SECTION A: CONTENTS OF APPLICATION

A1. PROJECT OVERVIEW

The proposed Wind Park will consist of 130 Wind Turbine Generators (WTGs) located at the applicant's proposed location on Horseshoe Shoal in Nantucket Sound, Massachusetts (See Attachment A-1). The WTGs will be arranged to maximize the Wind Park's energy generating capacity in order to achieve a maximum potential electric output of approximately 454 MW of renewable power. The wind-generated electricity from each of the turbines will be transmitted via a 33 kilovolt (kV) submarine transmission cable system to the Electric Service Platform (ESP) centrally located within the WTG array. The ESP will then transform and transmit this electric power to the Cape Cod mainland via two 115 kV alternating current (AC) submarine cable circuits. These submarine cable systems will make landfall in the Town of Yarmouth (Lewis Bay). From this landfall, an upland transmission system will be installed in an underground conduit system within existing roadways and rights-of-way (ROW) where it will intersect with the existing NSTAR Electric ROW near Willow Street in Yarmouth. The upland transmission line will continue within the ROW to the Barnstable Switching Station. The Project's interconnection with the existing NSTAR electric transmission line will allow wind-generated energy from the WTGs to be transmitted and distributed to users connected to the New England transmission system, including users on Cape Cod and the Islands. These areas in their entirety constitute the Project area.

The Project has been designed with sufficient spacing between WTGs (a minimum of 0.34 nautical mile (629 meters) x 0.56 nautical mile (1,000 meters) grid) so that the construction and operation of the proposed Project will not preclude or prohibit traditional uses of the water-sheet area within or around the Wind Park turbine array. Use of the water sheet area within the turbine array would include the continuation of general commercial and recreational navigation, commercial and recreational aviation, commercial and recreational fishing, and other traditional water-based activities that promote the use and enjoyment of this area of Nantucket Sound.

The proposed project would provide a utility-scale renewable power source[1] that would make a significant contribution towards meeting the Independent System Operator – New England (ISO-NE) system energy needs, and, contribute towards the renewable energy technology requirements of state and Federal mandates and goals by interconnection with the New England transmission and distribution system.

The proposed project would help to address the need for new renewable energy supplies in Massachusetts and New England to advance achievement of the Massachusetts Renewable Portfolio Standard (RPS); improve fuel source diversity of the power supply in Massachusetts; provide a new source of competitive market power to the New England region consistent with the goals of the Electric Industry Restructuring Act of 1997; and, help to buffer increases in retail energy costs to consumers resulting from existing and future fossil fuel price volatility. In its May 10, 2005 Final Decision, the Energy Facilities Siting Board stated "the power from the wind farm is needed on reliability and economic grounds, and to meet the requirements of Massachusetts and regional renewable portfolio standards" (EFSB, 2005).

Additionally, the Department of Energy (DOE) has identified the need for additional sources of energy to offset New England's dependence on natural gas. DOE is concerned that the increased demand for

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[1] Based on a review of historical ISO-NE data on proposed / planned interconnection and long term firm point-to-point transmission service requests to ISO-NE, the energy generating capacity of new utility-scale and regionally significant energy facility projects that have been permitted or are presently being studied for interconnection with the regional power grid have generating capacities that range between 200 and 1,500 MW.

natural gas will exceed its supply, leading to shortages and higher energy prices. The reliability of transporting natural gas by pipeline to generating facilities during winter peak periods has become a concern due to the inadequate capacity of the pipeline structure serving New England. The pipeline system that was originally designed to supply industrial and heating uses, now supplies 41% of New England's electricity needs. Declining natural gas reserves in North America, coupled with infrastructure investments needed in the delivery system, will increase the price of electricity. Canada, a ready source of natural gas in the past, is experiencing their own demand growth for natural gas and may not be able to reliably and cost effectively supply the United States with natural gas (An Energy Market Assessment, 2004). Wind power could be an additional energy source that would reduce the area's dependence on natural gas, thereby increasing energy reliability and lowering its price.

Please refer to Attachment A-2 for the estimated project Schedule.

A2. PROJECT LOCATION

The proposed location of the Wind Park will be located on Horseshoe Shoal in Nantucket Sound. The northernmost WTGs will be approximately 3.8 miles from the recently mapped dry rock feature (offshore near Bishop and Clerks) and approximately 5.2 miles from Point Gammon on the mainland; the southeastern portion of the Wind Park will be approximately 11 miles from Nantucket Island (Great Point), and the westernmost WTGs will be approximately 5.5 miles from the island of Martha's Vineyard (Cape Poge). For Project coordinates, please refer to Attachment A-3, Cape Wind Leasehold Application. Please refer to Attachment A-1 for Project Figures.

The proposed Project leasehold area as presented in the Cape Wind Leasehold Application submitted to MMS on 9/14/05, includes an expanded border around the perimeter of the Project Area in order to insure that a sufficient buffer exists between the Cape Wind Project Area, and any other subsequent leases by MMS that could impact the ability of the Cape Wind Project to produce power at the anticipated level. Cape Wind has voluntarily proposed to lease the additional area in order to preclude the lease and/or construction of any structures directly adjacent to the Project Area which could impact the wind or impede the current use of the watersheet area.

The Cape Wind Project Area is defined as shown in Attachment A-1. The Project area is described as a 100 foot offset virtual line drawn around the perimeter turbine locations encompassing an area of approximately 25 square miles. This is the area considered to encompass the wind turbine "array", the "Project Area", or "within the wind park".

The proposed submarine cable system route is approximately 12.5 miles in length (7.6 miles within the Massachusetts 3-mile territorial line) from the ESP to the landfall location in Yarmouth. The submarine transmission lines would travel north to northeast in Nantucket Sound into Lewis Bay past the westerly side of Egg Island, and then make landfall at New Hampshire Avenue. The submarine transmission lines would transition to the upland transmission line by using horizontal directional drilling (HDD) methodologies to a transition vault situated at the end of New Hampshire Avenue.

Upon making landfall, the proposed transmission line route would then follow New Hampshire Avenue north, merging with Berry Avenue. The route continues north on Berry Avenue, crossing Route 28 and continuing north on Higgins Crowell Road to Willow Street. Continuing north on Willow Street, the route passes under Route 6, to the proposed intersection point with the existing NSTAR Electric 115 kV transmission line ROW, approximately 500 feet north of Summer Street. The route then turns westerly within the NSTAR Electric's existing ROW to the Barnstable Switching Station, crossing under Route 6. The proposed upland transmission line would be located entirely within existing public roadways for a length of approximately 4.0 miles from landfall to the NSTAR Electric transmission line ROW located on the west side of Willow Street. The upland transmission line would then proceed underground approximately 1.9 miles along the existing NSTAR Electric ROW to the Barnstable Switching Station.

A3. DESCRIPTION OF PROJECT COMPONENTS

A3.1 Wind Turbine Generators (WTGs)

The Project will utilize pitch-regulated upwind WTGs with active yaw and a three-blade rotor. The main components of the WTG are the rotor, the transmission system, the generator, the yaw system, and the control and electrical systems, which are located within the WTGs nacelle. The WTGs nacelle will be mounted on a manufactured steel tower supported by a monopile foundation system. At the base of the tower, a pre-fabricated access platform and service vessel landing (approximately 32 feet from mean lower low water (MLLW)) will be provided. The steel tower and nacelle will be mounted on a welded steel monopile foundation.

- **Nacelle -** The nacelle is the portion of the WTG that encompasses the drive train and supporting electromotive generating systems that produce the wind-generated energy.
- **Rotor -** The WTG rotor has three blades manufactured from fiberglass-reinforced epoxy, mounted on the hub.
- **Tower -** A manufactured tubular conical steel tower with triple paint system supports the WTG nacelle.
- **Monopile** - The monopiles that will be located within the Project Area will utilize two different diameter foundation types depending on water depth. Water depths between 0-40 feet will utilize a 16.75 foot diameter monopile and water depths between 40-50 feet will utilize a 18.0 foot diameter monopile.

A3.2 Electrical Service Platform (ESP)

An ESP will be required to be installed and maintained within the approximate center of the WTG array. The ESP will serve as the common interconnection point for all of the WTGs within the array. Each WTG will interconnect with the ESP via a 33 kV submarine cable system. These cable systems will interconnect with circuit breakers and transformers located on the ESP in order to transmit wind-generated power through the 115 kV shore-connected submarine cable system. The two 115 kV submarine circuits will then ultimately connect to the existing land-based NSTAR Electric transmission system on Cape Cod.

The ESP will provide electrical protection and inner-array cable sectionalizing capability in the form of circuit breakers. It will also include voltage step-up transformers to step the 33 kV inner-array transmission voltage up to the 115 kV voltage level for the submarine cable connection to the land-based system. The service platform will also function as a helipad and as a maintenance area during periods of servicing the Wind Park equipment.

The ESP will be a fixed template type platform consisting of a jacket frame with six 42-inch driven piles to anchor the platform to the ocean floor (See Attachment A-1). The platform will consist of a steel superstructure of approximately 100 feet by 200 feet. The platform will be placed approximately 39 feet above the MLLW datum plane in 28 feet of water.

A3.3 Inner-Array Cables

Each of the 130 WTGs within the Wind Park will generate electricity independently of each other. Within the nacelle of each turbine, a wind-driven generator will produce low voltage electricity, which will be "stepped up" by an adjacent transformer to produce the 33 kV electric transmission capacity of the WTG. Solid dielectric submarine cables from each WTG will interconnect within the grid and terminate at their spread junctions on the ESP.

The submarine cable system interconnecting the WTGs with the ESP will be of solid dielectric AC construction, using a three-conductor cable with all phases under a common jacket. The cables will be arranged in strings, each of which will connect up to approximately 10 WTGs to a 33 kV circuit breaker on the ESP. There will be a total of approximately 66.7 miles of inner-array cabling throughout the wind park.

The conductor cross sections are 3x150 mm^2, 3x400 mm^2, and 3x600 mm^2 and the overall diameter of the cable is 132 mm, 146 mm, and 164 mm respectively.

A3.4 Description of the Proposed Transmission Facilities

From the centrally located ESP within the Wind Park, the wind-generated energy from each of the WTGs will be transformed to the voltage of 115 kV. Two solid dielectric 115 kV AC submarine transmission circuits will bring the electric energy from the ESP to the mainland, a distance of approximately 12.5 miles. These submarine transmission lines will make landfall at the proposed location at the end of New Hampshire Avenue in the Town of Yarmouth. From this landfall, an upland 115 kV transmission line will be installed in an underground conduit system within existing roadways for approximately 4.0 miles until it intersects the existing NSTAR Electric transmission line ROW at Willow Street in Yarmouth. From that point, the upland transmission line will proceed west and then south in an underground conduit system approximately 1.9 miles along the existing NSTAR Electric ROW to the Barnstable Switching Station. The interconnection with the existing NSTAR Electric transmission system will allow wind-generated renewable energy from the WTGs to be distributed to consumers connected to the New England transmission grid, including consumers on Cape Cod and the Islands of Martha's Vineyard and Nantucket.

- **Submarine 115 kV Transmission Cable System** - Each circuit consists of two (2) three-conductor cables, resulting in a total of four (4) cables. The four, three-conductor cables offer several other advantages including integral fiber optic cables and increased reliability in the case of an internal fault in one cable, where more than 75% of the total power available could still be delivered while the faulted cable is awaiting repair. The four submarine transmission cables will be installed as two circuits by bundling two cables per circuit together during installation and installing the two circuits. The conductor cross section is 3x800 mm^2 and the overall diameter of the cable is 197 mm.
- **Upland 115 kV Transmission Cable System** - The proposed upland cables will be jointed to the submarine cables at the landfall in Yarmouth. The upland transmission line system will utilize 12 single-conductor 115 kV cables. The 12 cables will be segregated into two circuits, each composed of two cables per phase. The cables will run in a concrete encased ductbank. The conductor cross section will be 800 mm^2.

  The upland transmission line will enter the NSTAR Electric ROW and make the physical connection to the Barnstable Switching Station by continuing with two new underground transmission lines in the existing NSTAR Electric ROW approximately 1.9 miles in length and running from the point where the new upland transmission line intersects the existing ROW in Yarmouth to the Barnstable Switching Station. The two transmission lines together would be comprised of 12 (2 circuits x 2 conductor/phase x 3 phases) cables 800 mm^2 in a cross sectional area. A third bay would be added at the Barnstable Switching Station to allow for the installation of three new circuit breakers and two banks of shunt reactors.

- **Ancillary Structures** The duct system will consist of a single ductbank system with a total of sixteen (16) 6-inch PVC ducts encased within a concrete envelope. The ductbank will be constructed within a trench beneath existing roadway corridors along the majority of the route. Twelve (12) of the 16 ducts will be occupied with the upland transmission lines, two ducts will contain fiber optic lines for protective relaying and communications, and two vacant ducts will be reserved for future use as spares.

  In addition to the landfall transition vault at the landfall site, the proposed transmission facility will include underground vaults along the public roadway and NSTAR Electric's ROW. The vaults will include upland transition vaults which are required at locations utilizing trenchless techniques and typical splice vaults. All vault locations will include two parallel vaults constructed of reinforced concrete

ATTACHMENT A-1
CAPE WIND PROJECT FIGURES

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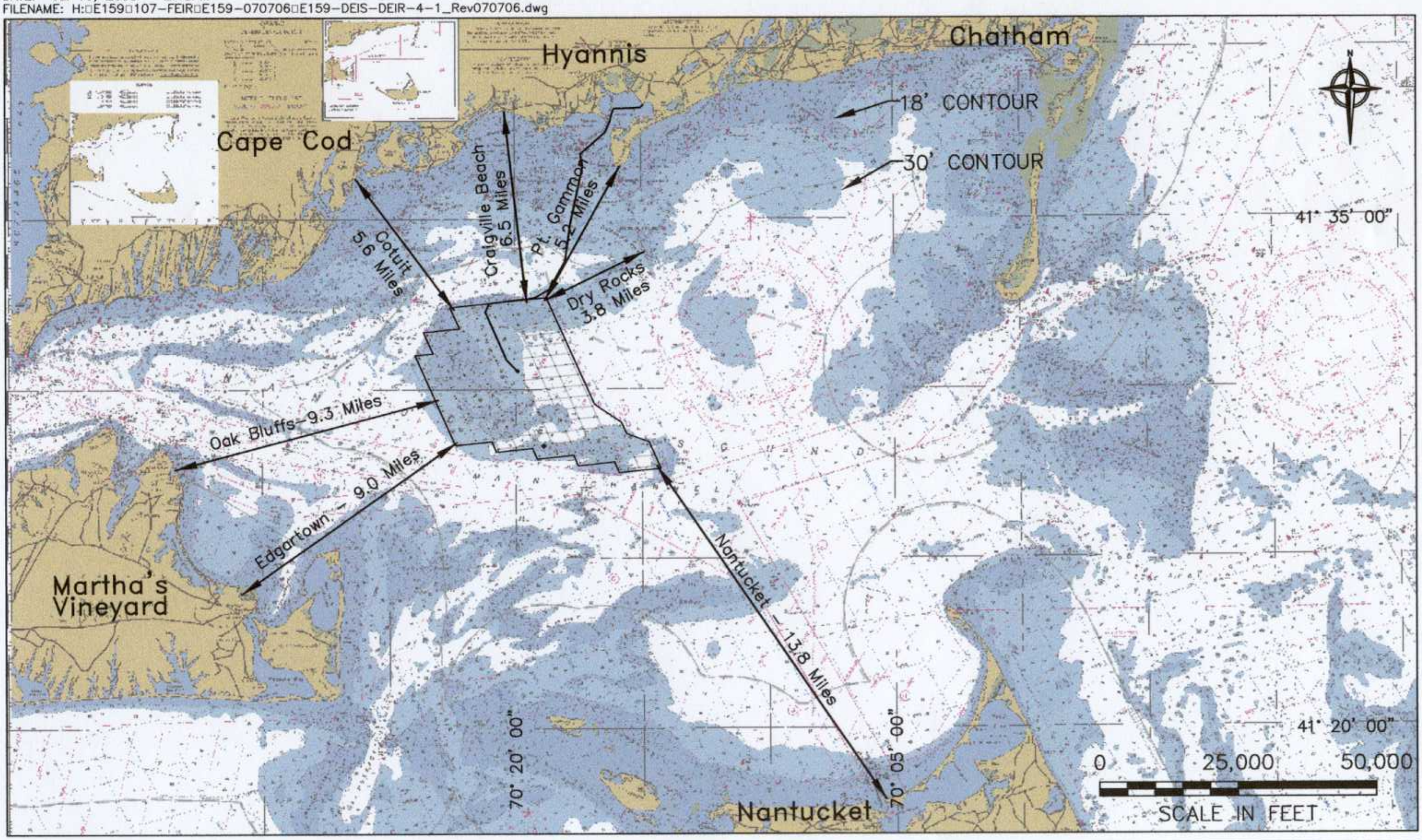

