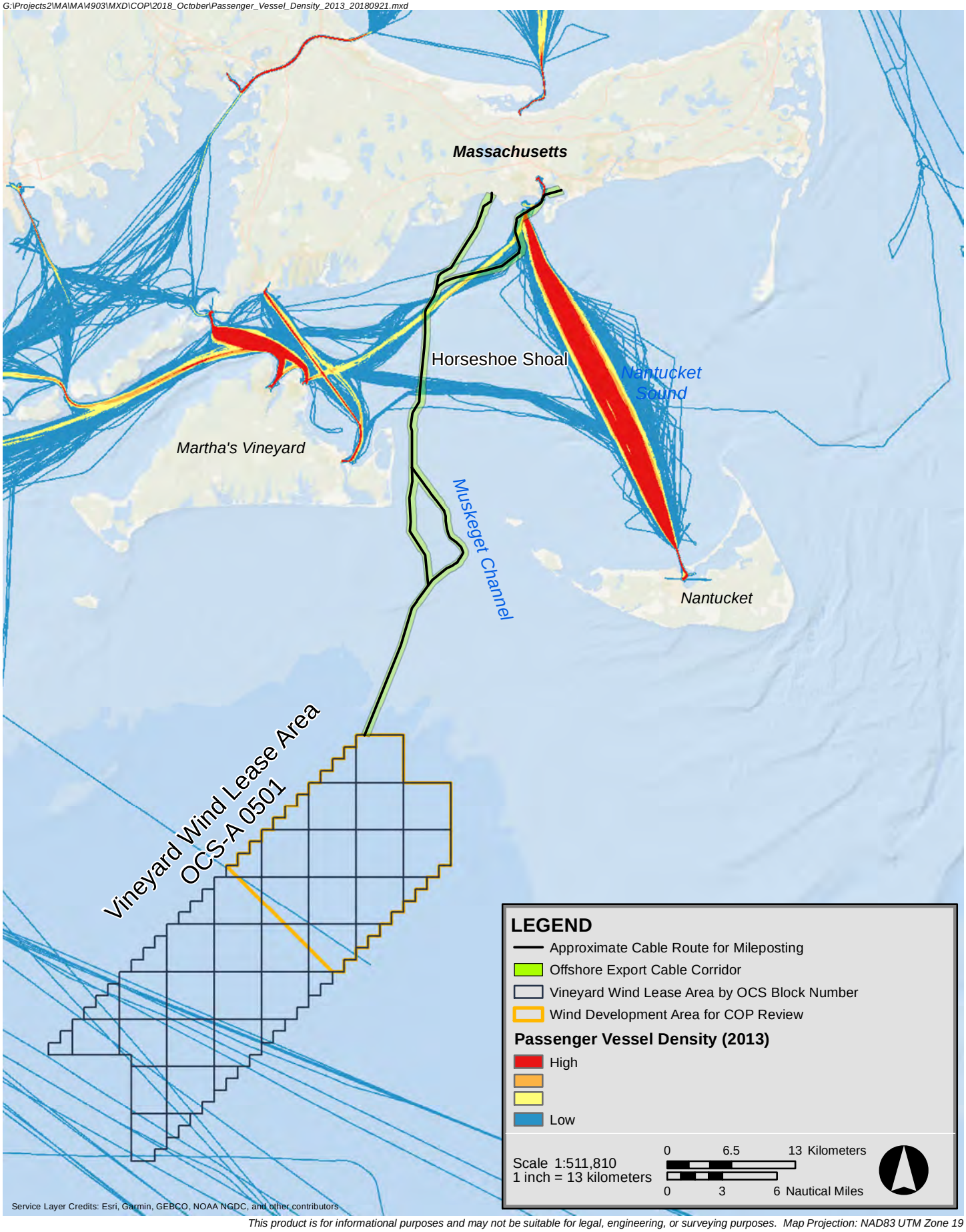
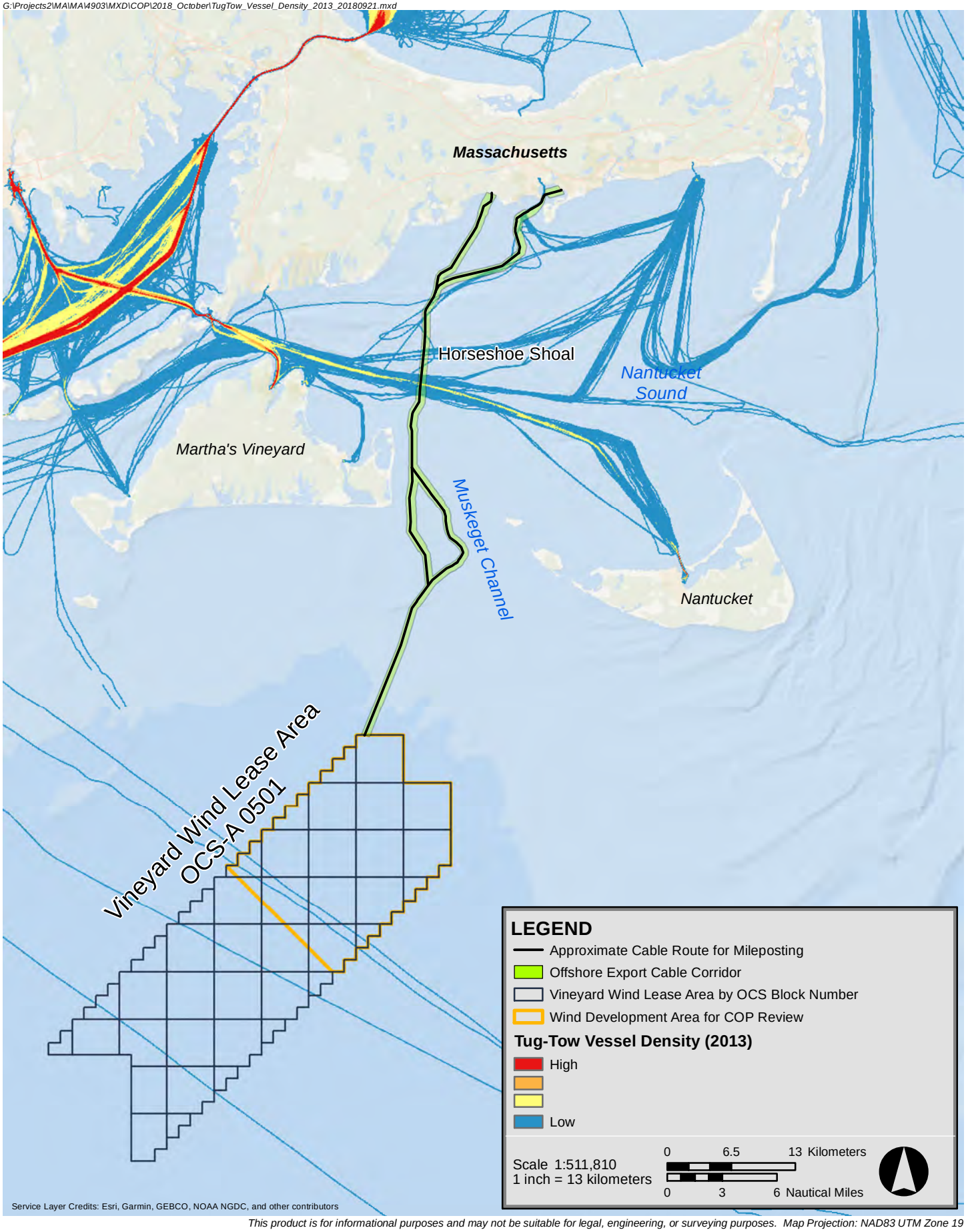


This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes. Map Projection: NAD83 UTM Zone 19