ESS Group, Inc.
Engineers
Scientists
Consultants

Cape Wind Associates, LLC.
Cape Wind Project

Scale: 1"=25,000'

Cape Wind Project Locus
NOAA Chart# 13237, Nantucket Sound & Approaches

Figure 1

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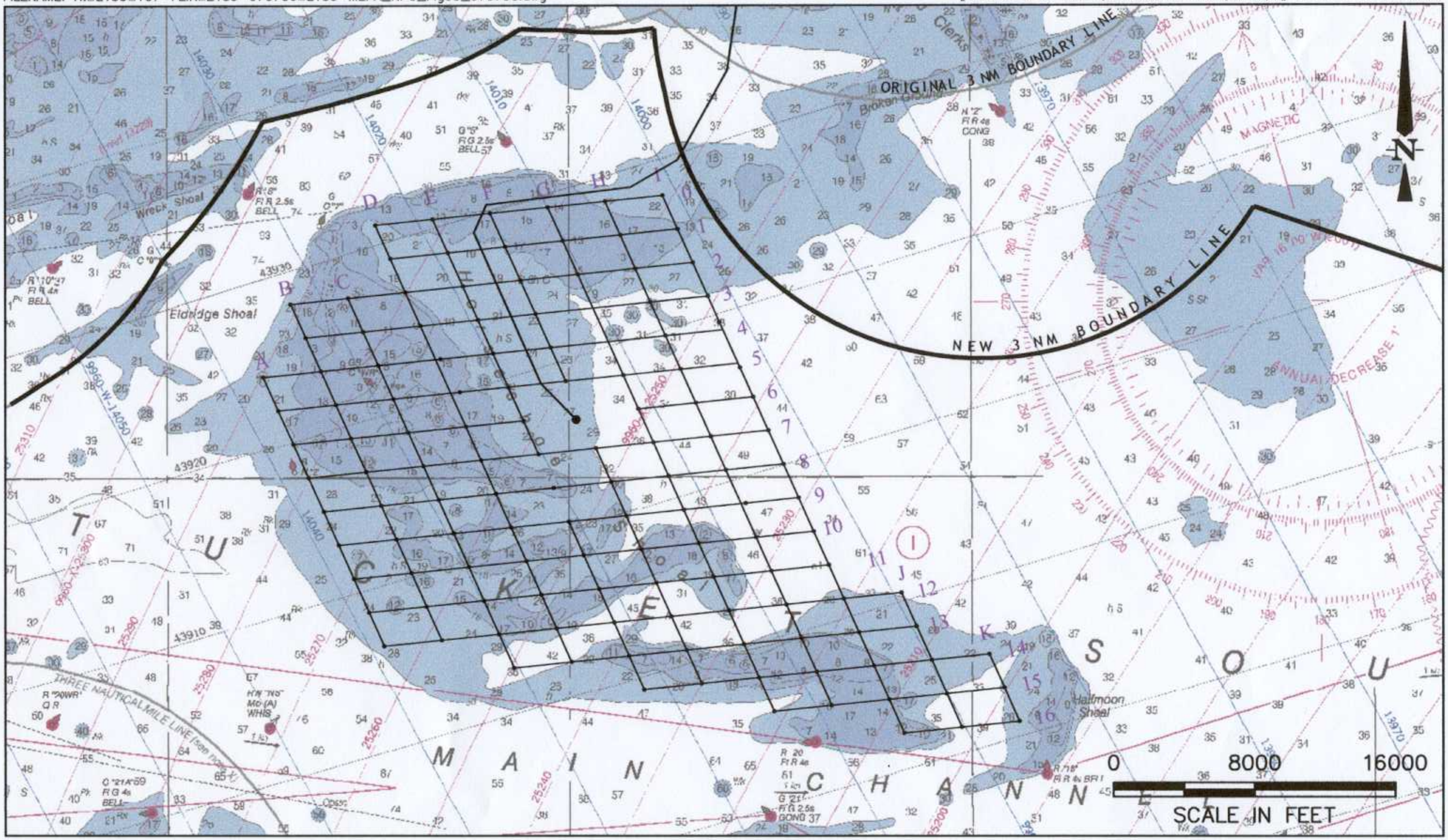

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Cape Wind Project

Revised Turbine Array
NOAA Chart# 13237, Nantucket Sound & Approaches

Source of New 3 NM Boundary Line Coordinates: Minerals Management Service, Outer Shelf Official Protraction Diagram
OPD Number NK19-07, Block Numbers 6481 & 6531

Figure 2

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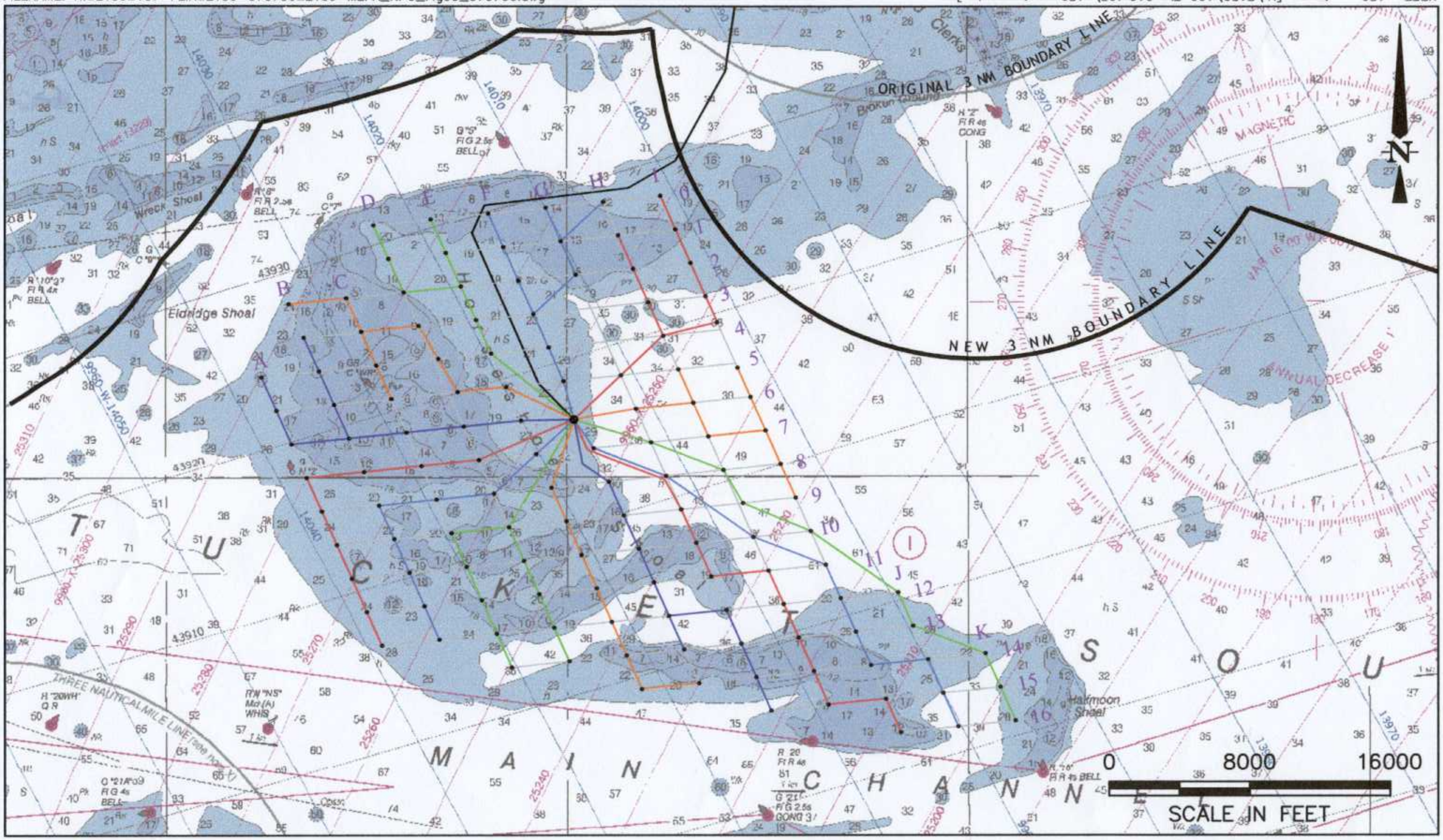

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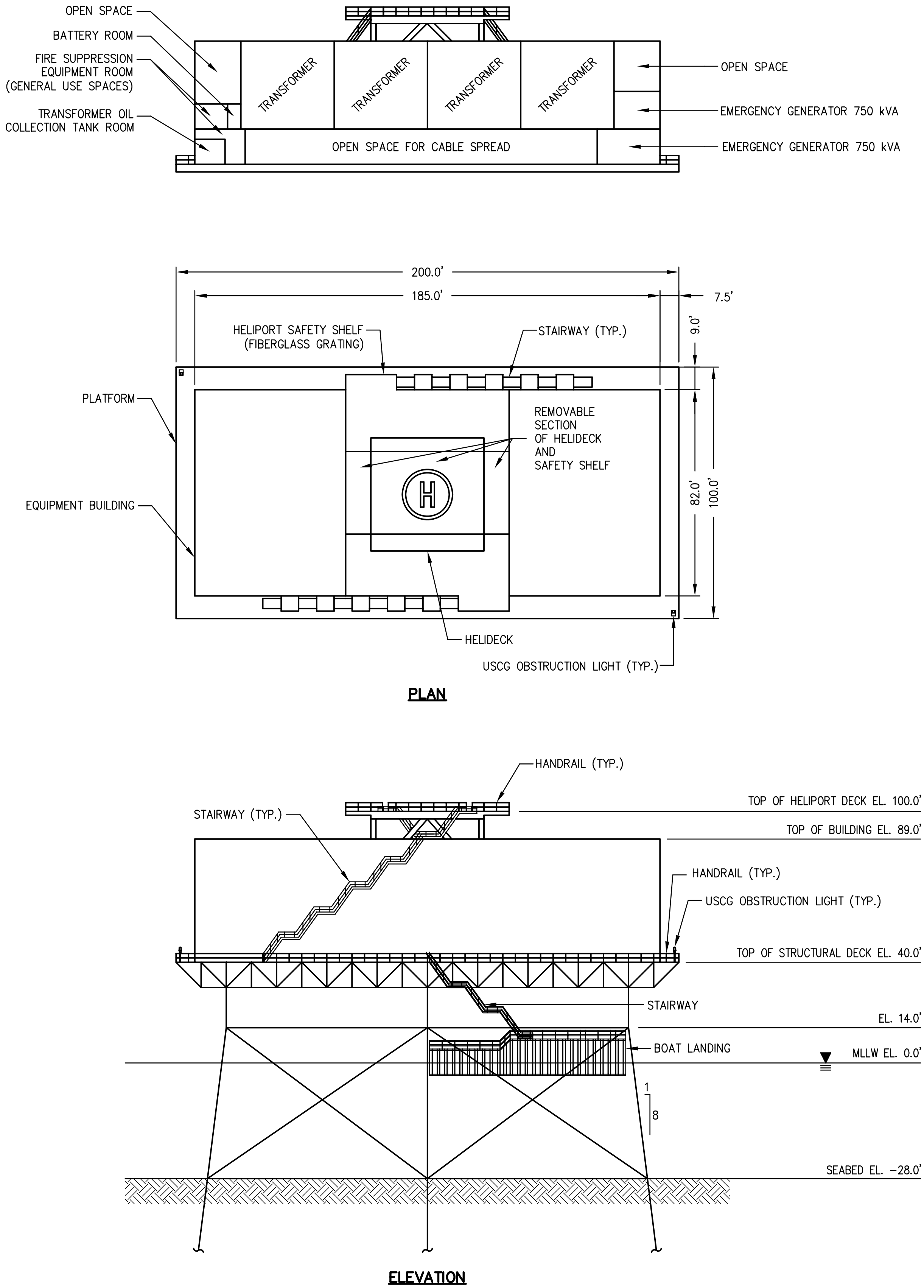
Cape Wind Project

Revised Inner Array Cable Layout
NOAA Chart# 13237, Nantucket Sound & Approaches

Source of New 3 NM Boundary Line Coordinates: Minerals Management Service, Outer Shelf Official Protraction Diagram
OPD Number NK19-07, Block Numbers 6481 & 6531