Vineyard Wind Project

VINEYARD WIND

Figure 7.8-2
2013 Passenger Vessel Density



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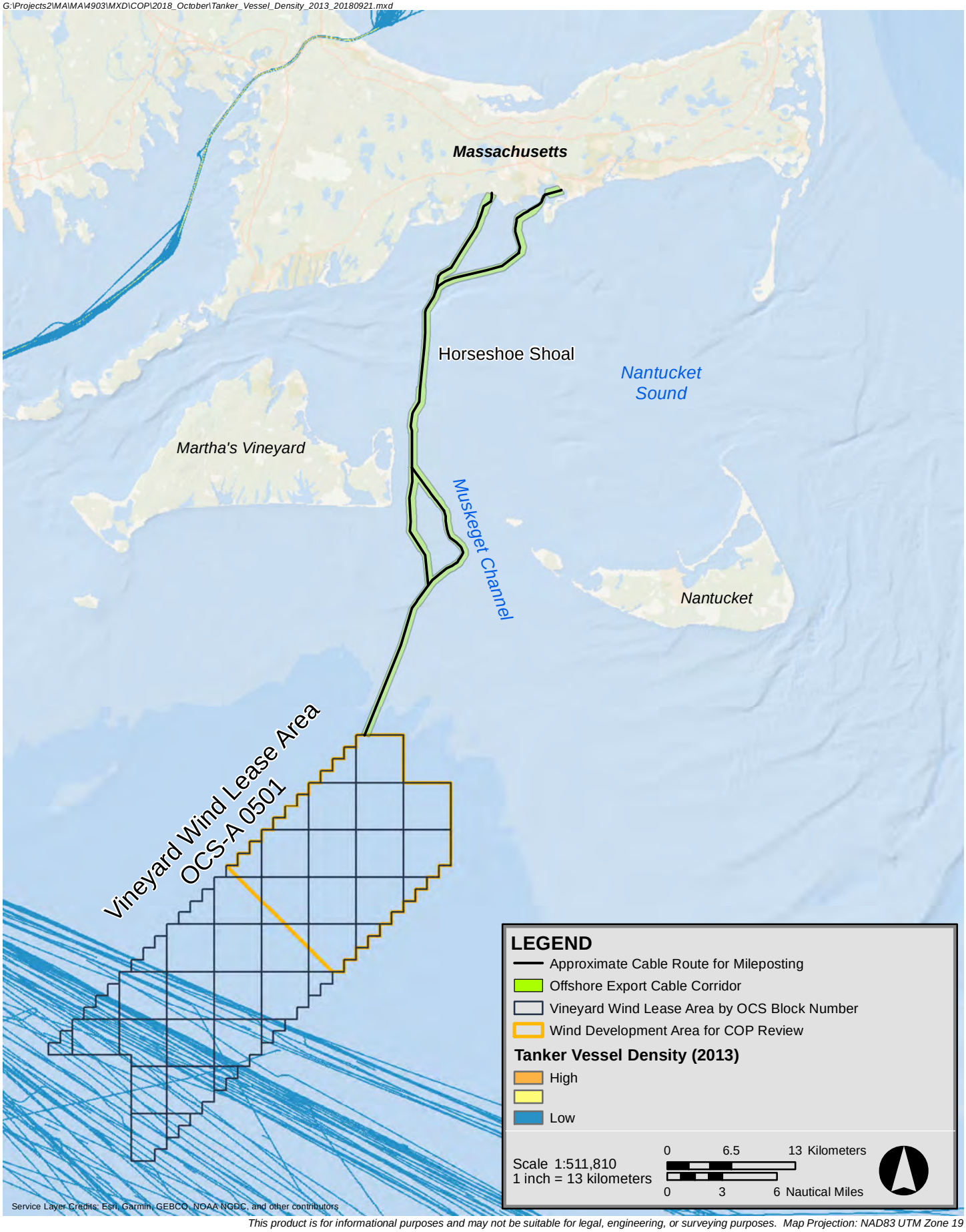
Vineyard Wind Project

VINEYARD WIND

Figure 7.8-3
2013 Tug-Tow Vessel Density



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Vineyard Wind Project

VINEYARD WIND

Figure 7.8-4

2013 Tanker Vessel Density

estimated that a maximum of approximately 46 vessels could be involved in the Project at one time; however, the maximum number of vessels involved in the Project at one time is highly dependent on the Project's final schedule, the final design of the Project's components, and the logistics solution used to achieve compliance with the Jones Act.

Vessels making round-trips from port facilities are primarily smaller Crew Transport Vessels (CTVs), tugboats, and smaller jack-up vessels. Over the course of construction, Vineyard Wind anticipates an average of approximately seven daily trips between both the primary and secondary ports and the WDA or OECC. During the most active month of construction, it is anticipated that an average of approximately 18 daily vessel trips will occur. The Navigational Risk Assessment (see Appendix III-I) conservatively assesses the unlikely scenario that the maximum number of vessels are working in the WDA or along the OECC and all must return to port on the same day, resulting in a maximum of approximately 46 vessel trips in one day. However, as with the total number of vessels involved in the Project, the number of daily vessel trips to each of the Project's ports is highly dependent on the Project's final schedule, design, and logistics.

Specific to offshore export cable installation, on average, approximately six vessels will be used for cable laying activities along the OECC in any given month, although as many as approximately nine vessels may be used for cable laying activities in any one month. Vessels used for cable installation may include a cable laying vessel, up to three anchor handling tug supply vessels, a CTV, a pre-lay grapnel run vessel, a tug boat, a pre-construction survey boat, a trenching vessel, a dredging vessel, a boulder clearance vessel (if required), and a vessel used to install cable protection (if required). Many of the cable installation activities are sequential; therefore, these vessels would not all operate along the Offshore Export Cable Corridor simultaneously.

Detailed descriptions of the vessel types generally used for offshore wind energy development are provided in the NRA. Additional details on the Project's expected vessel trips is provided in Section 3.7 of the COP Addendum.

7.8.2.1.1 Impacts to Navigation

Each of the vessels being evaluated for construction and installation have operational and navigation constraints similar to the commercial vessels typically seen in the Project Region and are not anticipated to affect navigation in the WDA, largely because the WDA is not heavily trafficked (as described in Appendix III-I). Temporary safety zones may be established around work areas during the construction and installation phase. Temporary safety zones are expected to improve safety in the vicinity of active work areas, and would not affect the entire WDA or OECC. Temporary safety zones may be marked with temporary buoys placed at four corners of the safety zone within an approximately 500 m (1,640 ft) distance of the construction and installation activity, which may include WTG and/or ESP installation within the WDA, or cable installation along the OECC.

Construction and installation activities will cause a modest increase in vessel traffic when foundations, WTGs, and inter-array cable are installed in parallel, including within the TSS approaches to and from ports in Rhode Island and Massachusetts.

Although a modest increase in vessel traffic is anticipated due to construction and installation activities, port facilities and adjacent waterways, particularly with regard to the New Bedford harbor, are capable of accommodating this small increase with limited to no disruption to ongoing port operations. As reported to the US Army Corps of Engineers by all commercial freight and passenger vessel operators, on average there were 2,426 commercial and passenger vessel movements from Buzzards Bay through New Bedford Harbor annually between 2012 and 2016 (excluding commercial fishing vessels). In addition to these vessel movements, the approximately 219 federally permitted commercial fishing vessels and an estimated 500 recreational vessels homeported in New Bedford Harbor add to the vessel traffic in and around New Bedford Harbor. As described in the Appendix III-I, the New Bedford Port Director communicated that 150 to 200 vessels transit the New Bedford hurricane protection barrier each day. This suggests that the incremental increase in vessels that will use Massachusetts ports during the Project's construction and installation phase can be accommodated without creating conflicts with existing uses.

Nonetheless, vessels entering New Bedford Harbor are limited by the 45 m (150 ft) wide opening in the hurricane barrier. Larger beam construction and installation vessels transiting the hurricane barrier may pose temporary navigational obstructions to other vessels also transiting the hurricane barrier.

When construction and installation vessels are on-station along the OECC or in the WDA, within areas of confined navigation or in close proximity to obstructions, temporary navigational impacts in the immediate vicinity of those vessels may occur. Other vessels transiting these areas may need to make adjustments to planned routes or transit times to avoid construction and installation vessels.

Radar systems are commonly used in maritime applications to detect and monitor other vessels' positions and movements near a radar-equipped vessel. Radar systems also provide information regarding vessel position relative to fixed objects such as AToNs. Construction and installation activities are expected to have little effect on marine radar systems. Increased vessel traffic, as noted above, will have no impact on the operation of marine radar systems.

As WTGs are installed during the construction and installation phase, they will produce new radar signals. An evaluation of the effects of WTGs on marine radar systems operated near the UK Kentish Flat Offshore Wind Farm (BWEA, 2007) indicates that the expected impacts of offshore WTGs on marine radar systems depends on a number of variables, including vessel size, a vessel's proximity to the WTGs, a vessel's angle of travel in relation to the wind farm, and the position of the radar systems onboard a vessel. Additional

information on marine radar systems is provided in Section 7.8.2.2.1, below, in Section 7.2 of Appendix III-I, and in Section 5 of the Supplementary Analysis for the Navigational Risk Assessment.

Aside from temporary safety zones and the potential for increased vessel traffic, no significant disruption of the Project Region's established navigation patterns or aids to navigation is anticipated during the construction and installation phase.

7.8.2.1.2 Impacts to Commercial Vessel Traffic

Additional vessel traffic associated with construction and installation activities is not anticipated to affect commercial vessel traffic in the Project Region. Certain vessels transiting confined navigation channels will have limited maneuverability within the bounds of the navigation channel or at the New Bedford Harbor hurricane barrier, as noted above. These vessels may therefore require other vessels transiting navigation channels or the hurricane barrier to adjust course, where possible, or adjust their departure/arrival times to avoid navigational conflicts. However, navigational conflicts are not anticipated to be a common occurrence, and Vineyard Wind will provide Offshore Wind Mariner Updates and coordinate with USCG to issue Notices to Mariners ("NTMs") advising other vessel operators of construction and installation activities. Vineyard Wind will also coordinate arrival and departure of Project vessels with the New Bedford Harbormaster, the USCG, local pilots, and other port operators.

On average, approximately six cable-laying, support, and crew vessels may be deployed along sections of the OECC in any given month during the construction and installation phase. As described in Appendix III-I, Section 4.1.3, ferry services operating along the OECC do not anticipate a significant impact to their route so long as they are provided with adequate notice of construction and installation activities. As such, Vineyard Wind will continue to work with ferry operators, harbor pilots, and other vessel operators to ensure any impacts to commercial vessel traffic are minimized to the greatest extent practicable.

AIS data suggests that commercial vessel traffic through the WDA is infrequent, and construction and installation activities are not anticipated to affect such vessel traffic. Construction and installation impacts to commercial fishing vessels are addressed in Section 7.6.2.1.