Figure 3



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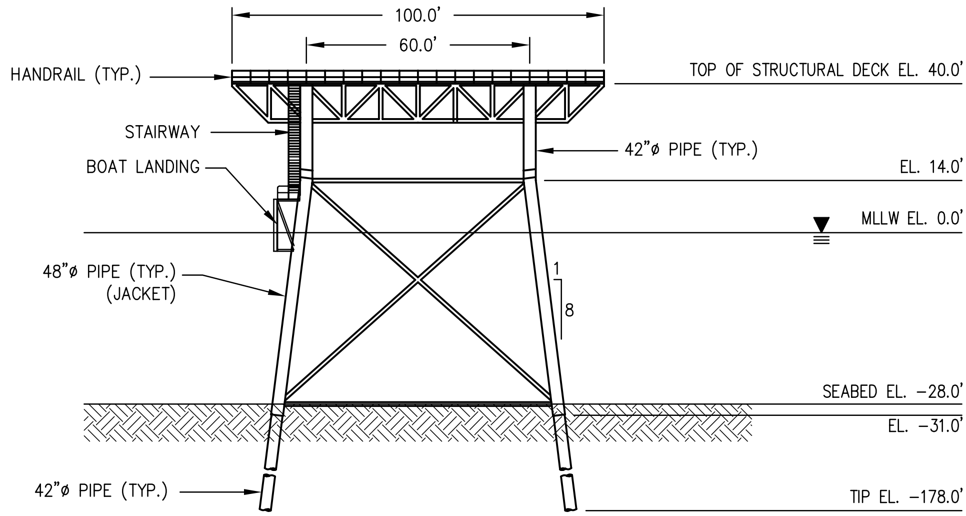
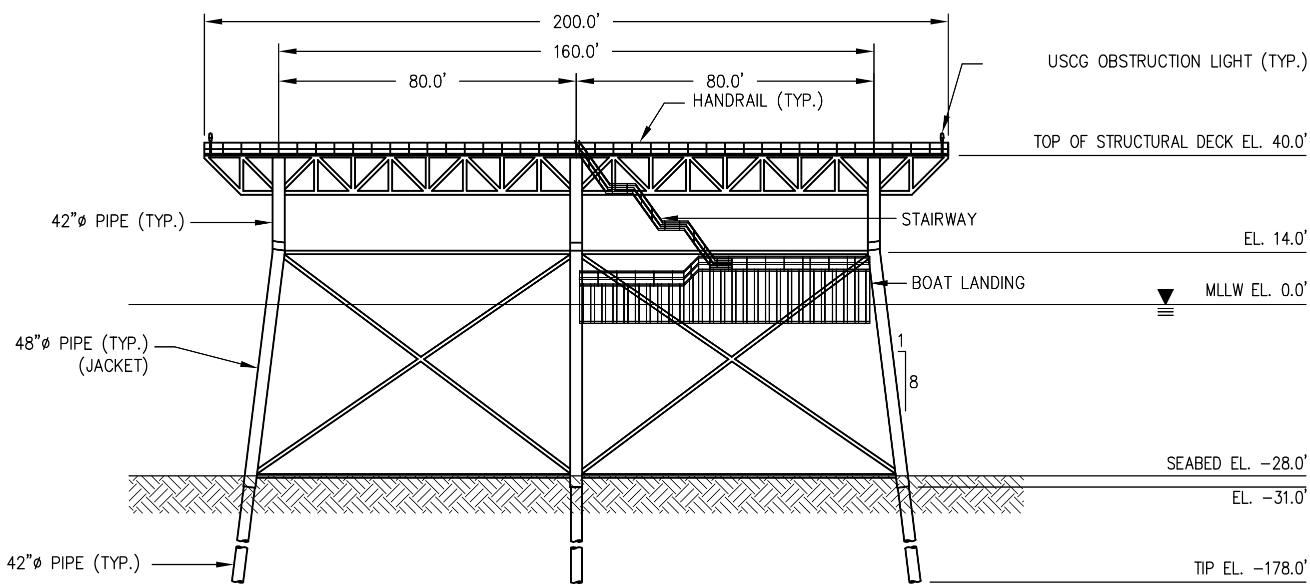
Cape Wind Project

Proposed Electric Service Platform
Elevation & Plan View - (Not to Scale)
Sheet 1 of 2

Figure 4



SIDE ELEVATION



FRONT ELEVATION

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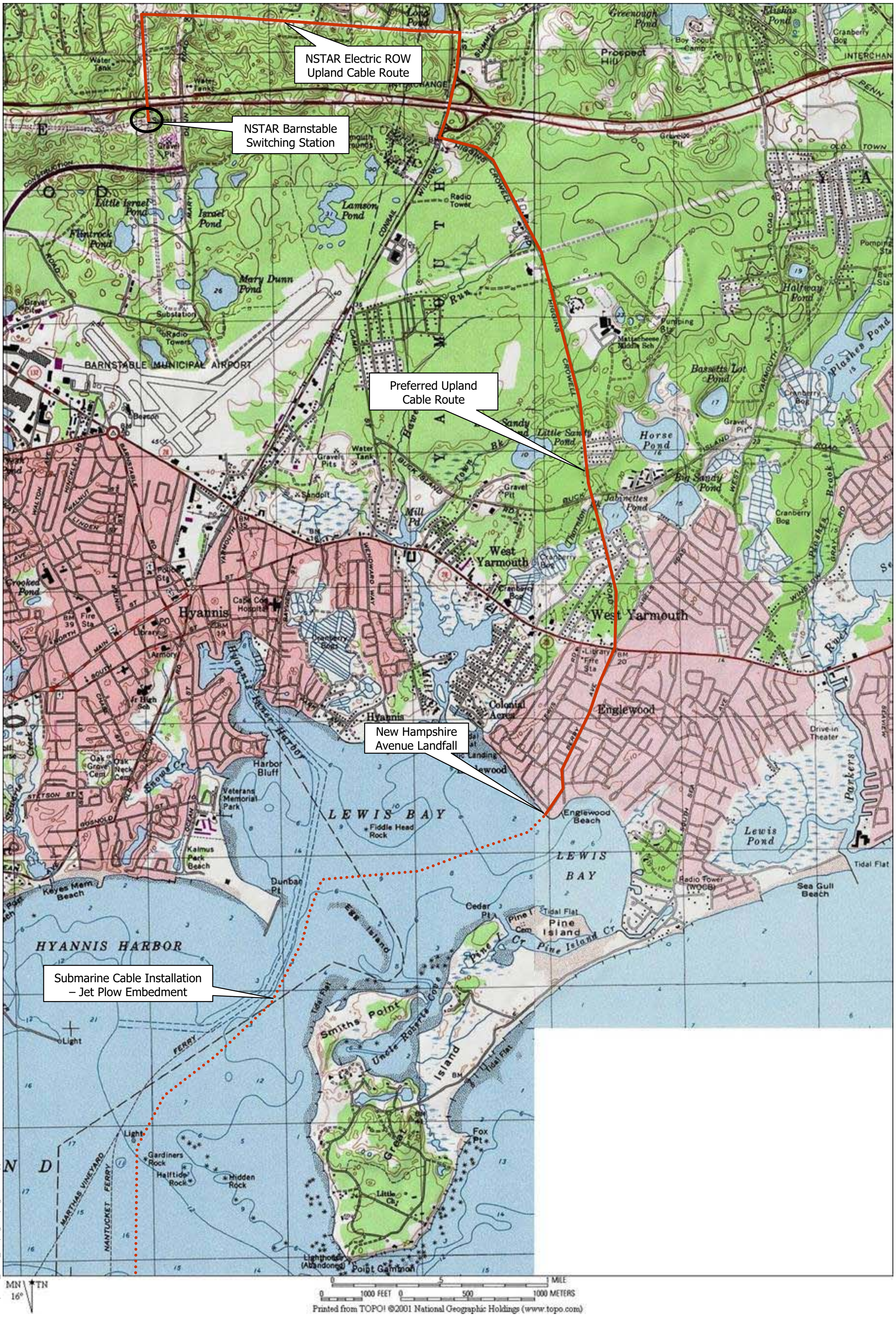
Cape Wind Associates, LLC
Cape Wind Project

Proposed Electric Service Platform
Foundation and Structural Detail - (Not to Scale)
Sheet 2 of 2

Figure 4



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Cape Wind Project

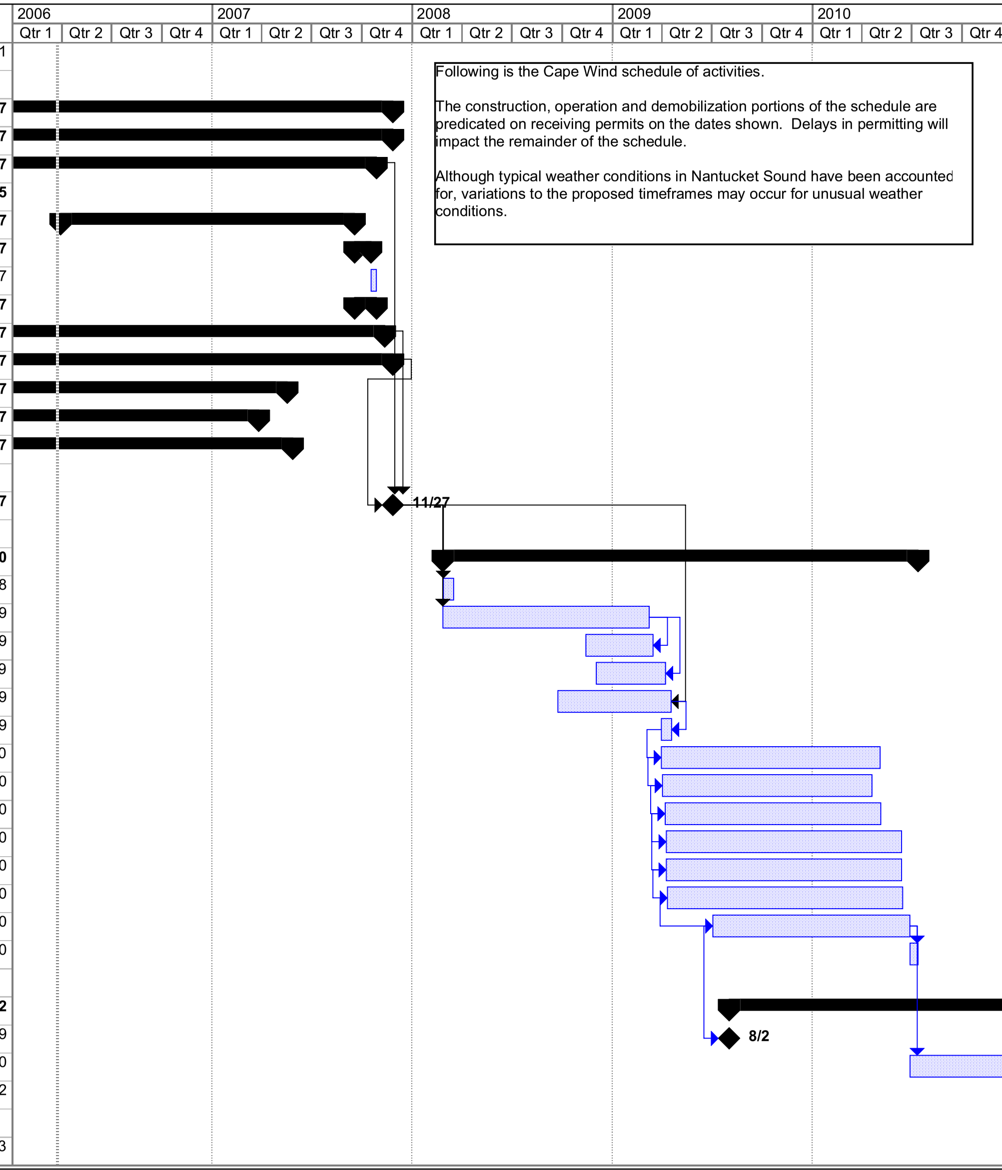
Submarine and Upland Transmission Line Route

Source: USGS Topographic Maps on CD-ROM – Northeastern USA
Scale: As Shown

Figure 5

ATTACHMENT A-2
CAPE WIND PROJECT SCHEDULE

Task Name	Duration	Start	Finish
Initiate Cape Wind Project	0 days	**Thu 11/15/01**	Thu 11/15/01
Permitting Process	**2204 days**	**Thu 11/15/01**	**Tue 11/27/07**
Federal Permits	**2204 days**	**Thu 11/15/01**	**Tue 11/27/07**
NEPA Process and Timeline	**2168 days**	**Wed 11/21/01**	**Sun 10/28/07**
Prior Activities under USACE	**1410 days**	**Wed 11/21/01**	**Sat 10/1/05**
MMS timeline from NOI	**537 days**	**Fri 3/31/06**	**Tue 9/18/07**
MMS draft and issue ROD	**30 days**	**Wed 9/19/07**	**Thu 10/18/07**
Grant Lease Under Sec. 8 of the OCS Lands Ac	10 days	Fri 10/19/07	Sun 10/28/07
USACE Sec. 10 Permit Process Post FEIS	**40 days**	**Wed 9/19/07**	**Sun 10/28/07**
FAA Notice of Proposed Construction	**1746 days**	**Sat 2/1/03**	**Mon 11/12/07**
USCG PAN	**2204 days**	**Thu 11/15/01**	**Tue 11/27/07**
State Permits	**2011 days**	**Thu 11/15/01**	**Fri 5/18/07**
Regional Permits	**1959 days**	**Thu 11/15/01**	**Tue 3/27/07**
Local Permits	**2021 days**	**Thu 11/15/01**	**Mon 5/28/07**
Completion of Permitting	**0 days**	**Tue 11/27/07**	**Tue 11/27/07**
Construction Activities	**868 days**	**Wed 2/27/08**	**Tue 7/13/10**
Mobilize and Set Up Project Office	19 days	Thu 2/28/08	Mon 3/17/08
Upland Duct Bank Construction	377 days	Wed 2/27/08	Mon 3/9/09
Onshore Control Center Construction	123 days	Fri 11/14/08	Mon 3/16/09
115 kV Upland Transmission Cable Installation	127 days	Wed 12/3/08	Wed 4/8/09
Install ESP Offshore	207 days	Wed 9/24/08	Sat 4/18/09
115 kV Submarine Transmission Cable Installation	19 days	Wed 4/1/09	Sun 4/19/09
Install Monopiles and scour protection	400 days	Wed 4/1/09	Wed 5/5/10
Install Transition Pieces	383 days	Fri 4/3/09	Tue 4/20/10
Install WTGs	394 days	Wed 4/8/09	Thu 5/6/10
Mechanical Trim-out WTGs	430 days	Fri 4/10/09	Sun 6/13/10
Electrical Trim-out WTGs	430 days	Fri 4/10/09	Sun 6/13/10
Install 33 kV Submarine Intra Array Cable	430 days	Sun 4/12/09	Tue 6/15/10
Test and Commission WTGs	360 days	Sat 7/4/09	Mon 6/28/10
Performance Test Project	15 days	Tue 6/29/10	Tue 7/13/10
Operation	**12188 days**	**Sun 8/2/09**	**Mon 12/15/42**
Begin unitial operation	0 days	Sun 8/2/09	Sun 8/2/09
Full operation	10958 days	Tue 6/29/10	Thu 6/28/40
Wind down operation	900 days	Fri 6/29/40	Mon 12/15/42
Decomissioning	1000 days	Fri 6/29/40	Wed 3/25/43



ATTACHMENT A-3
CAPE WIND MMS LEASEHOLD APPLICATION

Based on Form 3100-11
(October 1992)

Serial No.

UNITED STATES
DEPARTMENT OF THE INTERIOR
MINERALS MANAGEMENT SERVICE

OFFER FOR LEASE, EASEMENT OR RIGHT-OF-WAY AND GRANT OF LEASE, EASEMENT OR RIGHT-OF-WAY FOR ENERGY AND RELATED PURPOSES

The undersigned *(reverse)* offers to take a lease, easement or right-of-way in all or any of the submerged lands in Item 2 that are available for such leases, easements or rights-of-way pursuant to the Outer Continental Shelf Lands Act of 1953, as amended and supplemented (43 U.S.C. 1331 et seq.), for the purpose of constructing and operating an offshore wind farm with approximately 468 MW of capacity and 130 wind turbines, submarine cables and related facilities (collectively the "Wind Energy Facilities").