Given the scale of the Project and the possibility that one or more other offshore wind projects may be using portions of the New Bedford Terminal at the same time, Vineyard Wind may make use of one or more port facilities described in Section 7.1.1.1 and Section 7.1.1.2. Vineyard Wind plans to use port facilities in the Project Region to offload shipments of components, prepare them for installation, and then load components onto jack-up barges or other suitable vessels for delivery to the lease area for installation. Some component fabrication and fit-up may take place at one or more of these port facilities. It is also possible that other North Atlantic commercial seaports may be used. At this juncture,

the Project may use a port facility in nearby Rhode Island to offload, store, and stage the turbine blades or other components for delivery to the offshore WDA, as needed. These port facilities were selected, in part, based on the port's existing infrastructure and capacity to host construction and installation vessels with few impacts to existing uses and users. Additional vessel traffic may occur within those ports as a result of construction and installation activities. Vessels will also be delivering materials and wind turbine generators ("WTGs") from outside the Project Region. With mitigation measures described in Section 7.8.2.1.3, the increased vessel traffic is not anticipated to result in significant disruption of commercial vessel traffic is anticipated during the construction and installation phase.

7.8.2.1.3 Avoidance, Minimization, and Mitigation Measures

Coordination among the New Bedford Harbor Development Commission, the New Bedford Harbor Master, USCG, local pilots, and other entities will be necessary to ensure that impacts from construction and installation vessels are minimized. Vineyard Wind is committed to working with each stakeholder to address navigation and other concerns during each phase of the Project. As part of this effort, Vineyard Wind will develop and implement a communication plan to engage these stakeholders. Vineyard Wind will work to coordinate a vessel traffic management plan, as necessary, to align construction and installation vessel operations with established port operations.

During the construction and installation phase, Vineyard Wind will employ a Marine Coordinator to manage all construction vessel logistics and act as a liaison with the USCG, port authorities, state and local law enforcement, marine patrol, and port operators. As specified in the Project's Draft Safety Management System (COP Volume I Appendix I-B), the Marine Coordinator will keep informed of all planned vessel deployment and will manage the Project's marine logistics and vessel traffic coordination between the staging ports and the WDA.

Offshore Wind Mariner Updates and NTMs will be distributed by Vineyard Wind and USCG to notify recreational and commercial vessels of their intended operations to/from and within the WDA. Local port communities and local media will be notified and kept informed as the construction progresses. Updated navigational charts (paper and electronic) with the location of the Project will be issued to stakeholders. The Project's website will be updated regularly to provide information on the construction zone, scheduled activities, and specific Project information.

To minimize hazards to navigation, all Project-related vessels, equipment, and appurtenances will display the required navigation lighting and day shapes. PATONs will also be installed by the Project during the construction and installation process to further assist navigators in determining their position and best safe course of navigation through and around the WDA. As the components for the WTGs are being installed, temporary PATONs will be added to vertical foundation/transition piece structures and WTGs, as required. Permanent PATONs will be installed on the fully constructed WTGs in

accordance with International Association of Lighthouse Authorities ("IALA") Guidance for the marking of man-made offshore structures (IALA Recommendation O-139, edition 2, 2013), and USCG approval. WTGs and ESPs will be equipped with Automatic Identification System ("AIS") transponders, day marks, painted markings, and lighting, as required. High-visibility yellow paint will cover WTG foundations from the waterline (at all tidal conditions) to a height of at least 15 m (50 ft) above the water line. Selected WTGs will also be equipped with sound signals. See Appendix III-I for further discussion of marking and lighting requirements.[29]

Vineyard Wind is committed to working with the USCG to mitigate safety concerns during construction. This may include a temporary safety zone around construction activities. This proposed safety zone would be adjusted as construction work areas change within the WDA, allowing fishermen and other stakeholders to make use of the WDA areas not under construction. When feasible, Vineyard Wind will deploy one or more safety vessels to monitor vessel traffic approaching construction operations. Additional resources (e.g., safety vessels, personnel) will be in close proximity to construction and installation activities to respond to safety or environmental concerns, as they may arise.

Vineyard Wind has also engaged with marine pilots to coordinate construction and installation vessel approaches to the Project Region, as required by state and federal law, and to minimize impacts to commercial vessel traffic and navigation.

7.8.2.2 Operations and Maintenance

As described in Section 1.5, the Project is being permitted using an Envelope concept. Up to 106 turbine locations are being permitted to allow for spare positions (in the event of environmental or engineering challenges). Although the Project is including 106 WTG positions in the Project Envelope, only up to 100 positions will be occupied by a WTG. The site layout for up to 106 turbine locations is shown on Figure 3.1-2 of Volume I. The WTGs are laid out in a grid-like pattern with spacing of 0.76-1.0 nm between turbines. In consultation with local fishermen and the USCG, corridors in a northwest/southeast and northeast/southwest direction have been maintained. Additionally, for the 800 MW Project, there will be one conventional 800 MW ESP or two conventional 400 MW ESPs.

Vineyard Wind plans to locate the Project's O&M Facilities in Vineyard Haven on Martha's Vineyard. The O&M Facilities will function for the operational life of the Project, which is anticipated to extend up to 30 years after construction and installation. Once operational, the O&M Facilities will operate with a staff of technicians and engineers responsible for long-term operation and maintenance of the Project. The O&M Facilities, including the vessels necessary for the long-term maintenance of the WDA, will be of a scale compatible with on-going water-dependent industrial uses and existing infrastructure of the surrounding

[29] The Project's lighting and marking scheme is being refined through ongoing consultations with USCG.

port. Operations and maintenance functions may be co-located with the port facility and/or with existing Project offices on the mainland. The O&M facility will require deep-water access and quayside facilities. The O&M facility will also include berths for crew transport vessels CTVs and other support vessels. These siting requirements are consistent with existing conditions at many working ports. Because an average of fewer than three vessels O&M vessels will transit to and/or from the O&M facility on any given day, vessel activities at the O&M facility are not expected to adversely affect other commercial or recreational vessel traffic.

During the operations and maintenance phase, the number of Project-related vessels operating in the Project Region will vary depending on several factors, including: manufacturer-specified WTG maintenance schedules, WTG and cable inspections and/or troubleshooting, emergency repairs, or replacement of damaged or inefficient parts. Vineyard Wind intends to use port facilities at both Vineyard Haven and the New Bedford Terminal to support O&M activities (see Section 3.2.6 of Volume I). Crew Transport Vessels ("CTVs") and other support vessels will operate from the O&M Facilities. Larger vessels used for major repairs during O&M (e.g. jack-up vessels, heavy cargo vessels, etc.) would likely use the New Bedford Terminal. For regularly scheduled maintenance and inspections, it is anticipated that on average fewer than three O&M vessels will transit to and/or from the O&M facility on any given day. In other maintenance or repair scenarios, additional vessels may be required, which could result in a maximum of three to four vessels per day operating within the WDA.

During the operations and maintenance phase, both inter-array and export cables will be inspected on a regular basis. Cable inspection may involve the use of survey vessels and other vessel-based systems for subsurface inspections. These inspections will occur on a regularly scheduled maintenance timetable, but are generally expected to occur less than once each year. The vessels used for such inspections are similar in size and operational requirements as other vessels frequently operating in the Project Region.

Typical marine and aerial radar systems rely on measurement of return signals in response to an output of electromagnetic energy. Radar systems work by transmitting a signal generated by an antenna in a particular direction and detecting the return of the electromagnetic signal reflected off of objects in the path of the signal. Several studies have assessed the impact of European wind farms on radar signals, including at the Horns Rev and North Hoyle Wind Farms in Denmark the UK, respectively (Howard & Brown, 2004). Additional studies were conducted at the Kentish Flat Offshore Wind Farm in the UK in 2005 (MARICO, 2007). To-date, the most comprehensive study concerning the possible effects of wind farms on radar was conducted by the British Wind Energy Association ("BWEA") in 2005 at the Kentish Flat Offshore Wind Farm (BWEA, 2007). The Kentish Flat studies gathered field data on marine radar systems in proximity to an operating offshore wind farm. Data was sourced from marine radar systems installed in various vessel types, including the types of vessels and radar systems currently operating in the Project Region.

The study was designed to determine if particular types of vessels, radar, or antennae are more susceptible to effects from wind farms. The data collected were intended to facilitate the preparation of more informed navigational risk assessments and to assist in the development of appropriate mitigation measures.

During the study, marine radar systems were observed as the vessel was passing in proximity to the wind farm. Approximately one-third of the vessels participating in the study experienced no discernable effects on their radar system when passing near the wind farm (BWEA, 2007). Of those radar systems that were affected, a proportion of the interference observed was related to false or multiple echoes of the vessel's superstructure (i.e., radar signals bouncing back and forth between the transmitting vessel and WTGs, causing weak false echoes of the transmitting vessel to appear on the radar screen as a series of faint targets). These false or multiple echoes appeared when the vessel was near the wind farm and disappeared as the vessel moved past the wind farm and the angle of the radar signal to the wind farm changed.[30] BWEA (2007) noted that while unwanted effects were recorded on vessel radar systems, the radar operators were able to readily identify the false echoes and could safely navigate in and around the wind farm.

In 2009, the USCG considered the potential impacts to radar navigation from WTGs (USCG, 2009). The USCG concluded that the WTGs would not adversely impact a mariner's ability to effectively use radar as a navigation tool even though certain WTGs may impact radar systems, in part because most mariners were experienced at interpreting radar signals under a variety of circumstances.

The proposed WTG layout is likely to have similar effects on marine radar systems as those described in the above referenced studies. False or multiple echoes, for example, may be identified on marine radar systems operated in proximity to the WDA. However, as noted above, the effectiveness of radar systems and any impacts from WTGs will vary from vessel to vessel based on several factors, including radar equipment settings and installation. In order to mitigate potential effects on marine radar systems, WTGs will be equipped with AIS transponders. AIS transponders are based on VHF mobile bands, which have not shown any impacts from WTGs.