1. Name CAPE WIND ASSOCIATES, LLC
   Street 75 ARLINGTON STREET, SUITE 704
   City, State, Zip Code BOSTON, MASSACHUSETTS 02116

2. This application/offer/lease/easement/right-of-way is for submerged lands of the Outer Continental Shelf described as follows:

Legal description of submerged land requested: * Parcel No.: NA   * Sale Date (m/d/y): NA / NA / NA

T.   R.   Meridian   State   County

PLEASE SEE ATTACHED DESCRIPTION OF SUBMERGED LANDS. Applicant seeks leases, easements and rights-of-way, as appropriate, for the location and operation of the Wind Energy Facilities on or about those submerged lands known as Horseshoe Shoal in Nantucket Sound, all as more particularly described in the description of submerged lands attached hereto and incorporated herein. Such submerged lands and Wind Energy Facilities are described in greater detail in File No. NAE-2004-338-1 of the United States Army Corps of Engineers, in which the Applicant has sought authorization for such structures pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 401 et seq.).

Total acres applied for 21,671
(approximately 9.55 acres to be occupied by structures)

Amount remitted: Filing fee $ TBD   Rental fee $ TBD   Total $ TBD

DO NOT WRITE BELOW THIS LINE

3. Submerged land included in lease, easement or right-of-way:

T.   R.   Meridian   State   County

Total acres in lease/easement/
right-of-way ______________________

Rental retained $ ______________________

This lease, easement or right-of-way is issued granting the exclusive right to produce or support production, transportation, or transmission of energy from sources other than oil and gas; or to use facilities currently or previously used for activities authorized under the Outer Continental Shelf Lands Act of 1953, as amended and supplemented (43 U.S.C. 1331 et seq.) in the submerged lands described in Item 3 together with the right to build and maintain necessary improvements thereupon for the term indicated below, subject to renewal or extension in accordance with the appropriate granting authority. Rights granted are subject to applicable laws, the terms, conditions, and attached stipulations of this lease, easement or right-of-way, the Secretary of the Interior's regulations and formal orders in effect as of issuance, and to regulations and formal orders hereafter promulgated when not inconsistent with rights granted or specific provisions of this lease, easement or right-of-way.

Type and primary term of lease, easement or right-of-way:

NONCOMPETITIVE LEASE, EASEMENT AND RIGHT-OF-WAY (THIRTY YEARS)

THE UNITED STATES OF AMERICA

by ____
(Signing Officer)

____ __________
(Title) (Date)

EFFECTIVE DATE OF LEASE, EASEMENT OR RIGHT-OF-WAY___________

(Continued on reverse)

4. (a) Undersigned certifies that offeror is a citizen of the United States; an association of such citizens; a municipality; or a corporation organized under the laws of the United States or of any State or Territory thereof and all parties holding an interest in the offer are in compliance with all regulations issued pursuant to the Outer Continental Shelf Lands Act of 1953, as amended and supplemented (43 U.S.C. 1331 et seq.), and in existence upon the Effective Date of this lease, easement or right-of-way.

(b) Undersigned agrees that signature to this offer constitutes acceptance of this lease, easement or right-of-way, including all terms, conditions, and stipulations of which offeror has been given notice, and any amendment or separate lease, easement or right-of-way that may include any land describe in this offer open to granting at the time this offer was filed but omitted for any reason from this lease, easement or right-of-way. The offeror further agrees that this offer cannot be withdrawn, either in whole or in part unless the withdrawal is received by the proper MMS Regional Office before this lease, easement or right-of-way, an amendment to this lease, easement or right-of-way, or a separate lease, easement or right-of-way, whichever covers the land described in the withdrawal, has been signed on behalf of the United States.

18 U.S.C. Sec. 1001 makes it a crime for any person knowingly and willfully to make to any Department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

Duly executed this _______________ day of __________________________________ 20 _______ ____

(Signatures of Grantee or Attorney-in-fact)

DESCRIPTION OF SUBMERGED LANDS:

Wind energy development rights respecting approximately 21,671 acres of submerged land, of which approximately 9.55 acres to be occupied by 130 offshore Wind Turbine Generators (WTGs), an Electric Service Platform (ESP), 115 kV submarine transmission cables, 33 kV submarine inner-array cables, and associated scour control devices, each as further described below, bounded by the following approximate coordinates (listed in degrees, minutes and decimal seconds):

	Latitude	Longitude
From	41 32 56.16437	70 18 38.59213
To	41 32 24.61504	70 23 00.29743
To	41 30 58.73639	70 24 01.69002
To	41 28 22.55298	70 22 24.19083
To	41 28 01.81306	70 21 49.56339
To	41 27 14.45057	70 14 04.59347
To	41 27 47.41257	70 13 39.83200
To	41 28 25.54506	70 14 03.29092
To	41 29 50.04478	70 16 39.20231

Approximately 0.67 acres of submerged land, to be occupied by 130 offshore Wind Turbine Generators (WTG), each located at the following approximate coordinates (listed in degrees, minutes and decimal seconds) according to the attached figure:

	WTG	Latitude	Longitude			WTG	Latitude	Longitude
1	A4	41 30 55.77389	70 23 48.35701		66	F4	41 31 12.06271	70 20 13.68744
2	A5	41 30 37.08711	70 23 37.11240		67	F5	41 30 53.36616	70 20 02.51123
3	A6	41 30 18.40254	70 23 25.83975		68	F7	41 30 15.97986	70 19 40.07476
4	A7	41 29 59.71501	70 23 14.59952		69	F8	41 29 57.28621	70 19 28.84476
5	A8	41 29 41.02910	70 23 03.33086		70	F9	41 29 38.59323	70 19 17.62310
6	A9	41 29 22.34190	70 22 52.09290		71	F10	41 29 19.89894	70 19 06.40456
7	A10	41 29 03.65340	70 22 40.85804		72	F11	41 29 01.20141	70 18 55.22328
8	A11	41 28 44.96457	70 22 29.62366		73	F12	41 28 42.50938	70 18 43.97152
9	A12	41 28 26.27541	70 22 18.39108		74	F13	41 28 23.81027	70 18 32.81614
10	B2	41 31 36.41158	70 23 27.96360		75	F14	41 28 05.11468	70 18 21.60343
11	B3	41 31 17.72429	70 23 16.71881		76	G0	41 32 30.07480	70 20 15.72521
12	B4	41 30 59.04369	70 23 05.37957		77	G1	41 32 11.38227	70 20 04.49383
13	B5	41 30 40.36346	70 22 54.04306		78	G2	41 31 52.68943	70 19 53.27081
14	B6	41 30 21.66924	70 22 42.87661		79	G5	41 30 56.61084	70 19 19.56121
15	B7	41 30 02.98152	70 22 31.63176		80	G6	41 30 37.91283	70 19 08.39662
16	B8	41 29 44.29349	70 22 20.38870		81	G7	41 30 19.21835	70 18 57.17466
17	B9	41 29 25.60414	70 22 09.15401		82	G8	41 30 00.52355	70 18 45.95580
18	B10	41 29 06.91448	70 21 57.92242		83	G9	41 29 41.82843	70 18 34.73742
19	B11	41 28 48.22449	70 21 46.69130		84	G10	41 29 23.13397	70 18 23.52213
20	B12	41 28 29.53517	70 21 35.46329		85	G11	41 29 04.43530	70 18 12.34412
21	C2	41 31 39.68764	70 22 44.86759		86	G12	41 28 45.74210	70 18 01.09561
22	C3	41 31 20.99325	70 22 33.71482		87	G13	41 28 27.04085	70 17 49.94351
23	C4	41 31 02.30340	70 22 22.48232		88	G14	41 28 08.34510	70 17 38.73405
24	C5	41 30 43.62200	70 22 11.14907		89	G15	41 27 49.64707	70 17 27.53427
25	C6	41 30 24.92663	70 21 59.98588		90	H0	41 32 33.31792	70 19 32.78791

DESCRIPTION OF SUBMERGED LANDS (continued):

	WTG	Latitude	Longitude			WTG	Latitude	Longitude
26	C7	41 30 06.23776	70 21 48.74430		91	H1	41 32 14.62522	70 19 21.55847
27	C8	41 29 47.54856	70 21 37.50450		92	H2	41 31 55.92829	70 19 10.36108
28	C9	41 29 28.85611	70 21 26.29541		93	H3	41 31 37.23687	70 18 59.10630
29	C10	41 29 10.16530	70 21 15.07364		94	H4	41 31 18.54220	70 18 47.88224
30	C11	41 28 51.47318	70 21 03.85367		95	H5	41 30 59.84722	70 18 36.66128
31	C12	41 28 32.78172	70 20 52.63548		96	H6	41 30 41.14805	70 18 25.49996
32	C13	41 28 14.08896	70 20 41.42697		97	H7	41 30 22.45242	70 18 14.28126
33	D0	41 32 20.32366	70 22 24.44582		98	H8	41 30 03.75647	70 18 03.06567
34	D1	41 32 01.63460	70 22 13.20332		99	H9	41 29 45.31893	70 17 48.41865
35	D2	41 31 42.94522	70 22 01.96262		100	H10	41 29 26.36358	70 17 40.63852
36	D3	41 31 24.24969	70 21 50.81312		101	H11	41 29 07.66764	70 17 29.42698
37	D4	41 31 05.82707	70 21 36.04193		102	H12	41 28 48.97040	70 17 18.21853
38	D5	41 30 47.38255	70 21 21.57281		103	H13	41 28 30.42276	70 17 07.41467
39	D6	41 30 28.18056	70 21 17.07951		104	H14	41 28 11.56987	70 16 55.74002
40	D7	41 30 09.49538	70 21 05.77414		105	H15	41 27 52.87190	70 16 44.66697
41	D8	41 29 50.79921	70 20 54.61910		106	I0	41 32 36.55564	70 18 49.87046
42	D9	41 29 32.10172	70 20 43.46453		107	I1	41 32 17.86079	70 18 38.64429
43	D10	41 29 13.40975	70 20 32.24602		108	I2	41 31 59.16370	70 18 27.45017
44	D11	41 28 54.71647	70 20 21.02931		109	I3	41 31 40.47112	70 18 16.19865
45	D12	41 28 36.02386	70 20 09.81438		110	I4	41 31 26.00431	70 18 07.56009
46	D13	41 28 17.33383	70 19 58.55788		111	I5	41 31 00.69969	70 17 52.38729
47	E0	41 32 23.57913	70 21 41.53312		112	I6	41 30 44.37885	70 17 42.60211
48	E1	41 32 04.88891	70 21 30.29389		113	I7	41 30 25.68206	70 17 31.38668
49	E2	41 31 46.19837	70 21 19.05646		114	I8	41 30 06.98495	70 17 20.17435
50	E3	41 31 27.50750	70 21 07.82212		115	I9	41 29 48.28751	70 17 08.96249
51	E4	41 31 08.81631	70 20 56.58827		116	I10	41 29 29.58975	70 16 57.75374
52	E5	41 30 50.12578	70 20 45.35752		117	I11	41 29 10.89167	70 16 46.54545
53	E6	41 30 31.42908	70 20 34.18640		118	I12	41 28 52.19039	70 16 35.38364
54	E7	41 30 12.73692	70 20 22.95791		119	I13	41 28 33.49070	70 16 24.19469
55	E8	41 29 54.05025	70 20 11.65892		120	I14	41 28 14.79195	70 16 12.99215
56	E9	41 29 35.35260	70 20 00.50761		121	I15	41 27 56.09230	70 16 01.79850
57	E10	41 29 16.65947	70 19 49.28580		122	I16	41 27 37.39263	70 15 50.60702
58	E11	41 28 57.96601	70 19 38.06447		123	J12	41 28 55.41269	70 15 52.46083
59	E12	41 28 39.27223	70 19 26.84624		124	J13	41 28 36.70898	70 15 41.31851
60	E13	41 28 20.57067	70 19 15.73175		125	J14	41 28 18.00878	70 15 30.11885
61	E14	41 28 01.87983	70 19 04.47163		126	J15	41 27 59.30443	70 15 18.98140
62	F0	41 32 26.83015	70 20 58.61924		127	J16	41 27 40.60359	70 15 07.78530
63	F1	41 32 08.13878	70 20 47.38328		128	K14	41 28 21.22147	70 14 47.24476
64	F2	41 31 49.44708	70 20 36.14910		129	K15	41 28 02.51598	70 14 36.11058
65	F3	41 31 30.75506	70 20 24.91804		130	K16	41 27 43.81398	70 14 24.91774

DESCRIPTION OF SUBMERGED LANDS (continued):

Approximately 0.46 acres of submerged land, to be occupied by an Electric Service Platform to be located at the following approximate coordinates (listed in degrees, minutes and decimal seconds):

	Latitude	Longitude
ESP	41 30 31.91088	70 19 54.73761

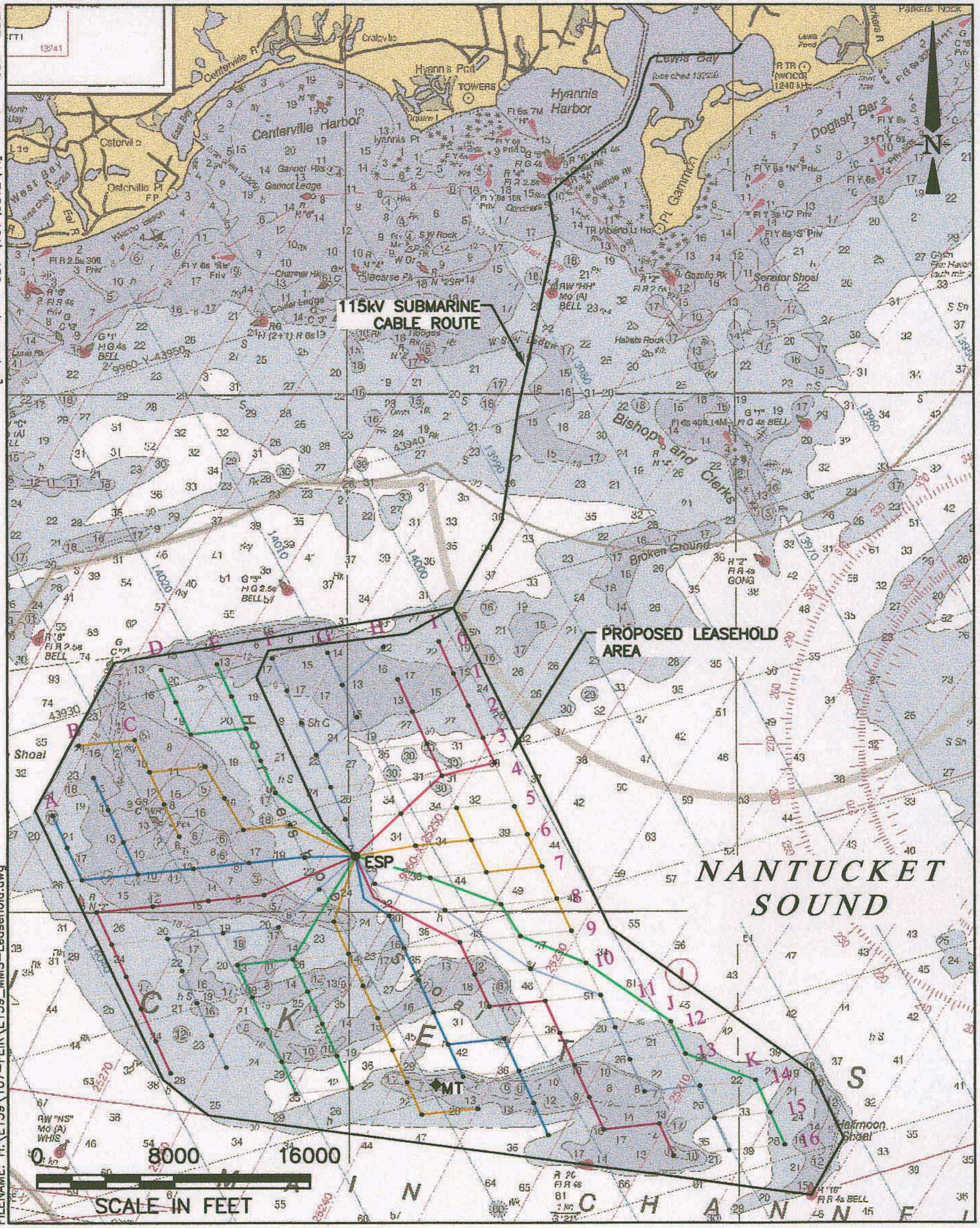
Approximately 1.54 acres of submerged land (the cables occupy additional submerged land within the Commonwealth of Massachusetts), to be occupied by four 115 kV submarine transmission cables (two circuits), each approximately 7.75 inches in diameter, located in two jet-plowed trenches (one circuit per trench) following the approximate course listed in the following coordinates (listed in degrees, minutes and decimal seconds):