Vineyard Wind will continue to work with the USCG and BOEM to maintain safe navigation within the area of the WDA. As noted in the USCG (2009) assessment, impacts to radar should not negatively impact a mariner's ability to safely navigate in the WDA; even so, Vineyard Wind will work with stakeholders to identify potential mitigation measures, as necessary.

[30] Radar system settings and the location of the radome onboard the vessels are among the factors that influence radar signals.

7.8.2.2.1 Impacts to Navigation

During the operations and maintenance phase, increased risks to navigation may result from the presence of WTGs and ESPs, which are fixed structures in open water, in the WDA. Larger WTGs may have a higher tip clearance, which would likely reduce navigational risk. To aid navigation in proximity to the WDA, navigational markings and lighting on or near the WTGs and ESPs will be installed.

Vineyard Wind plans to locate the O&M Facilities in Vineyard Haven on Martha's Vineyard. Improvements to Vineyard Haven may be needed to accommodate Vineyard Wind's needs, such as improvements to existing marine infrastructure (e.g., dock space for CTVs, access, etc.) and to structures (office and warehouse space). Any such improvements are not anticipated to impact ongoing port operations and would be completed at the direction of the site owner/lessor, as described in Section 7.7.2.1.

Based on the anticipated vessel type and activity, no significant disruption of the Project Region's established navigation patterns or aids to navigation is anticipated during the operations and maintenance phase. As noted in Appendix III-I, vessels may select routes that avoid the WDA or may travel at reduced speeds through the WDA which could result in extended travel time through or around the WDA.

7.8.2.2.2 Impacts to Commercial Vessel Traffic

Section 4.0 of the NRA provides a summary of vessel types, characteristics, operating areas and routes, traffic density, and seasonal traffic variability within the Offshore Project Area.

As noted in Section 7.8.1.1, commercial vessel traffic in the WDA is characterized as low, and therefore few impacts to commercial vessel traffic are anticipated. Commercial vessels may select alternate routes around the WDA rather than navigating through the WDA.

Operations and maintenance vessels will be operating between the O&M Facilities and the WDA. The O&M Facilities will require deep-water access and quayside facilities. However, because these siting requirements are consistent with existing working ports, the O&M Facilities are not expected to affect commercial vessel traffic. Operations and maintenance vessels will rarely be operating along the OECC unless a vessel is merely transiting the area. Therefore, few impacts to passenger vessel routes along the OECC from operations and maintenance activities are anticipated.

Upon installation of the offshore export cable system, anchoring of vessels in proximity to the OECC is not recommended. However, any anchoring limitations along the OECC are not anticipated to affect commercial vessel traffic.

Most operations and maintenance activities in the WDA will only require the use of a CTV, which is anticipated to have no effect on commercial vessel traffic. Larger multipurpose vessels will only be deployed in the event of major maintenance issues or when larger equipment requires replacement; these are expected to be infrequent events. These larger vessels would likely operate from the New Bedford Terminal.

7.8.2.2.3 Avoidance, Minimization, and Mitigation Measures

Vineyard Wind will coordinate with the appropriate entities to minimize impacts to commercial vessel traffic and work with the USCG to ensure NTMs are distributed. The Project's website will be regularly updated to provide information on the O&M activities occurring in the area.

To aid mariners navigating the WDA, WTGs and ESP will be lit, marked, and maintained as PATONs in reference to International Association of Lighthouse Authorities ("IALA") Guidance for the marking of man-made offshore structures (IALA Recommendation O-139, edition 2, 2013), and US Coast Guard approval. As noted in Section 7.8.2.1.3, AIS transponders will be installed on WTGs to further aid mariners in identifying the location of WTGs and to mitigate the effects, if any, of the WTGs on marine radar systems. The number and location of AIS transponders to be located on WTGs is being evaluated. Additional details regarding proposed aids to navigation are provided in Appendix III-I. To minimize hazards to navigation, all Project-related vessels, equipment, and appurtenances will display the required navigation lighting and day shapes.

As described in the NRA, the proposed symmetry and alignment of WTGs is aligned with typical vessel travel patterns. WTGs are separated by a distance of 1.85 km (1.0 nm) to create the lineal corridors that provide an optional route for vessels traversing the WDA along its southeast-northwest axis and the northeast-southwest axis.

Vineyard Wind will work with the USCG to develop a communication plan for search and rescue evacuations and other emergency response situations. To mitigate potential impacts to search and rescue aircraft operating in the WDA, the Project will have a strict operational protocol with the USCG that requires the Project to secure the WTG (stop the blades from rotating) within a specified time upon request from the USCG.

7.8.2.3 Decommissioning

Decommissioning of the offshore components, described in Section 4.0 of Volume I, includes removal of WTG and ESP pile foundations and possibly cables within the WDA and OECC. Impacts from these activities will be similar to those associated with construction as described in Section 7.8.2.1.1.

7.8.2.3.1 Impacts to Navigation

Impacts from decommissioning activities are anticipated be similar to those associated with construction and installation, as described in Section 7.8.2.1.1. As part of the decommissioning process, all PATONs will be removed from the WDA.

7.8.2.3.2 Impacts to Commercial Vessel Traffic

Impacts from decommissioning activities are anticipated to be similar to those associated with construction and installation, as described in Section 7.8.2.1.2

7.8.2.3.3 Avoidance, Minimization, and Mitigation Measures

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 7.8.2.1.3.

7.9 Other Uses (Marine Minerals, Military Use, Aviation, Offshore Energy)

The Project Region hosts multiple uses and activities, including national security and military uses, cables and pipelines, aviation, marine mineral extraction, offshore energy projects, and radar systems. When developing new infrastructure, careful planning and consideration of other uses is required to minimize risk to these competing uses.

7.9.1 Description of the Affected Environment

The following sections describe other uses within the Project Region that may be affected by the Project. The Project Region is the geographic area that could be affected by Project-related activities, and consists of the communities in Barnstable County, Bristol County, Dukes County, Nantucket County in Massachusetts, and Newport County, Rhode Island. Collectively, this area is referred to as the "Project Region".

7.9.1.1 National Security

United States Navy

Newport, Rhode Island hosts Naval Station Newport, which is home to 50 Navy, Marine Corps, Coast Guard, and US Army Reserve commands and activities. Approximately 5,800 employees work at the various Naval Station commands, and an additional 17,000 students annually pass through one of the many schools on base. Naval Station Newport is home to the Navy Supply Corps School, the Center for Service Support, the US Marine Corps Aviation Logistics School, and the Navy's most prestigious educational institution, the Naval War College.

Naval Station Newport is also home to the Naval Undersea Warfare Center ("NUWC"), one of the corporate laboratories of the Naval Sea Systems Command. The NUWC is the Navy's research, development, test and evaluation, engineering, and fleet support center for submarines, autonomous underwater systems, and offensive and defensive weapons systems associated with undersea warfare.

The Navy maintains three range complexes located along the mid-Atlantic and northeastern seaboard of the US. A range complex is a designated set of specifically bounded geographic areas that encompass a water component (above and below the surface), airspace, and may encompass a land component and is where training and testing of military platforms, tactics, munitions, explosives, and electronic warfare systems occur. Range complexes include established Operating Areas ("OPAREAs") and special use airspace, which may be further divided to provide better control of the area and events being conducted for safety reasons.

Combined, these areas are the principal locations for some of Navy's major training and testing events and infrastructure. Three separate range complexes, the Boston Range Complex, the Narragansett Bay Range Complex, and the Atlantic City Range Complex, are collectively referred to as the Northeast Range Complex. These range complexes span 1,224 kilometers ("km") (761 mi) along the coast from Maine to New Jersey. The Northeast Range Complex includes special use airspace with associated warning areas and surface and subsurface sea space.

The Northeast Range Complex is further subdivided into three OPAREAs: Boston OPAREA, Narragansett Bay OPAREA, and Atlantic City OPAREA. The Wind Development Area ("WDA") is located within the Narragansett Bay OPAREA. This OPAREA is a surface and subsurface exercise/operating area, extending approximately 185 km (100 nautical miles ["nm"]) south and 407 km (220 nm) east of the coasts of Massachusetts, Rhode Island, and New York. OPAREA training exercises generally occur in deeper offshore waters, southeast of the WDA (SAMP, 2010; J. Casey, personal communication, November 30, 2017). Navy vessels may, however, remain in shallower portions of the Narragansett Bay OPAREA in preparation for formal voyages. (J. Casey, personal communication, November 30, 2017)

United States Coast Guard

The United States Coast Guard ("USCG") 1st District is headquartered in Boston, Massachusetts and is responsible for USCG activities in Northern New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, and Maine.

The 1st District maintains two "ashore" units in the vicinity of the WDA. Sector Southeastern New England, located in Woods Hole, Massachusetts and its affiliated USCG Stations throughout the Project Region cover over 777 square kilometers ("km^2") (3,000 square miles ["mi^2"] of offshore waters and 1,930 km (1,200 mi) of coastline in Rhode Island and southeastern Massachusetts, including Cape Cod and the Islands. Air Station Cape Cod, the USCG's only Coast Guard Aviation Facility in the northeast, is located at

Joint Base Cape Cod. Air Station Cape Cod provides search and rescue, maritime law enforcement, international ice patrol, aids to navigation support, and marine environmental protection. USCG Base Cape Cod, the single point for Deputy Commandant for Mission Support in support of USCG operations within the 1st Coast Guard District, is also located at Joint Base Cape Cod.

The 1st District also maintains three "afloat" units in the vicinity of the WDA: the USCG Cutter ("USCGC") Ida Lewis, a "Keeper" class coastal buoy tender, and USCGC Juniper and USCGC Oak, both "Juniper" class seagoing buoy tenders.

7.9.1.2 Aviation and Air Traffic

Various segments of airspace overlie the Project Region, including: US territorial airspace, different levels of controlled airspace, and special-use airspace.

Territorial airspace is the airspace over the US, its territories and possessions, and over US territorial waters out to 22 km (12 nm) from the coast. Limited areas of the WDA are located within territorial airspace. The WDA is also within the limits of the Air Defense Identification Zone, into which all international flights entering the US domestic airspace must provide the appropriate documentation.

Project-related activities may occur within three different controlled airspace classifications: Class E, East Coast Low Area, and the Atlantic Low Area. These classifications of airspace define the volumes of airspace within which air traffic control services are provided and often dictate different operating requirements that are imposed upon pilots, including weather, communication, and equipment minimums.

A portion of the WDA is also within Warning Area "W-105A," which is a block of airspace ranging from 0-15,240 meters ("m") (0-50,000 feet ["ft"]) Above Mean Sea Level ("AMSL"). Warning Area airspace, such as W-105A, is designated for aircraft operations of a nature such that limitations may be imposed on other aircraft not participating in those operations. The Department of Defense ("DoD") uses domestic and international airspace for readiness training and exercises. To make pilots aware of military operations, the Federal Aviation Administration ("FAA") designates sectors of airspace as warning areas and charts these areas on aeronautical charts with an identifying number. The Navy and, occasionally, other DoD organizations use the airspace over and adjacent to the WDA.

7.9.1.3 Offshore Energy

The Energy Policy Act of 2005, Public Law No. 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf Lands Act ("OCSLA"), which authorizes the Secretary of the Interior to issue leases, easements, or rights-of-way on the Outer Continental Shelf ("OCS") for the purpose of wind energy development. See 43 U.S.C. § 1337(p)(1)(C).

To that end, BOEM and its partners have identified the most appropriate areas for commercial wind energy leasing on the OCS off the Atlantic Coast. To date, BOEM has identified several Wind Energy Areas ("WEAs") on the OCS that are considered appropriate for commercial offshore wind energy development. The WEAs were selected after an exhaustive process with a goal of minimizing conflicts among existing uses and the environment. The Project is located in the Massachusetts WEA ("MA WEA"), in proximity to the Rhode Island/Massachusetts Wind Energy Area ("RI/MA WEA"). Vineyard Wind anticipates the development of additional offshore energy projects in lease areas within both the MA WEA and RI/MA WEA.

In conformance with Section 7(a) of the Project's Commercial Lease of Submerged Lands for Renewable Energy Development on the OCS, the Project does not propose activities that will unreasonably interfere with or endanger activities or operations carried out under any lease or grant issued or maintained pursuant to the OCSLA.

It should be noted that a marine hydrokinetic facility being evaluated for the Muskeget Channel has been discontinued and the project is no longer pursuing deployment of tidal energy turbines with the Muskeget Channel.

7.9.1.4 Sand and Marine Mineral Extraction

Sand resources on the OCS managed by BOEM provide, in certain situations, material to support costal resilience projects and plans designed with federal, state, and local partners. Chronic shoreline erosion and damage caused by coastal storms, and a growing awareness of the risks associated with sea level rise from climate change have increased the demand for sand suitable for beach and other nourishment efforts along the Atlantic coast. In order to help coastal communities recover from coastal storms and promote resilient coastal systems, BOEM funded offshore surveys in 2015, 2016, and 2017 to identify new sources of sand in federal waters. BOEM's geological and geophysical research program, the Atlantic Sand Assessment Project, identifies and assesses new potential sand.

There are no federal OCS sand and mineral lease areas within the Offshore Project Area. No significant sand resource blocks have been identified in the Offshore Project Area.

7.9.1.5 Cable and Pipelines

There are currently four submarine transmission cable systems located in Nantucket Sound that service Nantucket and Martha's Vineyard. These cables are identified on NOAA Raster Navigational Charts ("RNCs"). Service to Martha's Vineyard is provided by two cables interconnecting the Town of Falmouth, on Cape Cod, with Vineyard Haven and Tisbury through the easterly side of Vineyard Sound. Two cables also service Nantucket. Cables from Dennis Port and Hyannis Port interconnect through Nantucket Sound to a landfall at Jetties Beach. The Hyannis Port cable makes landfall at Kalmus Beach in Outer Lewis Bay. If the New Hampshire Avenue landing site is selected for the Offshore Export Cable

Corridor ("OECC"), a cable crossing will occur over an existing National Grid submarine power cable that connects the south shore of Cape Cod to Nantucket (see Section 4.2.3.3 of Volume I). The cable crossing will occur south of Dunbar Point outside of Lewis Bay as shown on Figure 4.2-2. The specifics of this crossing will be developed with National Grid as Project planning continues.

Other than the Project's offshore cable system, no publicly noticed plans for additional submarine cables in the Offshore Project Area have been made available.

No pipelines service Martha's Vineyard or Nantucket.

7.9.1.6 Radar Systems

Commercial air traffic control ("ATC") radar systems, national defense radar systems, and weather radar systems are operating in the Project Region. A number of commercial ATC radar systems are deployed to service the Project Region, as noted below. National defense radar systems operating within the Project Region include the Precision Acquisition Vehicle Entry/Phased Array Warning System ("PAVE/PAWS") installation at Joint Base Cape Cod. Additional details on that system are provided in Appendix III-I.

Weather radar systems operating in the Project Region include NEXRAD, which is also known as Next-Generation Radar. NEXRAD is a network of 160 high-resolution S-band Doppler weather radars operated by the National Weather Service ("NWS") in a joint effort with the US Departments of Commerce, Defense, and Transportation, the US Air Force Weather Agency, and the FAA. The primary function of the NEXRAD system is to supply data to meteorologists for weather forecasting purposes. A NEXRAD installation is located at the NWS's Taunton facility ("KBOX"), located approximately 97 km (60 mi) to the north of the WDA.

The FAA also operates a Terminal Doppler Weather Radar ("TDWR") installation at the Boston Logan International Airport. TDWR systems are used primarily for the detection of hazardous wind shear conditions, precipitation, and winds aloft on and near major airports situated in climates with great exposure to thunderstorms, such as Boston, Massachusetts. The TDWR system at Logan Airport is located approximately 145 km (90 mi) to the north of the WDA.

An initial review indicates that the following 10 radar sites are located within approximately 100 nautical miles (nm) of the Project:

- Boston Airport Surveillance Radar model-9 (ASR-9);
- Boston Terminal Doppler Weather Radar (TDWR);
- Cape Cod Air Force Station Early Warning Radar (EWR);

- Falmouth Airport Surveillance Radar model-8;
- Nantucket Airport Surveillance Radar (ASR-9);
- North Truro Air Route Surveillance Radar model-4 (ARSR-4);
- Providence ASR-9;
- Riverhead ARSR-4;
- Boston ("KBOX") WSR-88D; and
- Brookhaven WSR-88D.

These radar sites provide radar data to multiple DoD, Department of Homeland Security (DHS), FAA, and NOAA facilities for conducting air traffic control, air defense, ballistic missile defense, homeland security, space surveillance, and weather operations.

7.9.2 Potential Impacts of the Project

Table 7.9-1 Impact-producing Factors for Other Uses

Impact-producing Factors	Wind Development Area	Offshore Export Cable Corridor	Construction & Installation	Operations & Maintenance	Decommissioning
Vessel Traffic	X	X	X	X	X
WTGs/ESPs	X		X	X	X
Transporting WTGs	X		X		X
Cable Installation		X	X		
Marine Commerce Terminal/Port Facilities			X		X
Helicopters	X			X	

7.9.2.1 Construction and Installation

As described in Section 3.0 of Volume I, Project components will be installed in the offshore environment, including wind turbine generators ("WTGs"), up to two electrical service platforms ("ESPs"), and export, inter-array, and inter-link cables. The Project is located in the MA WEA, which was selected, in part, because it avoids and/or minimizes conflicts with the uses described in this section.

7.9.2.1.1 National Security

At various points during construction, large vessels with limited maneuverability will be delivering WTGs and associated equipment to one or more port facilities and to the WDA. At times, these vessels will be operating within restricted navigation channels or will be on-station while construction and installation activities are being conducted. These activities are not anticipated to affect national security or Navy interests. However, Vineyard Wind and the USCG will provide Offshore Wind Mariner Updates and Notices to Mariners that describe Project-related activities that may be of interest to national security interests, including Navy personnel operating within the Project Region.

Representatives from Vineyard Wind have been in contact with personnel at the Navy's Fleet Area Control and Surveillance Facility to discuss the Project's parameters and to solicit input on potential impacts to Navy operations in the Project Region. No concerns with the Project have been identified. Vineyard Wind will continue to provide relevant Project updates to the Navy throughout the life of the Project.

Vineyard Wind has been working cooperatively with USCG personnel to address any navigation, operations, or other concerns with Project-related activities. Vineyard Wind will continue to coordinate Project activities with the USGC.

7.9.2.1.2 Aviation and Air Traffic

The following sections address the potential airspace impacts associated with the onshore construction staging areas and the vessel routes. DoD warning areas are also discussed. Proposed marking and lighting of the turbines is discussed in Section 3.1.1 of Volume I. Appendix III-J contains an aviation impact analysis of the WDA.