	Latitude	Longitude
From	41 30 31.91088	70 19 54.73761
To	41 30 51.97159	70 20 20.95881
To	41 32 16.06651	70 21 10.79199
To	41 32 31.61178	70 21 01.47626
To	41 32 41.19533	70 19 13.74372
To	41 32 56.16437	70 18 38.59213
From the Submerged Lands Act boundary, the transmission cables are located within the Commonwealth of Massachusetts on the following approximate course.		
To	41 33 46.21591	70 18 01.06685
To	41 34 50.96913	70 17 48.30469
To	41 36 33.09146	70 17 18.87042
To	41 36 55.92024	70 17 23.70889
To	41 37 34.47038	70 16 23.51099
To	41 37 51.12834	70 16 14.12006
To	41 38 05.78174	70 16 08.83447
To	41 38 14.23689	70 16 04.53858
To	41 38 15.95872	70 16 01.31747
To	41 38 17.38546	70 15 00.99168
To	41 38 20.47604	70 14 55.92140
To	41 38 22.67755	70 14 53.90895

Approximately 4.35 acres of submerged land, to be occupied by 33 kV submarine inner-array cables, to be located in jet-plowed trenches connecting the above offshore Wind Turbine Generators in strings to the ESP according to the attached figure.

Approximately 2.53 acres of submerged land, to be occupied by scour control devices, as further described in File No. NAE-2004-338-1 of the United States Army Corps of Engineers.

The foregoing approximate locations of facilities are subject to adjustment in accordance with geological and engineering concerns and final project design and may include such modifications as may be necessary to the development of the wind energy resources associated with the above-referenced bounded area of submerged lands, subject to compliance with applicable laws and regulations.



XREF: e159-xr-image [H:\E159\101\e159-xr-image.dwg]
XREF: E159xr107 [H:\E159\107-FEIR\E159xr107.dwg]
IMAGE: H:\E159\101\CapeWind_Small2.jpg
IMAGE: H:\Charts\Nad83-ma-isl-ft\13237.tif
IMAGE: H:\Charts\Nad83-ma-isl-ft\13229-3.tif
IMAGE: H:\Charts\Nad83-ma-isl-ft\13229-4\13229-4.tif
IMAGE: H:\Charts\Nad83-ma-isl-ft\13237.tif

DATE: Aug 30, 2005 - 2:47PM
FILENAME: H:\E159\107-FEIR\E159_MMS-Leasehold.dwg

ESS Group, Inc.
Engineers
Scientists
Consultants

Cape Wind Associates, LLC.
Cape Wind Project

Scale: 1"=8000'

Proposed Leasehold

Figure 1

SECTION B:
GENERAL INFORMATION

B1. CONTACT INFORMATION

Questions or requests for additional information should be made to Cape Wind Associates, LLC:

Craig Olmsted
Cape Wind Associates, LLC
75 Arlington Street, Suite 704
Boston, MA 02116
1-617-904-3100 ext. 119
colmsted@emienergy.com

B2. PROJECT NAME

The name of the proposed Project is: Cape Wind Energy Project.

B3. ESTIMATED ENERGY PRODUCTION RATES AND LIFE OF PROJECT

The number of WTG units in the array are a function of the energy generation capacity of each WTG (3.6 megawatts (MW)±) multiplied by the desired installation capacity of 468 MW to produce a combined maximum energy generating capacity of approximately 454 MW after consideration of inherent energy losses within the system. The offshore Wind Park will be capable of producing an average annual output of approximately 170 MW. The Project is designed for a maximum delivered electrical energy capacity of 454 MW, which will be connected to the existing NSTAR electric transmission system servicing Cape Cod and the New England region. This generating capacity is based on the design wind velocity of 30 mph and greater, up to the maximum operational velocity of 55 mph. Based on the average wind speed of 19.75 mph, the net energy production delivered to the regional transmission grid will be approximately 1.6 GW hours/year.

The Project's primary components, the wind turbine generators, have a stated design life span of twenty years. However, this estimate is based on experience generated from land-based machines which are subject to higher levels of turbulence and arguably experience greater wear and tear than can be expected offshore where winds are less turbulent. It is possible that the offshore Cape Wind Project could be operational beyond the minimum design life of twenty years. Additional factors contributing to this assumption include the following:

- The foundation system for the WTG's has been designed on a conservative basis with liberal service factors and corrosion allowances built in.
- The interconnecting cable system has been engineered with a design life of at least 50 years.
- The foundations, tower systems, and the turbine generators will be subject to an aggressive preventative maintenance, inspection and repair program on a continual basis.
- Turbines may be replaced and/or upgraded (on existing foundations and towers) on an ongoing basis, as technology advances.
- Up to the limit of the lease, the decision to replace or upgrade individual turbines will be made by the Project's owners based on an environmental and commercial evaluation.

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B4. NEW AND UNUSUAL TECHNOLOGY

Although quite similar in concept, offshore WTGs are different in some important aspects when compared to WTGs designed specifically for onshore use. Offshore WTGs are, in general, considerably larger to take advantage of marine equipment able to transport and install larger turbines then possible on land and to reduce the number of individual WTGs to install and maintain as well taking advantage of economies of scale.

Currently, recent proven technology in offshore WTGs range in hub height from about 70 to 80 meters with rotor diameters of 80 to over 110 meters. Few onshore WTGs reach these dimensions.

In addition, offshore turbines have navigational lighting systems specialized for their environment and subsystems designed for continuous exposure to a marine environment. Design of structural components accounts for issues not encountered onshore such as wind, wave, current and tide interaction and reduced wind turbulence. Cape Wind will design the installation on the 100 year return period and although the applicant cannot comply completely until final design is undertaken, it is understood that mutually agreed to third party certification will be necessary for the structural components of the wind farm including the electric service platform. Further, it is expected that all operational components such as the turbine and blades will also be fully certified by mutually agreed upon entity.

B5. BONDING INFORMATION

Cape Wind will provide a financial instrument or other assurance to the reasonable satisfaction of the US MMS that will ensure the decommissioning of the facility. It will be utilized at the end of the useful economic life of the wind park or in the event that the wind park is abandoned or otherwise rendered inoperable.

B6. CONSTRUCTION, OPERATIONS, AND DECOMMISSIONING

B.6.1 Construction

Major construction activities will be supported by onshore facilities, which are anticipated to be located in Quonset, Rhode Island. Material and equipment will be staged onshore, at existing port facilities in Quonset, RI (or some similar location), and then loaded onto various vessels for transportation to the offshore site, and ultimately installation. Once loaded, the vessels will travel from Quonset through Narragansett Bay to Rhode Island Sound to Vineyard Sound, North of Martha's Vineyard to the Main Channel, a distance of about 55 nautical miles. Construction personnel will be ferried to the construction site from the Falmouth area.

The Applicant has identified an existing, underutilized, industrial port facility in Quonset, RI as having the attributes required for staging an offshore construction project of the magnitude of the Cape Wind Project. The Quonset Davisville Port & Commerce Park is located on Narragansett Bay in the town of North Kingstown, Rhode Island and is owned and controlled by the Rhode Island Economic Development Corporation (RIEDC). This site is a portion of what once was a much larger government facility known as the U.S. Naval Reservation–Quonset Point, part of which is still actively utilized as a civilian airport and base for an Air National Guard Reserve squadron.

SECTION B:
GENERAL INFORMATION

The Quonset Davisville Port & Commerce Park is an active marine industrial site that houses several industrial businesses such as General Dynamics (shipbuilding) and Senesco (marine construction). Following the downsizing of the US Naval Reservation – Quonset Point, the park was created in order to develop prime industrial sites, create job opportunities and to improve the economic conditions throughout the region. The staging of the Cape Wind project from the Quonset Davisville Port & Commerce Park is consistent with the park's stated purpose. The site has deep-water capacity (30' depth) and two piers that are 1,200 feet in length.

Monopile installation will begin by loading individual monopiles onto a barge, two to four at a time, for transport to the work site. Depending upon the actual barge utilized and other logistical requirements, the Applicant is anticipating approximately 43 trips to move monopiles to the work site.

A jack-up barge with a crane will be utilized for the actual installation of the monopiles. The monopiles will be installed into the seabed by means of pile driving ram or vibratory hammer and to an approximate depth of 85 feet into the seabed.

Length of monopile, insertion distance and finished elevation will vary by individual location due to water depth and structural and geotechnical parameters. Monopiles to be installed will range in length from approximately 122 feet for those installed in the shallowest locations to more than 172 feet at the deepest sites. The anticipated duration of installing all of the monopiles from start to finish is expected to be approximately eight months.

Transition pieces which fit over the top of the monopile and provide a suitable surface to install the tower for the WTG, would be transported from Quonset Point, RI on barges, approximately four per barge. They would be lifted from the transport barge, set and grouted to the pile utilizing a jack up barge similar to that used to install the monopiles.

Installation of the balance of the WTG components will be conducted from a specialized vessel configured specifically for this purpose or alternatively from crane equipped jack up barges similar to those used for monopile installation. In the case of a specialized vessel, it would be loaded at Quonset, RI with the necessary components to erect two to four WTGs. Components include towers, nacelles, hubs and blades.

The vessel would transit from Quonset to the work site as described above and locate itself adjacent to one of the previously installed monopiles. The vessel's crane will then place the lower half of the tower onto the deck of the transition piece. Once this piece is secured, the upper tower section is raised and bolted to the lower half. In order, the nacelle, hub and blades are raised to the top of the tower and secured. Several of these components may be pre-assembled prior to final installation. This process is anticipated to take approximately 15 to 20 hours to cycle through one complete WTG and would be repeated for each of the 130 WTG locations. Including the approximately forty three trips to Horseshoe Shoal, this process will take approximately eight months. The installation of the WTG will overlap with the installation of the monopiles.

As the project progresses, the submarine inner-array cables will be installed via jet-plow embedment to a minimum depth of 6 feet below present bottom in order to connect the string of wind turbines (up to 10 WTGs per string). Cable installation will involve cable laying barge and assorted support vessels. Following the inner-array cable installation the seabed scour control system will be installed on the seabed around each monopile. The base design will consist of a set of six scour-control mats arranged to surround the monopole (ESS, 2006b). Each mat is 16.5 feet by 8.2 feet with eight anchors which securely tie to the seabed. If the alternate design of rock armoring is used in place of the scour control mats the installation procedure will likely involve multiple barge trips to complete the placement of the materials (ESS, 2006c). It is anticipated that the process of completing one string of WTGs (10 WTGs with associated inner-array cable and scour control system) will take approximately two weeks.

An ESP will serve as the common interconnection point for all of the WTGs within the array and will be installed and maintained at the approximate center of the WTG array. Each WTG will interconnect with the ESP via a 33 kV submarine cable system. These cable systems will interconnect with circuit breakers and transformers located on the ESP in order to transmit wind-generated power through the 115 kV shore-connected submarine cable system. The two 115 kV submarine circuits will then ultimately connect to the existing land-based NSTAR Electric transmission system on Cape Cod. The ESP will also function as a helipad and as a maintenance area during periods of servicing the Wind Park equipment.

The ESP will be a fixed template type platform consisting of a jacket frame with six 42-inch driven piles to anchor the platform to the ocean floor. Similar types of equipment that will be used for installation of the WTGs, will be utilized in the installation of the ESP. The platform will consist of a steel superstructure of approximately 100 feet by 200 feet.

The interconnecting 115 kV submarine cable system will be will be installed via jet-plow embedment to a minimum depth of 6 feet below present bottom from the ESP to the landfall in Lewis Bay, utilizing similar equipment as previously described for the 33 kV inner-array cables.

The upland cable will be routed through Yarmouth and on to Barnstable by conventional utility installation techniques utilizing underground ductbanks in most areas and HDD for major highway and rail crossings.

B.6.2 Operations

The Operations and Maintenance (O&M) Plan will provide operations and maintenance support of all components of the Wind Park including the ESP, submarine transmission cables and wind park security.

A continuously manned, land-based Operations Center will be established to remotely monitor all aspects of the Wind Park's operations. It is anticipated that this Operations Center will be located in the Town of Yarmouth.

The maintenance program will include preventive and emergency maintenance functions including shore based predictive maintenance analysis of the WTG and ESP. The maintenance plan is based on utilizing two additional locations: one for the parts storage and larger maintenance supply vessels and the second being closer to the site for crew transport.

The maintenance operation will be based in New Bedford, Massachusetts and will also deploy several crew boats out of Falmouth, Massachusetts. The New Bedford facility will be located on Popes Island and will include dock space for two 65-foot maintenance vessels as well as a warehouse for parts and tool storage and crew parking. An off-site warehouse will also be utilized to increase parts storage.

The New Bedford facility will house tools, spare parts and maintenance materials, and will be organized to support the daily work assignments. These will be loaded into small containers and assigned to each of the work teams and loaded onto the maintenance vessel for deployment to the wind farm site. The maintenance vessel will then go to the WTG or ESP and offload the containers to the work crews.

Dock space will be rented in Falmouth Inner Harbor to provide space for two crew boats between 35 and 45 feet overall length and one smaller (20-25 foot) high-speed emergency response boat. The crew boats will bring work crews to Horseshoe Shoal where they will be transferred to the WTG, ESP or the larger maintenance vessels. The number of individuals that will normally be transported out of Falmouth on a daily basis will be nine plus the boat crew of two.