At various points during construction, three areas will contain turbines, cranes, and equipment that may have an effect on flight operations. These areas are: 1) the onshore construction staging areas; 2) vessel routes used to transport equipment and turbines from the Onshore Project Area to the Offshore Project Area; and 3) the Offshore Project Area that will be the final, constructed location of the turbines.

The FAA has jurisdiction to review "structures interfering with air commerce," 49 U.S.C. § 44718, within US territorial waters which extend 22 km (12 nm) offshore. It is anticipated that eight turbines will be located within US territorial waters and are therefore subject to FAA jurisdiction. FAA also has jurisdiction to review certain structures used at construction staging areas and transported on vessels within territorial waters.

Under FAA's regulations anyone who proposes building certain structures, including those more than 61 m (200 ft) tall, must notify FAA. FAA then evaluates the proposed structure to determine if it would constitute an obstruction to air navigation that may affect the safe and efficient use of navigable airspace or the operation of planned or existing air navigation and

communication facilities. Whether a proposed structure is an "obstruction" is determined by the structure's height and location. If FAA concludes the proposed structure would be an obstruction or would have a substantial adverse physical or electromagnetic effect on the operation of air navigation facilities, or if FAA otherwise determines it necessary, FAA will conduct an aeronautical study to decide the extent of any adverse impact on the safe and efficient use of the airspace, facilities, or equipment.

With partially and fully constructed turbine heights in excess of 110 m (361 ft) Above Mean Sea Level (AMSL) onshore, en route to the WDA, and within the WDA, it may be necessary for FAA to conduct aeronautical studies of turbines and equipment located within territorial waters that meet the obstruction criteria.

Onshore Project Area

For each port being evaluated for use by the Project, it is anticipated that WTG components can be delivered from ship to shore, and stored in laydown areas without impacting aviation operations in the area. Ports being considered for delivery and storage of project components, therefore, would have no additional impacts to aviation should they be selected for use by Vineyard Wind.

Construction staging areas, including pre-assembly of turbine components, may be located at the New Bedford Terminal or other nearby facilities, located approximately 93 km (50 nm) northwest of the Offshore Project Area. The New Bedford Terminal is a multi-purpose facility designed to support the construction, assembly, and deployment of offshore wind projects and is ideally located for the erection of tall structures from an aviation standpoint. It is located approximately 6 km (3.75 mi) from the nearest airport, New Bedford Regional Airport ("EWB").

Incoming and outgoing ships with Project components and partial turbine assemblies may use this location. During the construction and installation phase of the Project, onshore cranes will be utilized for tower assembly and loading and unloading ships. Many of the ports under consideration for construction and installation, or related activities, already have cranes and other equipment necessary to handle WTG components

With a temporary height of 100 m (328 ft) above ground level ("AGL"), the turbine towers while at the construction staging area may exceed the 61 m (200 ft) AGL and therefore may require notice to the FAA. Cranes used in both the assembly process and the unloading and loading of Project components on vessels have an assumed height of 130 m (427 ft) AGL and may similarly require notice to FAA. Vineyard Wind expects to coordinate with FAA on defining the boundary of the assembly area. FAA Form 7460-1 Notice of Proposed Construction or Alteration would be submitted via the FAA's Obstruction Evaluation/Airport Airspace Analysis online portal (2017a).

Vineyard Wind conducted a preliminary analysis of the potential for impact of the onshore assembly site on visual flight rules ("VFR") operations and instrument flight rules ("IFR") procedures. FAA uses level and sloping imagery surfaces to determine if a proposed structure is an obstruction to navigation. With a site elevation of roughly 3 m (9 ft) AMSL, the top of the construction cranes could be as high as 133 m (437 ft) AMSL. At this height, structures will exceed public-use airport imaginary surfaces defined in 14 C.F.R. Part §77. As a result, structures of this height are likely to be subject to marking and lighting in accordance with FAA Advisory Circular 70/7460-1L.

At 133 m (437 ft) AMSL, cranes will exceed EWB's VFR traffic pattern airspace. However, considering the temporary nature of the construction staging area and existing obstacles adjacent to the site, it is likely that the FAA would accommodate this impact.

The lowest IFR height constraints overlying the Onshore Project Area range from 167 m (548 ft) to in excess of 183 m (600 ft) AMSL and are associated with minimum vectoring altitudes and instrument departure procedures. Given that these heights are greater than the heights of the cranes and onshore equipment, it is unlikely that the FAA would have concerns about their use.

Offshore Project Area

As previously stated, the Federal Aviation Administration (FAA) has jurisdiction to review "structures interfering with air commerce," per 49 U.S.C. § 44718, within US territorial waters which extend 12 nautical miles offshore. It is assumed that eight turbines will be located within US territorial waters and are therefore subject to FAA jurisdiction. However, BOEM is confirming whether this assumption is correct. FAA does have jurisdiction to review the structures used at the onshore staging area and structures transported on vessels within the territorial waters.

Wind turbines within territorial waters must be submitted to the FAA for evaluation. With expected tip heights to be up to 255 meters (837 feet), the proposed wind turbines will be considered obstructions under 14 CFR Part 77.17(a)(1) because they exceed a height of 499 feet at the site of the structure; therefore, aeronautical studies will be conducted. However, heights in excess of this surface are feasible provided the proposed wind turbines do not exceed FAA obstacle clearance surfaces requiring procedural changes that would affect a significant volume of operations.

At 255 meters (837 feet), the WTGs could necessitate changes to minimum vectoring altitudes ("MVAs") and other obstacle clearance surfaces for some airports in the region. However, because more than 90 percent of existing air traffic over the WDA occurred at altitudes that would not be impacted by the presence of WTGs (i.e., between 1,500 and 5,000 feet AMSL), it is unlikely that any potential impacts would affect a significant volume of flight operations (see Appendix III-J). This is supported by FAA's Determinations of No

Hazard for the Project's WTGs within US territorial waters (for tip heights of 212 m [696 ft] AMSL), which state that, "Increasing the MVAs in the area of the turbines will not impact a significant number of operations."

Following detailed aeronautical studies for the WTGs within territorial waters with tip heights of 212 m (696 ft), the FAA ultimately concluded that:

> "This aeronautical study considered and analyzed the impact on existing and proposed arrival, departure, and en route procedures for aircraft operating under both visual flight rules and instrument flight rules; the impact on all existing and planned public-use airports, military airports and aeronautical facilities; and the cumulative impact resulting from the studied structure when combined with the impact of other existing or proposed structures. The study disclosed that the described structure would have no substantial adverse effect on air navigation."

Vineyard Wind will re-file applications with the FAA for those WTGs within US territorial waters with a maximum height of 255 m (837 ft); it is expected that FAA will reach similar conclusions for WTGs up to 255 m tall and that the Project will again receive Determinations of No Hazard.

Appendix III-J contains a comprehensive aviation impact analysis of the WDA. The purpose for this analysis was to identify aviation impacts resulting from the construction of wind turbines with tip heights of up to 255 meters (837 feet) above Mean Lower Low Water (MLLW) within the Lease Area.

The Preliminary Screening Tool ("PST") on the FAA Obstruction Evaluation/Airport Airspace Analysis website provides a cursory indication whether wind turbines may be visible, that is, within radar line-of-sight to one or more radar sites, and likely to affect radar performance.[31] The PST Long Range Radar ("LRR") analysis accounts for Air Route Surveillance Radar sites and a few select Airport Surveillance Radar sites used for air defense and homeland security.[32] The PST Long Range Radar analysis does not account for all DoD, DHS, and/or FAA radar sites including early warning radar sites. Further, the PST NEXRAD analysis accounts for WSR-88D radar sites but does not account for FAA Terminal Doppler Weather Radar (TDWR) radar sites.[33]

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[31] See http://oeaaa.faa.gov.

[32] For LRR, the PST uses a buffered radar line-of-sight analysis at a blade-tip height of 750 feet Above Ground Level (AGL).

[33] For NEXRAD, the PST uses a blade-tip height of 160 meters (525 feet) AGL. It should be noted that the PST NEXRAD analysis does not reflect the wind farm impact zone scheme updated in 2018 by the National Oceanic and Atmospheric Administration (NOAA) WSR-88D Radar Operations Center (ROC). The updated scheme expands the red area, or "No Build Zone," from three to four kilometers (km) and to areas where wind turbines penetrate the third elevation angle scanned by a WSR-88D.

The PST is helpful for identifying potential impacts to Long Range Radar and NEXRAD; however, the results are preliminary, as suggested by the title of the PST, and do not provide an official decision as to whether impacts are acceptable to operations.

The PST Long Range Radar results show four air traffic control, air defense, and homeland security radar sites within approximately 40 nm of the Project (the four sites are the Falmouth Airport Surveillance Radar model-8 [ASR-8], Nantucket Airport Surveillance Radar model-9 [ASR-9], North Truro Air Route Surveillance Radar model-4 (ARSR-4), and Providence ASR-9). The PST analysis results for Long Range Radar show that the Project falls within red and yellow areas for the Nantucket ASR-9 and a yellow area for the Falmouth ASR-8 (Figure 7.9-1). Red indicates that impacts are highly likely, as indicated by a 20 nm area around all Long Range Radar sites, and yellow indicates that impacts are likely. While the PST indicates that impacts may occur to two of the four radar sites, based on the fact that there are multiple radar sites within approximately 100 nm of the Project, overlapping coverage in addition to existing efforts by the operator(s) to optimize radar systems are expected to mitigate any potential effects of the Project.

In addition to the results from the PST, a basic radar line-of-sight ("RLOS") analysis was conducted for five radar sites (three of which were also considered in the PST):

- Cape Cod AFS EWR;
- Falmouth ASR-8;
- Nantucket ASR-9;
- North Truro ARSR-4; and
- Riverhead ARSR-4.

Similar to the PST, the RLOS analyses identified that the Project's WTGs with a blade tip height of 255 m (837 ft) AGL would be visible to and may affect the Falmouth ASR-8 and Nantucket ASR-9 radar sites. As noted previously for these two sites, based on the fact that there are multiple radar sites within approximately 100 nm (185 km) of the Project, overlapping coverage in addition to existing efforts by the operator(s) to optimize radar systems are expected to mitigate any potential effects of the Project. The RLOS analyses also identified that the Project's WTGs would be visible to and could impact the Cape Cod AFS EWR.

The Project previously received Determinations of No Hazard from the FAA for those WTGs within US territorial waters with a maximum height of 212 m (696 ft). FAA's Determinations of No Hazard found that although the studied WTGs would be within the line of sight of Nantucket ASR-9 and Falmouth ASR-8, after further study, "it was determined that this would not have a substantial adverse effect to operations at this time." The Project will re-file applications with the FAA for those WTGs within US territorial

waters, with a maximum height of 255 m (837 ft), and it is expected that the Project will again receive Determinations of No Hazard after further review by the FAA. The adjacent Bay State Wind project received Determinations of No Hazard for WTGs up to 320 m (1,049 ft). The DoD will comment through the FAA review process.

The RLOS analyses identified that the Project's WTGs will not be visible to or interfere with the North Truro ARSR-4 and Riverhead ARSR-4 radar sites. Finally, the Project Area is beyond the instrumented range of the Boston ASR-9, Boston TDWR, and the Providence ASR-9 radar sites. As such, no impacts are expected. For NEXRAD, the PST analysis results show that the Project falls within a green area, or "No Impact Zone", which indicates that impacts are not likely to WSR-88D operations (Figure 7.9-1). Specifically, no impacts to the Boston WRSR-88D or Brookhaven WSR-88D radar systems are expected.

Marine Vessel Transportation of Project Components

The transport of Project components into and out of the New Bedford Terminal and to the Offshore Project Area is an essential element of the Project. The height of a loaded vessel could range from 50-110 m (164-361 ft) MLLW.

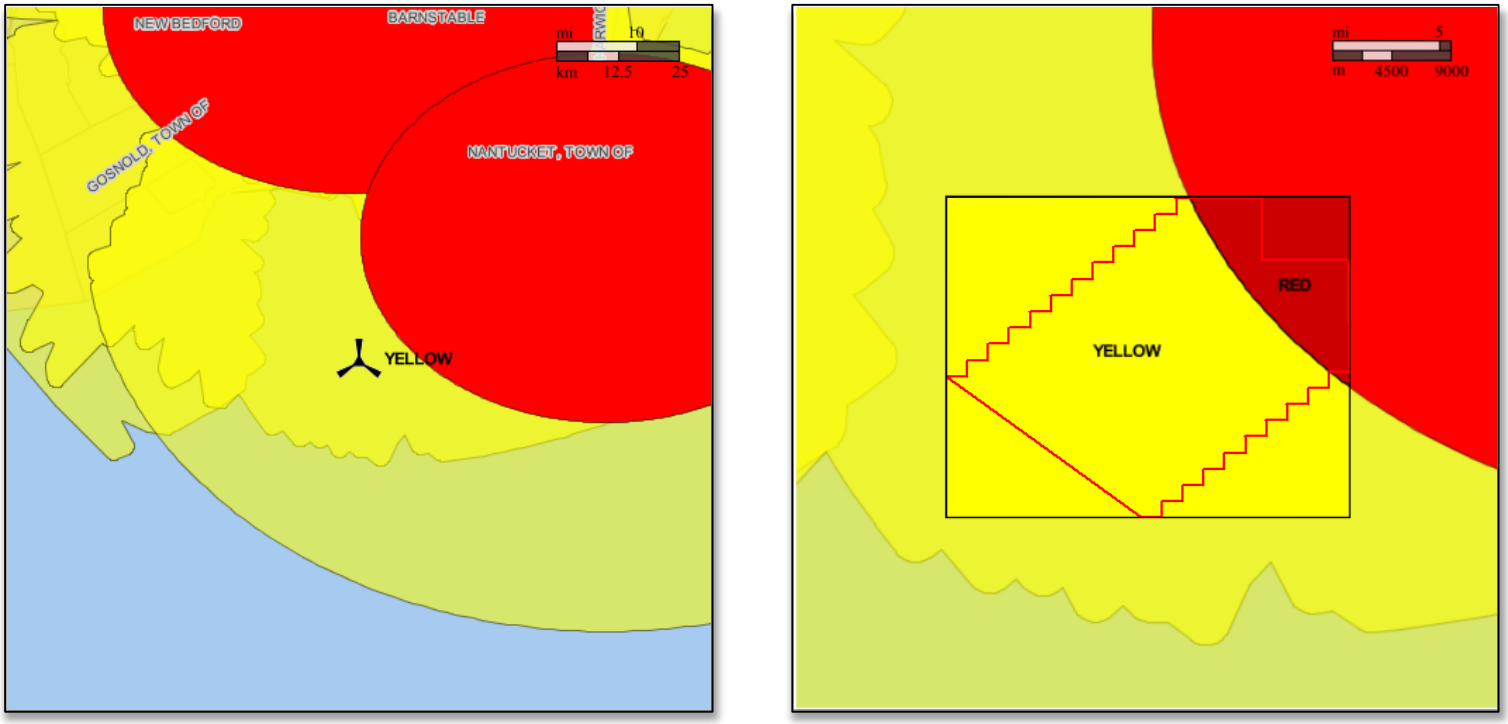
Airports and heliports located along the shore in the vicinity of the vessel routes could be affected by vessels carrying turbine towers. However, an initial airspace analysis indicates that no impacts would occur.

Through coordination with FAA, certain actions may be necessary to protect air traffic operations on a temporary basis during vessel operations. These actions could include the publication of Notices to Airmen for each vessel movement above a specified height and Temporary Flight Restriction which would restrict specific low altitude aircraft movements. Temporary low/medium intensity obstruction lighting may also be required on the highest point of the structure during transit.

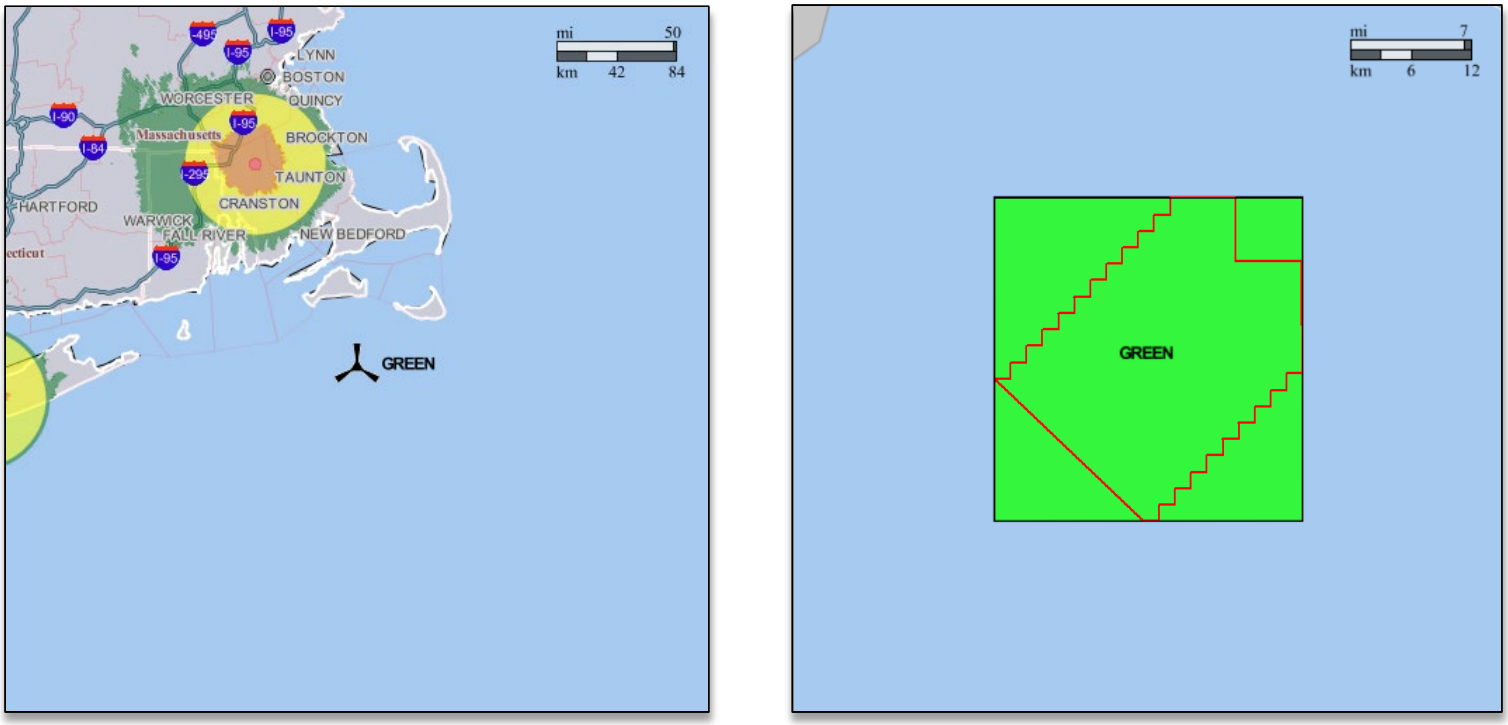
Department of Defense Warning Areas

DoD uses domestic and international airspace for readiness training and exercises. To make pilots aware of military operations, the FAA designates sectors of airspace as warning areas and charts these areas on aeronautical charts with an identifying number. The Navy and, occasionally, other DoD organizations use the airspace over and adjacent to the WDA. As noted above, this airspace has been designated as W-105A (Appendix III-J, Figure 4).