Maintenance Intervals

The WTG design is based on a minimum twenty year operating life and all components have been analyzed to meet this design criterion. Based on both offshore and onshore WTG operational experience, five days per year per turbine has been established as anticipated maintenance intervals. These visits cover two days of planned or preventative maintenance, and three days of unplanned or forced outage emergency maintenance. Based on 130 WTGs, this is equivalent to 650 maintenance days. Based on 252 workdays per year (which adjusts for weather days and holidays) this results in 2.5 work teams or conservatively three teams being deployed. During these deployments the ESP will be included with the trips. Weather conditions will have an influence on the maintenance operations of the wind park. Scheduled outages for maintenance will be planned for summer months when winds are low and sea states are minimal. Experience has shown that wind speeds must be less than eight m/sec to gain safe access to the WTGs, although safe access with winds up to 12 m/sec is possible depending on direction and sea state. Based on these weather related concerns, the number of trips per day could be altered to take advantage of good weather.

Post-construction inspection and monitoring for scour and erosion will be conducted periodically by diver inspection, especially following major storm events. The submarine cables will be inspected periodically to ensure adequate coverage is maintained. If problem areas are discovered, the submarine cables will be reburied.

Number of Vessel Trips

Based on the above analysis the normal activity would include two vessel trips per working day (252 days/year), which would include one crew boat from Falmouth and the maintenance support vessel from New Bedford. In addition an occasional second round trip from Falmouth could take place in times of fair weather or for emergency service.

ESP Service

The ESP will have a helicopter-landing platform in addition to the boat dock. This will allow for maintenance crews to be deployed to the ESP during periods when wind and wave conditions are unsuitable for boat transfers. The helicopter platform will also allow for emergency evacuation of any individuals who may become injured.

B.6.3 Decommissioning

Decommissioning the Project is largely the reverse of the installation process. Sediments inside the monopile will be removed and, in accordance with the MMS's removal standards (30CFR 250.913)[1], the monopile and transition piece assembly will be cut approximately 15 feet (5 meters) below the seabed, with the portion of the pile below the cut remaining in place. Cutting of the pile would likely be done using one or a combination of: underwater acetylene cutting torches, mechanical cutting, or high pressure water jet. Decommissioning of the wind farm is broken down into several steps, closely related to the major components of the Project:

[1] Minerals Management Service, Notice to Lessees 2004 – G06 "Structure Removal Operations"

- Submarine transmission cables
- Turbine generators and towers
- Monopile foundations and scour system
- Electric Service Platform
- Upland transmission cables

It is anticipated that equipment and vessels similar to those used during installation, will be utilized during decommissioning. For offshore work this would likely include a jet plow, crane barges, jack-up barges, tugs, crew boats and specialty vessels such as cable laying vessels or possibly a vessel specifically built for erecting WTG structures. For upland work, traditional construction equipment such as backhoes and cable trucks would be utilized.

B7. TRANSMISSION INFORMATION

The wind-generated electricity from each of the turbines will be transmitted via a 33 kV submarine transmission cable system to the ESP centrally located within the WTG array. The ESP will then take the wind-generated energy from each of the WTGs and transform and transmit this electric power to the Cape Cod mainland via two 115 kV AC submarine cable circuits which have been approved by the MA Energy Facilities Siting Board. These submarine cable systems will make landfall in the Town of Yarmouth. From this landfall, an upland transmission system will be installed in an underground conduit system within existing roadways and ROW where it will intersect with the existing NSTAR Electric ROW near Willow Street in Yarmouth. The upland transmission line will continue within the ROW to the Barnstable Switching Station. The Project's interconnection with the existing NSTAR Electric transmission line will allow wind-generated energy from the WTGs to be transmitted and distributed to users connected to the New England transmission system including users on Cape Cod and the Islands. The New England Independent System Operator (ISO) Reliability Committee has voted unanimously in favor of accepting electricity from the Cape Wind Project for the power generated from the 130 turbines which will be integrated into the regional grid.

B8. LIST OF PERMITS/APPROVALS

The following is a list of permits and/or approvals as may be required for the Cape Wind Energy Project.

Agency	Approval/Permit/Action Item	Status
FEDERAL		
Department of Interior - Minerals Management Service	Grant Lease, Easement, or Right-of-Way Under Sec. 8 of the Outer Continental Shelf (OCS) Lands Act	Filed: 9/14/05
	Project Plan (Supplement to 9/14/05 Grant Lease)	Filed: 7/11/06
	Environmental Management System	To be filed
	Oil Spill Response Plan	To be filed
	Structure Permit Applications	To be filed
	Decommissioning Permit Application	To be Submitted Prior to Decommissioning
	Cable Application	To be filed
	MMS Draft Environmental Impact Statement	To be filed
	Final Environmental Impact Statement	To be filed
	Record of Decision	Pending

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Agency	Approval/Permit/Action Item	Status
United States Army Corps of Engineers (USACE)	Individual Permit – Section 10 Rivers and Harbors – File No. USACE NAE-2004-338-1(formerly 200102913)	Filed: 11/22/01 Approval: Pending
	USACE Draft Environmental Impact Statement	Filed: 11/2004 Approval: MMS is now the lead federal agency
United States Environmental Protection Agency	NPDES General Stormwater Permit	To be filed
	40 CFR Part 55 Air Permit for OCS Sources	To be filed
Federal Aviation Administration	Notice of Proposed Construction or Alteration Form (FAA Form 7460-1) – File No. 2002-ANE-982-OE through 1111-OE	Filed: 10/25/02 Approval: 04/09/03
US Coast Guard	Permit to Establish and Operate a Private Aid-to-Navigation to a Fixed Structure	To be filed
STATE		
Massachusetts Environmental Policy Act	Environmental Notification Form – EOEA No. 12643	Filed: 11/15/01 Approval: 4/22/02
	Draft Environmental Impact Report	Filed: 11/15/04 Approval: 3/3/05
	Notice of Project Change	Filed: 6/30/05 Approval: 8/8/05
	Final Environmental Impact Report	To be filed
	Issuance of Certificate	Pending
Massachusetts Energy Facility Siting Board	Petition to Construct Jurisdictional Facilities	Filed: 9/17/02 Approval: 5/10/05
	Certificate of Environmental Impact and Public Need – File No. EFSB 02-2	
	Approval under Section 72 under C.164 – File No. D.T.E. 02-53	Filed: 9/17/02 Approval: pending
Massachusetts Department of Environmental Protection – Wetlands and Waterways Regulation Program	Chapter 91 Waterways License	Filed: 12/13/04 Approval: pending
	MADEP Water Quality Certification	To be filed
	Superceding Order of Conditions	To be filed, if required
Massachusetts Coastal Zone Management	Concurrence with Federal Consistency Certification Statement	CZM Review is currently being coordinated
Massachusetts Highway Department	Permit to Access State Highway and Access Agreement	To be filed
Massachusetts Historical Commission: State Archaeologist	Permit for Upland Reconnaissance Archaeological Survey - Permit No. 2246	File: 3/12/03 Approval: 3/28/03
	Permit for Upland Intensive Archaeological Survey – Permit No. 2595	Filed: 9/18/03 Approval: 9/23/03
Massachusetts Board of Underwater Archaeology	Reconnaissance Permit; Excavation Permit	To be filed, if required
REGIONAL		
Cape Cod Commission	Development of Regional Impact Review – File No. JR#20084	Filed: 11/15/01 Approval: pending
	Issuance of DRI	Pending
LOCAL		
Yarmouth Conservation Commission	Notice of Intent	To be filed
	Issuance of Order of Conditions	
Barnstable Conservation Commission	Notice of Intent	To be filed
	Issuance of Order of Conditions	
Yarmouth Department of Public Works (DPW)	Street Opening Permit	To be filed
Barnstable DPW	Street Opening Permit	To be filed

SECTION C:
DESCRIPTION OF THE BIOLOGICAL AND PHYSICAL ENVIRONMENT

C1. GEOLOGY AND SEDIMENT CONDITIONS

Cape Cod extends from southeastern Massachusetts approximately 40 miles (64.4 kilometers) east and then north into the Atlantic Ocean. Martha's Vineyard is located about 5 miles (8 kilometers) south of the Cape, with Nantucket about 25 miles (40 kilometers) south of the Cape and 15 miles (24 kilometers) east of Martha's Vineyard. These sand-rich landforms partially surround and shelter Nantucket Sound, a broad passage of relatively shallow water, from the open Atlantic Ocean. Horseshoe Shoal is located roughly in the middle of Nantucket Sound, between Cape Cod and the Islands. As its name suggests, Horseshoe Shoal is shaped like a horseshoe opening to the east, with a northern leg and a southern leg surrounded by deeper water, as shown on the bathymetric map presented as Attachment A-1.

Geologic Framework

The Project area is within the Atlantic Coastal Plain physiographic province, an area of low-lying generally seaward thickening sediments between the New England uplands and the seaward edge of the continental shelf.

From a geologic perspective, the Cape and Islands are relatively young lands, created largely by glacial and post glacial processes (Oldale, 2001). Advances and retreats of sediment-laden ice toward the end of the Wisconsinian-age glacial stage originally molded the present landscape in the late Pleistocene Epoch about 23,000 to 18,000 years ago. The movements of localized glacial ice lobes may have been influenced by the shape of the underlying lands, with major lobes occupying pre-existing topographic depressions, such as Buzzards Bay, Nantucket Sound, and Cape Cod Bay. Following glaciation, the landscape was further reworked by water-borne sediments during the gradual climatic warming that occurred during the Holocene Epoch.

Bedrock Geology

Bedrock is deep beneath the Cape and Islands, and is not exposed, as it is on the mainland to the west and north of Cape Cod. Bedrock is not mapped beneath Nantucket Sound on the Bedrock Geologic Map of Massachusetts (Zen, 1983). The map indicates that lithified (hard) bedrock beneath Cape Cod is metamorphic feldspathic gneiss and amphibolite of Proterozoic age. In Woods Hole, granite was penetrated at a depth of about 270 feet (82.3 meters); in Harwich, metamorphic rock described as schist was found at a depth of 435 feet (132.6 meters) (Oldale, 2001). A deep boring on Nantucket encountered igneous basalt, which may have been related to Triassic rifting of the early Atlantic Ocean (Oldale, 2001).

Younger non-lithified Cretaceous and overlying Tertiary-age coastal plain sediments are mapped as bedrock beneath Martha's Vineyard and Nantucket (Zen, 1983). Some of these seaward thickening unconsolidated pre-glacial deposits are exposed at Gay Head on Martha's Vineyard, and may have been locally incised beneath Nantucket Sound by ancient pre-glacial drainage patterns.

Twenty-two (22) geotechnical borings have been advanced in and around the Project areas by GZA GeoEnvironmental, Inc., to a maximum depth of 150 feet below the seafloor in three rounds of drilling. Within the Project area, the deepest boring advanced as part of the Project (Boring SB-01, advanced by GZA in August 2003) penetrated 150.3 feet (45.81 meters) of unconsolidated sediments, also well below the AB reflector. No lithified bedrock was encountered in any of the deep borings. The absence of hard bedrock and thickness of soft sediments within the Project area indicates that it is unlikely that rock blasting would be required to build the Project. USGS data indicates depth to bedrock in the vicinity of the Project Area is between 600 and 900 feet below the seafloor. Based upon this information, bedrock appears to be deeper than the maximum Project depth of interest (approximately 85 feet below the seafloor). Seismic acoustic basement was penetrated in boring GZA-SB-02 at approximately 60 feet below the sea bottom within the Project Area. This depth correlates to the top of a gray varved unit of fine sand, silt and clay. Only unconsolidated sediments were encountered below the AB reflector to the boring's drilled total depth of 98.5 feet below sea bottom.

Due to the highly discontinuous nature of the seismic reflectors (which is consistent with glacial outwash), isopach maps indicating sediment thickness were not prepared, as no horizons were found to be sufficiently continuous to allow for isopach mapping.

The geophysical data indicates that an underlying topographic high is present below the depth of glacial and post-glacial sediments beneath Horseshoe Shoal itself. This suggests that the Shoal is a relatively stable structural feature, possibly a pre-glacial coastal plain topographic high, and would be expected to provide a stable underpinning for the Project structures during the life of the Wind Park.

Faults and Historic Seismic Activity

No faults have been identified within the Project area, based upon a review of field data and available technical literature. Ancient faults at depths well below glacial and post-glacial sediments are likely associated with a reported buried Triassic-Jurassic rift basin southeast and outside of the Project area. This basin was probably formed during rifting associated with the early formation of the Atlantic Ocean (Oldale, 2001).

A USGS compilation of known earthquakes over a 300-year period indicates that no earthquake epicenters with estimated magnitudes 3.0 or greater have occurred within 10 miles (16 kilometers) of the Horseshoe Shoal site (USGS, 2001). The Project area is located within Seismic Zone 2A, which encompasses all of southern New England and eastern New York (Uniform Building Code, 1997).

Shallow hazards

With respect to shallow hazards, based upon a review of sub bottom reflection data, a limited area of near-surface gaseous sediment was encountered in the easternmost portion of the Project Area. No WTG was located in that vicinity, and the closest WTG (J6) has been relocated in the layout. This was the only area identified by OSI as having seismic characteristics indicative of shallow gaseous sediments. Gas hydrates which may mask seismic data and cause problems for drilling tend to be associated with sediments in the upper thousands of feet in the Gulf of Mexico, and do not appear relevant to shallow coastal seismic investigations such as those conducted for the Cape Wind Project. However, OSI has examined the data and found there do not appear to be any areas where subsurface gas deposits of significance are present beneath Horseshoe Shoal.

USGS interpretation of potential geologic hazards also showed no gaseous sediments in the vicinity of the Project Area (O'Hara & Oldale, 1987). Other potential shallow hazards include sand waves and exposure to cables; studies addressing these issues have been conducted and are cited in Section C-2.

Glacial and Post-Glacial Geology

During the Wisconsinian glaciation in the Pleistocene, ice blanketed New England reaching as far south as the Cape and Islands (Uchupi et al., 1996; Oldale, 2001). As the glaciers advanced and grew to the south, ice movement pushed a variety of sediments and rocks in front of and beneath the ice. The roughly east-west oriented topographic highs of present-day Nantucket and Martha's Vineyard mark the terminal moraines, or southernmost extent, of two lobes of glacial ice, which began to retreat approximately 18,000 years before present (BP). The topographic highs along the mid-Cape, along which much of Route 6 extends, are recessional moraines that mark the location where the receding ice sheet stalled temporarily.

As the climate gradually warmed during the Holocene Epoch of the last 12,000 years, the glaciers once covering the Cape and Islands continued to melt and retreat. Meltwaters rushed off the ice, transporting and sorting the sediments they carried into the topographic lows south of the moraines, creating generally level outwash plains of stratified drift, and temporary glacial lakes.

A 10-foot (3-meter) thick thinly-bedded stratigraphic unit of fine sand, silt and clay was encountered at approximately 60 feet (18.3 meters) below the sea floor in Boring GZA-SB-02. These types of sediments are described as "varved," and are often associated with glacial lake deposits. This unit, which coincides with the geophysical AB reflector, may indicate deposits from a former glacial lake that temporarily occupied low portions of what is now Nantucket Sound. Boring GZA-SB-02 is located on the inside edge of the northern leg of Horseshoe Shoal, near its inner embayment. Varved sediments were also encountered in several other borings located around the eastern perimeters of the shoal, at depths between approximately 48.5 to 60 feet (14.98 to 18.3 meters) below the seafloor (GZA, 2003). The sediments were not age-dated.