The scheduling of W-105A is managed by Fleet Area Control and Surveillance Facility, Virginia Capes, (an organizational element of the Navy located in Virginia Beach, VA). The vertical limits of W-105A begin at the surface of the water and extend to 15,240 m (50,000 ft) AMSL. Publicly available information for this warning area indicates that it is used for flight testing by the Navy. Adjacent sections of W-105A are used for surface-to-air gunnery exercises using conventional ordnance and antisubmarine warfare exercises.



Long Range Radar Results
Left panel: zoomed out view of a single point within the WDA
Right panel: zoomed in view of the WDA



NEXRAD Results
Left panel: zoomed out view of a single point within the WDA
Right panel: zoomed in view of the WDA

This warning area was identified in BOEM's Revised Environmental Assessment for the Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts (BOEM, 2014), and BOEM has coordinated with DoD on its final MA WEA. In addition, Vineyard Wind has consulted with the Navy and has been informed that the Project does not raise concerns for the Navy.

7.9.2.1.3 Offshore Energy

In conformance with the Section 7(a) of the Project's Commercial Lease of Submerged Lands for Renewable Energy Development on the OCS, the Project does not propose activities that will unreasonably interfere with or endanger activities or operations carried out under any lease or grant issued or maintained pursuant to the OCSLA.

7.9.2.1.4 Sand and Mineral Extraction

As described in Section 7.9.1.4, there are no federal OCS sand and mineral lease areas or identified significant sand resource blocks within the Offshore Project Area. Further, it is not anticipated that any sand or mineral extraction would occur within the areas designated by BOEM for offshore wind energy use (i.e., the MA WEA or RI/MA WEA).

The Project's construction and installation activities are not anticipated to affect sand and mineral extraction that may occur within the Project Region, other than potential, temporary vessel restrictions in areas of active offshore cable installation.

7.9.2.1.5 Cable and Pipeline

A submarine power cable owned by National Grid that services the Island of Nantucket, will be crossed if New Hampshire Ave Landfall Site is chosen for installation. Standard techniques for adequately protecting both the National Grid cable and the newly installed offshore export cable are well established, and those techniques will be followed. The specifics of this crossing will be developed with National Grid as Project planning continues.

7.9.2.1.6 Radar Systems

Impacts to radar systems used in aviation are described in Section 7.9.2.1.6. For NEXRAD radar systems, experience with WTGs located in NEXRAD line of sight has shown that WTGs can impact radar reflectivity, internal algorithms that generate alerts and derive weather products, and other attributes. The severity of impacts, in general, is related to the separation distance between the WTGs and the NEXRAD facility. Impacts increase as distance decreases, especially for WTGs located within 17.7 km (11 mi) of the NEXRAD facility (Vogt et al, n.d.).

Because the closest NEXRAD facility to the WDA is approximately 97 km (60 mi), there are no anticipated impacts associated with the WTGs that would require the implementation of mitigation measures. Partially assembled WTG components at the New Bedford Terminal or transiting to the WDA are similarly not anticipated to affect the NEXRAD system.

Two screening tools are available for NEXRAD. As described in Section 7.9.2.1.6, the PST analysis for NEXRAD shows that the Project falls within a green area, or "No Impact Zone," which indicates that impacts are not likely to WSR-88D operations (Figure 7.9-1).

Additionally, as part of the US Department of Energy's ("DOE") effort to address and remove siting barriers for wind energy developments, Sandia National Laboratories has partnered with the NOAA to develop a GIS-based NEXRAD screening tool that identifies potential impacts from WTG siting locations. The screening tool did not identify impacts to NEXRAD systems based on the parameters[34] supplied to the screening tool.

7.9.2.1.7 Avoidance, Minimization, and Mitigation Measures

Vineyard Wind will implement best management practices when practicable and develop a comprehensive communications plan to keep the relevant parties informed throughout the construction and installation phase of the Project. Additional analysis of Project components and activities by BOEM and the FAA (as applicable) may identify specific avoidance, minimization, and/or mitigation measures.

7.9.2.2 Operations and Maintenance

Upon completion of construction, impacts associated with operations and maintenance of the Project are not anticipated to have adverse effects on the uses contemplated in this section.

7.9.2.2.1 National Security

Project-related vessel traffic during the operations and maintenance phase of the Project is not anticipated to cause impacts to national security interest operating in the Project Region. Facilities in the WDA will be monitored and controlled remotely from the Project's Operations and Maintenance Facilities ("O&M Facilities"). During planned and unplanned maintenance events a crew would be dispatched to the identified location to complete repairs and restore normal operations. Typically, such maintenance events involve the use of a crew transport vessel, which should have little impact on commercial fishing or other activities in or near the WDA.

[34] The tool allows a maximum blade tip height of 200 m, which shows that the Project Area is considerably outside all mapped areas where impacts may occur.

7.9.2.2.2 Aviation and Air Traffic

During the operations and maintenance phase, it is not anticipated that components exceeding 61 m (200 ft) AGL will either be assembled at a port facility used by the Project, or delivered to and from the WDA.

As described in Section 7.9.2.1.2, because more than 90 percent of existing air traffic over the WDA occurred at altitudes that would not be impacted by the presence of WTGs (i.e., between 1,500 and 5,000 feet AMSL), it is unlikely that any potential impacts would affect a significant volume of flight operations.

Inspection and monitoring of the WDA may be conducted by helicopters, as needed (see Section 3.2.6 of Volume I). The helicopter(s) used to support operations and maintenance activities would ideally be based at a general aviation airport in reasonable proximity to the O&M Facilities. Any such flights will adhere to FAA and other requirements and are not anticipated to affect aviation and air traffic in the Project Region.

7.9.2.2.3 Offshore Energy

In conformance with the Section 7(a) of the Project's Commercial Lease of Submerged Lands for Renewable Energy Development on the OCS, the Project does not propose activities that will unreasonably interfere with or endanger activities or operations carried out under any lease or grant issued or maintained pursuant to the OCSLA.

7.9.2.2.4 Sand and Mineral Extraction

Operation and maintenance of the Project are not anticipated to impact any proposed future sand and mineral extraction.

7.9.2.2.5 Cable and Pipeline

Should the OECC cross the existing National Grid cable in Nantucket Bay, operations and maintenance activities may be required at, or near that crossing. In the unlikely event that maintenance activities are necessary at the cable crossing, industry standard techniques for adequately protecting both the National Grid cable and the offshore cable system will be implemented.

7.9.2.2.6 Radar Systems

As noted in Section 7.9.2.1.6, the closest NEXRAD facility to the WDA is approximately 97 km (60 mi). At that distance there are no anticipated impacts associated with the WTGs that would require the implementation of mitigation measures. For other radar systems described in Section 7.9.2.1.2, overlapping coverage in addition to radar optimization are expected to mitigate any potential effects of the Project.

7.9.2.2.7 Avoidance, Minimization, and Mitigation Measures

Vineyard Wind will implement best management practices when practicable and develop a comprehensive communications plan to keep the relevant parties informed throughout the operations and maintenance phase of the Project.

7.9.2.3 Decommissioning

As currently envisioned, decommissioning the Project is largely the reverse of the construction and installation process as described in Volume I.

7.9.2.3.1 National Security

No aspects of the Project are anticipated to affect national security, including USCG or Navy interests. Vineyard Wind will continue to work cooperatively with USCG and Navy personnel to address any navigation, operations, or other concerns with decommissioning activities.

7.9.2.3.2 Aviation and Air Traffic

Impacts to aviation and air traffic during the decommissioning phase are anticipated to be similar to those described in Section 7.9.2.1.2.

7.9.2.3.3 Offshore Energy

In conformance with the Section 7(a) of the Project's Commercial Lease of Submerged Lands for Renewable Energy Development on the OCS, the Project does not propose activities that will unreasonably interfere with or endanger activities or operations carried out under any lease or grant issued or maintained pursuant to the OCSLA

7.9.2.3.4 Sand and Mineral Extraction

Impacts to sand and mineral extraction during the decommissioning phase are anticipated to be similar to those described in Section 7.9.2.1.4.

7.9.2.3.5 Cable and Pipeline

Impacts to cable and pipeline during the decommissioning phase are anticipated to be similar to those described in Section 7.9.2.1.5. If additional cables and/or pipelines are installed prior to the decommissioning phase, industry standard techniques for adequately protecting cable and/or pipeline systems will be implemented.

7.9.2.3.6 Radar Systems

Impacts to radar systems during the decommissioning phase are anticipated to be similar to those described in Section 7.9.2.1.6.

7.9.2.3.7 Avoidance, Minimization, and Mitigation Measures

Impacts and avoidance, minimization, and mitigation measures associated with decommissioning are similar to those described in Section 7.9.2.1.