As sea level continued its overall rise during the Holocene Epoch, these unconsolidated glacial sediments continued to be transported, eroded, deposited and reworked by marine, tidal, and wind-driven (aeolian) forces. The sediments provide the raw material for the beaches of the Cape and Islands, which continue to be shaped by currents, storms and tidal marine processes today.

In conjunction with marine cultural resources studies conducted for the Project, as discussed in Section C-10 and (PAL, 2003, 2004b), the potential that Horseshoe Shoal was a previously exposed landform and therefore available for past human occupation and use was assessed. Worldwide and regional studies of sea level rise since the end of the last glaciation indicate different rates of rise in different geographic areas, even within New England. The variability suggests that other factors besides ice melt (such as localized geologic conditions that may include crustal subsidence or rebound) appear to influence sea-level rise. Comparison of the localized sea level curves to others suggest that sea level rose more quickly in southeastern Massachusetts than in other areas, a factor that has been attributed to concurrent crustal block subsidence in this area (Redfield and Rubin, 1962; Oldale and O'Hara, 1980). Other geologic and hydraulic processes, such as intricate meltwater systems and possible impoundment of meltwater behind ice dams, forming glacial lakes, could have also affected post-glacial water levels in Nantucket Sound.

Surface Conditions

A total of 87 vibracores were advanced by ESS/OSI in four sampling rounds (2001, 2003, 2004, and 2005). Shallow sediments obtained from vibracores to maximum depths of 20 feet (6.1 meters) across Horseshoe Shoal were comprised of predominantly medium-grained poorly sorted sands, winnowed of finer material by wave and tidal action. Fine sands and silty sands surround the shoal in deeper waters. Localized fractions of silt, gravel and/or cobbles, consistent with glacial drift, have also been identified in surficial and subsurface sediments in the survey area.

Review of the surficial geophysical data across Horseshoe Shoal indicates a generally sandy seafloor with several areas of sandwaves. A large field of sandwaves extends across the southern half of the Shoal, with several smaller fields located to the north within the Project area. The symmetry of the sandwaves indicates migration to the east or west, depending on where they formed on the shoal. Sandwaves forming on the west flank of the shoal tend to migrate easterly. Sandwaves forming on the east flanks of the shoal tend to migrate to the west. Sandwaves across the crest of the shoal have a symmetrical profile, suggesting an equal force in both the ebb and flood tidal phases.

An area of scattered boulders was identified during the 2003 geophysical survey in an area west and north of the ESP, (OSI, 2003b). Other intermittent glacially transported boulders may also be present within the Project area.

Subsurface sediment conditions along the proposed submarine cable route were found to be consistent with previous surveys and studies, and generally indicate a consistent sandy-type bottom with thin depositional layering. Interpretation of geophysical information about Lewis Bay indicates that sediments there are predominantly sands and silts of variable grain size, with traces of interbedded gravel, clay and shell-hash. Near the landfall, sediments contain a mixture of sand and silt. Near the mouth of Lewis Bay are scattered glacial erratics (boulders) on and just below the sandy surface, as shown on the nautical charts and as observed during the 2003 geophysical survey.

Subsurface Conditions

Geophysical subbottom reflectors are often related to specific stratigraphic units, as the acoustic properties of different types of sediment or rock affect the travel times of the sound waves emitted during remote sensing surveying. Numerous continuous and semi-continuous seismic reflectors were observed in the geophysical data throughout the Project area in both surface and subsurface sediments, suggesting minor horizontal and vertical variations in sediment type and depositional environment. Sections of "boomer" subbottom profile records run over representative WTG locations, correlated with deep borings advanced at the WTG locations (OSI, 2003a). The acoustical subbottom data and stratigraphy identified in the boring logs are consistent with the glacial history of the area. The data indicate that most of the subsurface material contains predominantly fine- to coarse-grained sand interbedded with deposits of clay, silt, shell-hash, gravel and/or cobbles, all derived from glacial outwash. Limited areas of Horseshoe Shoal contained near-surface gaseous sediments derived from organic material, which restrict seismic penetration (i.e., underlying strata are masked). Deeper water areas appear to contain fine-grained marine deposits. Although none of the borings encountered refusal (with the exception of GZA SB-01-2002 at approximately 74 feet, which was drilled with a 300 pound hammer), the presence of occasional large boulders (glacial erratics) on the seafloor indicates there may be occasional boulders in the subsurface. A higher concentration of coarser sediments (gravel to boulders) was noted in the shallow subsurface of the shoal in the northwest portion of the array during the 2005 geophysical survey, which was conducted in an area where WTGs have been relocated as a result of the recent state boundary shift. Coarse materials may also present in the upper 10 feet of the sediment column in areas where boulders are not evident on the seafloor.

Near-surface flat-lying subbottom reflectors indicate layers of recently deposited or reworked bottom-sediments at the near surface. These correspond to the poorly-sorted predominantly fine- to medium-grained sands often encountered in the borings in the upper 20 to 30 feet (6.1 to 9.1 meters) of stratigraphic sections, and may represent marine bar deposits atop Horseshoe Shoal. The relatively high-energy sand-rich deposits reflect the reworking and winnowing of sediments that continues to occur, as tides and wave action form the sand waves and swept surfaces of the shoal (see Section C-2).

Within the embayment between the legs of the shoal, several vibracores encountered what appears to be a correlative (i.e., possibly related) organic layer at depths between 5 and 12 feet (1.5 and 3.6 meters) below the seafloor. This layer was encountered in USGS Vibracore 4939 (O'Hara and Oldale, 1987), 2001 vibracores VC01-G4 and VC01-G7, and 2003 vibracores VC03-04 and VC03-05. The organic material recovered in USGS Vibracore 4939 was age-dated at approximately 6,470 +/- 200 years BP (O'Hara and

Oldale, 1987). Calibration of this date using OxCal Version 3.5 computer software provided a date range of 7,513 to 7,233 years Cal-BP with an 88 percent probability (see PAL, 2004b).

Reconstruction of paleo bathymetry indicates that, as of approximately 7,250 BP (the approximate time of the calibrated age date of the organic material in USGS Vibracore 4939), the easternmost area within the embayment may have contained a possible fresh water kettle pond (see Figure 4.3 in PAL, 2004b). Microscopic analysis of the organic material recovered in three vibracores within or near to this low area found plant assemblages indicative of deposition in or adjacent to a quiet shallow freshwater pond (in VC03-04 and VC01-G4) and a forest floor (in VC03-05) (King, 2003). The associated strata may represent now-submerged paleosols in proximity to freshwater, which are types of environmental settings sensitive for potential archaeological resources, as further discussed in Section C-10.

The discontinuous nature of these organic strata is reflected in the absence of organic material found in VC03-01, which was advanced several hundred feet from VC01-G4. The presence of the organic strata appear to correlate to shallow, highly discontinuous seismic reflectors observed in the "chirp" subbottom data in limited areas in the eastern embayment. The discontinuous nature of now-submerged ancient paleosols is consistent with the extensive disturbance and erosion expected during the high energy conditions that occurred during the Holocene Epoch marine transgression. The presence of these zones in several vibracores in the embayment may reflect greater preservation potential in that more protected area.

Bulk Physical Analyses of Sediment Samples

Sediment samples were submitted for bulk physical analyses. The following geotechnical analyses were performed: sieve analysis (ASTM Method D 422); moisture, ash and organic matter (ASTM Method D 2974); moisture content (ASTM Method D 2216); combined gradation analysis (ASTM Method D 422c); and Atterberg Limits (ASTM Method D 4318).

In brief, sediment collected across Horseshoe Shoal was found to be relatively homogeneous horizontally and at depth, and can be characterized as poorly graded, fine to coarse-grained sand with minimal percentages of silt and gravel. Cores collected in the embayment between the northern and southern legs of the shoal contained higher percentages of fine materials.

Sediment collected along the proposed submarine cable route in Nantucket Sound was similar to the sediment collected across Horseshoe Shoal, and consisted of poorly graded, fine to coarse-grained sand with varying percentages of silt and gravel.

Analytical results indicate the shallow sediments within the Project area are non-plastic and contain predominantly poorly graded sand (well sorted, with little variation in grain size) and silty sand. The bulk physical analysis would be utilized as a basis for design and construction specifications for the Project.

Bulk Chemical Analyses of Sediment Samples

Bulk chemical analyses were performed on selected cores collected from the WTG array area during the 2001, 2003, 2004, and 2005 vibracore program to determine whether disturbed sediments could pose an environmental concern.

Testing was performed for the following parameters using the following EPA analytical methods: Metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel, vanadium, zinc (EPA Method Series 6000 and 7000); PCBs congeners (EPA Method 8082); pesticides (EPA Method 8081); PAHs (EPA Method 8270C); TPH (EPA Method 8100M); and TOC (EPA Method 9060). To assess the relative environmental quality of these sediments, the analytical laboratory results for targeted chemical constituents were compared to established guidelines for marine and estuarine sediments (Long et al., 1995). None of the targeted chemical analytes were detected in the samples above ER-L or ER-M guidelines, where established, for marine sediments.

Studies Completed

- Marine geophysical/hydrographic surveys of the Wind Park, alternative interconnects, and Cape Wind's Scientific Measurement Devices Station (SMDS);
- Collection and characterization of sediment vibracores in 2001, 2003, 2004, and 2005;
- Geotechnical and geochemical analysis of sediment composites from selected vibracores;
- Collection of marine benthic grab samples in 2001, 2002, 2003 and 2005;
- Advancement of 3 borings to a maximum drilled depth of 98.5 feet (30 meters) below sea bottom in 2002; 10 borings to a maximum depth of 150.3 feet (45.81 meters) below sea bottom in August 2003; and 9 borings to a maximum depth of 102 feet (31.09 meters) below sea bottom in October 2003; and
- Sediment transport modeling of a range of current and wave conditions (see Section C-2)

C2. PHYSICAL OCEANOGRAPHIC CONDITIONS

The in-water area within which the Project is proposed is Nantucket Sound, with electric cable installation proposed in waters within Lewis Bay as well. Nantucket Sound is a broad passage of water that separates the south shore of the Cape Cod mainland and the islands of Nantucket and Martha's Vineyard. It is approximately 23 miles (37 km) long (east-west direction), and between 6 and 22 miles (9.7 and 35.4 km) wide. Lewis Bay is a coastal embayment along the south coastline of Cape Cod. It is northeast of Hyannis Harbor, and is separated from Nantucket Sound by Point Gammon and Great Island (see Attachment A-1). Oceanographic conditions for each area are discussed below.

Water Depths/Bathymetry

In general, the bathymetry in Nantucket Sound is irregular, with a large number of shoals present in various locations throughout this glacially formed basin. Charted water depths in the Sound range between one and 70 feet (0.3 and 21.3 meters) at MLLW.

The Proposed Site is located on Horseshoe Shoal, a prominent geological feature in the center of the Sound. Depths on Horseshoe Shoal are as shallow as 0.5-foot (0.15 meters) at MLLW. Measured depths of 60 feet (18.3 meters) at MLLW occur between the northern and southern legs of the shoal.

Water depths between Horseshoe Shoal and the Cape Cod shoreline are variable, with an average depth of approximately 15 to 20 feet (4.6 to 6.1 meters) at MLLW. Along the transmission line interconnection corridor, depths vary from 16 to 40 feet (4.9 to 12.2 meters) at MLLW, with an average depth of approximately 30 feet (9.1 meters) at MLLW.

Water depths in Lewis Bay and Hyannis Harbor are variable, ranging from 8 to 16 feet (2.4 to 4.9 meters) at MLLW in the center of the bay to less than 5 feet (1.5 meters) at MLLW along the perimeter and between Dunbar Point and Great Island. There are three navigation channels in Lewis Bay: the Federal Navigation Channel providing access to Hyannis Inner Harbor; one privately maintained channel into Mill Creek; and one privately maintained channel northeast of Great and Pine Islands.

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The submarine cable system route would extend outside the eastern edge of the federal channel into Lewis Bay, and would then turn east north of Egg Island to make landfall between Mill Creek and the privately maintained channel northeast of Great and Pine Islands. Water depths range from 2 to 16 feet (0.6 to 4.9 meters), with an average depth of approximately 8 feet (2.4 meters). The shallowest portions of Lewis Bay/Hyannis Harbor along this route exist between Great Island and Dunbar Point and at the landfall, with depths of 1 to 4 feet (0.3 to 1.2 meters) at MLLW.

Currents

Currents in Nantucket Sound are driven by strong, reversing, semidiurnal tidal flows. Wind-driven currents are moderate because of the sheltering effect of Nantucket and Martha's Vineyard. Typical tidal heights are in the range of 1 to 4 feet (0.3 to 1.2 meters), with tidal surges of up to approximately 10 feet (3 meters). Times of high and low tides vary across the Sound by up to two hours.

Tidal flow and circulation within the Sound generate complex currents, the directions of which form an ellipse during the two tidal cycles each day. The tidal current flows to the east during the flood tide (incoming) and to the west during the ebb tide (outgoing). Peak tidal currents often exceed two knots (Bumpus et al., 1973). In general, the intensity of tidal flow decreases from west to east.

To characterize site-specific and wind-driven currents at the Proposed Site in Nantucket Sound, analytical models were applied (Woods Hole Group, 2004a), with the results summarized as follows:

- Local changes in tidal current direction occur on Horseshoe Shoal due to its bathymetric features, with currents diverted slightly around the shallowest portion of the shoal.
- Flood currents are generally stronger than ebb currents, and spring tidal currents are approximately 15 to 20% stronger than mean tidal currents.
- Tidal current velocities were calculated to be approximately two feet/second (0.61 m/second) at Horseshoe Shoal.
- Wind-driven current velocities modeled at Horseshoe Shoal were found to be much lower than tidal velocities and concentrated over the crest of the shoal.

Waves

Wave model simulations were performed using the USACE's *Wind Speed Adjustment and Wave Growth* model (USACE, 1992) to estimate significant wave height (i.e., the average height of the highest 1/3 of waves in a sea state); peak period (i.e., the period that characterizes the majority of the waves in a sea state); and peak direction. Generally, the model indicates that Horseshoe Shoal is exposed to the largest waves from the easterly directions. Wind-generated significant wave heights generally range from less than 1 foot to nearly 4 feet (0.3 to 1.2 meters), with relatively short spectral peak wave periods (between 2 and 4 seconds). Using the model results, it was generally found that wave height changes in the shallow portions of the shoal due to wave shoaling and breaking, while wave period remains constant.

In addition, site-specific wave data was collected using an ADCP at the SMDS between April 2003 and September 2004. Wave data recorded at the SMDS between May 2003 and May 2004 indicated the maximum recorded significant wave height (H_s) reached 6.6 feet (2.0 meters) while the maximum wave height (H_m) reached 8.2 feet (2.5 meters). The majority of the wave patterns for the direction sectors had H_s between 1 foot (0.3 meters) and 1.3 feet (0.4 meters). The wave period varied widely depending on whether wind-generated waves (2-6 second periods) or swell (long periods) determined the shape of an individual wave spectrum. Recorded wave periods correlated well with wave height for the modeled wind-generated waves. The highest waves had periods of about 6 seconds, slightly longer (approximately 1 second longer) than periods predicted by wave modeling.

Typically, winds with speeds of 8.8 knots (15 m/s) generated waves with a significant wave height of 3.9 ± 0.7 feet (1.2 ± 0.2 m). This relationship varied slightly, depending on water depth at the time of measurement. Measured waves were approximately 10% higher during the periods of high water.

Salinity
Salinities in Nantucket Sound are near oceanic, and salinity gradients are small due to strong lateral and vertical mixing. River runoff into Nantucket Sound is low, so there is little dilution of ocean waters with fresh water. Surface and bottom water salinities vary seasonally and spatially from about 30 ppt to 32.5 ppt (Bumpus et al., 1973). Surface water salinities throughout the Sound are just over 31 ppt during the summer, and are uniformly about 32 ppt in the winter (Limeburner et al., 1980).

Temperature
The annual cycle of surface water temperatures in Nantucket Sound encompasses a range of about 45° F, from nearly 30° F (-1° C) in the winter to as high as 75° F (24° C) in the late summer (Bumpus et al., 1973). This was confirmed by site specific water temperature data collected at the SMDS between April 2003 and September 2004 which ranged from -1° C in February to 22.5° C in August. Because the Sound is shallow and well mixed, there is little lateral temperature variation and vertical temperature stratification. There is a tendency in the summer for surface water temperature to increase from east to west in Nantucket Sound. In the winter, the gradient is in the opposite direction (Limeburner et al., 1980).

Bottom water temperature varies less and changes more slowly on a seasonal basis than surface water temperature. The highest bottom water temperature in Nantucket Sound during summer is in the range of 61° F to 66° F (16 to 19° C) (Theroux and Wigley, 1998). Warmest bottom water temperatures are near the coast of the south shore of Cape Cod, and temperature decreases with distance offshore. Coolest bottom water temperatures in Nantucket Sound (during winter) are in the range of 32° F to 35.6° F (0 to 2° C), and become warmer with distance from the Cape Cod and Nantucket shorelines.

Sediment Transport Regimes
Modeling has shown that active sediment transport occurs at all of the shoals, even under typical wave and tidal current conditions. There is a net transport of sediment to the east as a result of flood dominated tidal currents. The greatest impact on sediment transport initiation is due to waves. The highest sediment transport rates are focused locally on the shallowest portions of the shoal, and there is relatively little sediment transport in the deeper regions for typical conditions.

Bed load transport (sediment movement along the sea bottom) on Horseshoe Shoal is typically an order of magnitude greater than suspended load transport. This is expected at the Horseshoe Shoal Site, where sediments are relatively coarse (see Section C-1 for more detail on sediment types and characteristics). In addition, the level of wave and energy under typical conditions is not sufficient to lift and suspend large volumes of sediment within the water column.

Ambient Near-Bottom Suspended Sediment Concentrations
Since tidal currents affect large areas, it is appropriate to estimate near-bottom suspended sediment concentrations resulting from tidal action rather than a volume of suspended sediment. The concentration depends on both the wave characteristics (period and height) and the direction at which the waves approach relative to the tidal currents. When the approach of average waves (2.6 second period, 1.6-foot (0.49 meter) height) is aligned with running tidal currents, near-bottom suspended sediment concentrations in Nantucket Sound are estimated to be approximately 71 mg/l. When average waves (2.2 second period, 1.3-foot (0.40 meter) height) approach perpendicular to running tidal currents,

near-bottom suspended sediment concentrations in Nantucket Sound are estimated to be approximately 45 mg/l.

In addition, accepted human activities (such as trawling) result in the creation of increased near-bottom suspended sediment concentrations. The volume of sediment that is injected into the water column by fishing gear, such as an otter trawl, is dependent upon the type of sea floor being disturbed, the nature of the currents in the disturbed area, the rate at which the trawl is towed, and the rate of sediment settling. Churchill (1998) has measured near-bottom total TSS to be up to 1,500 mg/l as a result of trawling operations. With the seafloor conditions found in Nantucket Sound, it is estimated that approximately 1.32 cubic yards (1.01 cubic meters) of suspended sediment is injected into the water column for every foot of commercial trawling.

Studies Completed

- Integrated marine geophysical/hydrographic surveys and geologic/sediment sampling programs were conducted by Cape Wind in 2001, 2002, 2004, and 2005 over Horseshoe Shoal and along the submarine cable system corridor between Horseshoe Shoal and the proposed landfall location in Yarmouth.
- Geophysical Survey - Bathymetric measurements, side-scan sonar data, subbottom data, and magnetometer data were collected within the Project area, including the interconnection route into Lewis Bay.
- Current Measurements – Detailed current measurements were taken using a vessel-mounted Acoustic Doppler Current Profiler (ADCP) at various locations throughout Nantucket Sound, in the vicinity of the Wind Park area. Measurements include current speed and direction at half-meter water depth increments throughout a tidal cycle.
- Sediment Samples – Vibracore and grab samples were obtained for bulk physical characterization of Project area sediments in Nantucket Sound and Lewis Bay, and for use in evaluating benthic habitat. In addition, vibracores were obtained from the proposed landfall location to support preparation of the Project's State 401 Water Quality Certificate.
- Additional site-specific field data was collected on Horseshoe Shoal through the use of continuously recording instrumentation placed on the SMDS, which is installed on the southern edge of the Project area. Data collected included wind direction and speed, wave height and frequency, and current speed and direction.
- Analytical models were applied to characterize wave, current (tidal and wind-driven), and sediment transport processes at the Proposed Site. The modeling and results are described in detail (See Woods Hole Group, 2004a, b). The modeling methods applied by Woods Hole Group are summarized below.
    - **Waves:** An analytical model developed by the USACE (*Wind Speed Adjustment and Wave Growth)* (USACE, 1992) was used to determine wind-generated wave characteristics in Nantucket Sound based on wind information obtained from Nantucket Airport. A shoaling coefficient and wave breaking criteria was applied to the highest wind-generated wave condition modeled for Nantucket Sound to characterize the spatial distribution of wave height over the Proposed Site. In addition, one average ocean swell wave condition was modeled to estimate extreme wave heights and periods for a 2-year, 10-year, 50-year, and 100-year return periods.
    - **Currents:** An empirical analysis based on current ADCP data and historical data was used to determine tidal current speeds and direction for the Proposed Site; and modeling by Woods Hole Group (Trowbridge 2002, Appendix B of Woods Hole Group, 2004a) was used to determine wind-driven currents on Horseshoe Shoal.
    - **Sediment Transport:** A comprehensive analytical two-dimensional sediment transport model was developed by Woods Hole Group based on theory Madsen and Grant 1976 (Appendix C of

Woods Hole Group, 2004a) was used to conduct 26 simulations, addressing a range of current and wave conditions for the Proposed Site. For each condition, the model calculated wave-induced bottom current velocities, near-bottom tidal current velocities, a qualitative representation of where and whether sediment transport would be likely to occur, and quantitative estimates of potential bed load, suspended load, and total sediment transport rates.

- Numerical Model Simulations: A simplified model (using SSFATE modeling techniques) was performed by Applied Science Associates, Inc. (ASA) to simulate physical oceanographic processes within Nantucket Sound and in the vicinity of the Wind Park and potential impacts to those processes from the presence of the WTGs, the ESP, and the burial of the submarine cables. The following analyses were performed by ASA:
  - "Simulation of Sediment Transport and Deposition from Cable Burial in Nantucket Sound for the Cape Wind Energy Project" (ASA, 2005b).
  - "Analysis of Effects of Wind Turbine Generator Pile Array of the Cape Wind Energy Project in Nantucket Sound" (ASA, 2005c).
  - "Estimates of Seabed Scar Recovery from Jet Plow Cable Burial Operations and Possible Cable Exposure on Horseshoe Shoal from Sand Wave Migration" (ASA, 2005d).
- Results of Model Simulations of Sediment Deposition from Cable Burial Operations in Lewis Bay, MA (ASA, 2003a)
- Revised Scour Report – Cape Wind Project Nantucket Sound (ESS, 2006b)
- Conceptual Rock Armor Scour Protection Design – Cape Wind Project Nantucket Sound (ESS, 2006c)
- Memo: Hydrodynamic Analyses of Scour Effects around Wind Turbine Generator Piles, Use of Rock Armoring and Scour Mats, and Coastal Erosion and Deposition (ASA, 2006b)

C3. BENTHIC AND SHELLFISH RESOURCES

Benthic

Macrobenthic organisms (or benthos) include those organisms that live either on or beneath the seabed floor and include worms, crustaceans, small clams, snails, and other macroinvertebrates.

Based on literature reviewed, Nantucket Sound is generally reported as a highly productive area for benthic invertebrates with numbers of benthic organisms typically averaging in excess of 2,000 organisms/m^2 (Theroux and Wigley, 1998). The studies conducted in support of the Project found macroinvertebrate abundances in the Project area averaging 4,180 organisms/m^2 at Horseshoe Shoal during 2001, 7,574 organisms/m^2 across all three of the shoals studied in Nantucket Sound during 2002, and 11,588 organisms/m^2 in the northwest corner of Horseshoe Shoal in 2005. The study conducted within Lewis Bay in 2003 found macroinvertebrate abundances in the Project area averaging 25,350 organisms/m^2. Historically, mesh used to sieve samples may have been larger than that used during the current studies (500 µm) which may have resulted in more organisms being retained on the sieve in the current studies. The benthic faunal diversity (i.e., numbers of species and numbers of individuals per species) in Nantucket Sound is reported to be lower than diversity in the rest of the Southern New England Shelf (Theroux and Wigley, 1998).

The sandy substrate of Nantucket Sound is dynamic and mobile, as indicated by ripple marks and sand waves. The magnitude and frequency of sand movements has a marked influence on the structure and abundance of the benthic communities. Organisms living on or in these sandy sediments are adapted for movement or settlement in sand and recovery from natural burial.

Literature reviewed indicates that the most abundant taxa (taxa is defined in this document as either a distinct species or a group of similar species in the same genus, family, or order based on the level of taxonomic identification employed) in the Nantucket Sound benthic fauna are crustaceans and mollusks, followed by polychaete worms (Avery et al., 1996). Among the crustaceans, amphipods are reported to be by far the most abundant. The sandy sediments of Nantucket Sound are reported to support a diverse assemblage of amphipod species. Samples collected from the offshore waters during 2002 were dominated by Nematoda (roundworms) comprising (by number) 45% of the macroinvertebrate communities sampled from Horseshoe shoal (ESS Group, 2002, Table 4).

Bivalves are reported to be the most abundant and diverse of the mollusks, while Gastropods (snails) are also reported to be common (Pratt, 1973). According to MDMF (2001), there is reported to be a heavily populated area of northern quahog (*Mercenaria mercenaria*) in the shoals east of Horseshoe Shoal. Bay scallops (*Argopecten irradians*) are reported to occur in shallow waters of Nantucket Sound, primarily in areas near seagrass beds. Also, two species of large gastropod whelks (*Busycotypus canaliculatum* and *Busycon carica*) are reported to be quite abundant in the coastal waters of Nantucket Sound (Davis and Sisson, 1988). While the sampling program in 2001 was not specifically designed to capture these larger sized commercial shellfish species, the sampling program was modified in 2002 to ensure that the larger organisms that might occur deeper in the sediment would be accounted for in the analysis (see ESS Group, 2002). None of these mollusk taxa were identified in the samples collected from the Project area during the benthic resource studies conducted in 2001 or 2002 (ESS Group, 2001b;2002). In 2003, a shellfish survey was conducted in Lewis Bay to specifically locate larger mollusks in the vicinity of the Project's landfall (ESS Group, 2003b). Northern quahogs were documented in the near shore areas associated with the Town of Yarmouth shellfish beds.

The annelid fauna of Nantucket Sound is also reported to be diverse (Theroux and Wigley, 1998). Maurer and Leathem (1981) identified 333 species of polychaete worms in sandy sediments from Georges Bank and Nantucket Shoals. Many of these species occur in the deeper waters of Nantucket Sound. Biomass is reported to be lower in shallow areas of Nantucket Sound (Theroux and Wigley, 1998). This is most likely due to the unstable sandy sediments in these shallow waters. Annelids, particularly the Polychaeta, were extremely abundant and diverse in the samples collected during 2001 (37 taxa identified) and 2002 (29 taxa identified) (ESS Group, 2001b; 2002).

Throughout the assessment of the Nantucket Sound benthic community, an obvious link between depth, sediment type, and macroinvertebrate community diversity was observed. However, the data also showed that there was no such link between these variables and overall macroinvertebrate abundance. The only microhabitat variable investigated that was shown to significantly ($P<0.10$) affect macroinvertebrate abundance was the presence or absence of sand waves.

Shellfish

Massachusetts Division of Marine Fisheries (MDMF) research trawl survey data was obtained from trawl locations within Nantucket Sound. The analysis of the MDMF research trawl data at the Wind Park site on Horseshoe Shoal by season indicated that channeled whelk was considered very common in the spring and variably common in the fall from trawls on Horseshoe Shoal. The knobbed whelk was considered very common in trawls from Horseshoe Shoal in the fall, but less common in the spring. Lady crab and spider crab were considered very common from trawls on Horseshoe Shoal during both the spring and fall. Shellfish species that were considered rare, very rare, or not observed in trawls from Horseshoe Shoal include American lobster, bay scallop, Atlantic surf clam, blue mussel, and northern horse mussel.

SECTION C:
DESCRIPTION OF THE BIOLOGICAL AND PHYSICAL ENVIRONMENT

Commercial Shellfish Resources in Nantucket Sound

Various species of shellfish are harvested commercially from Nantucket Sound. Shellfish species harvested in this area include mussels, quahogs, bay scallops, surf clams, soft shell clams, and conch. Conch is the generic term for various species of whelk such as the knobbed whelk, channeled whelk, and lightning whelk, which are common gastropods in the Sound. Data provided from NMFS vessel trip reports suggest that various species of conch are an important fishery in Nantucket Sound. For any given year from 1994 through 2004, the conch species constituted more than 81% of the total annual shellfish landings (see ESS Group and Battelle, 2005). Total annual shellfish landings ranged from lows of approximately 10,000 pounds to highs of approximately 448,000 pounds during this 10-year period.

MDMF monitors the fish pot fishery for conch in Nantucket Sound separately from shellfish harvested using other methods such as rakes or various shellfish dredges. Catch reports for conch were not required prior to 1992; therefore, landings prior to this year were not available for review. The MDMF data suggest that conch landings from fish pots have shown a general decline from 1992 through 2004. Fishing pressure, as gauged by the number of licenses issued, appears to have declined over the years as well (i.e., 47 licenses in 1993-1995 to 28 licenses in 2004), however it should be noted that the trend in licenses alone may not be completely representative of fishing pressure.

MDMF annual landings from 1990 through 2004 total approximately 27.1 million pounds. Sea clams appear to be the most common species harvested over the 15-year period in Nantucket Sound, constituting approximately 47.35% of the total shellfish landings reported to MDMF for this time period. Mussels are the second most common species of shellfish harvested, constituting 31.74% of the total landings reported to MDMF over this time period. The various species of conch harvested from Nantucket Sound, using methods other than fish pots (discussed above) from 1990 through 2004, account for 14.03% of the total landings. Quahogs (ocean quahogs, mixed quahogs, and littlenecks), bay scallops, sea scallops, and soft shell clams account for less than 7% of the total shellfish landings from 1990 through 2004.

Although northern quahogs (*Mercenaria mercenaria*) seem to account for a low percentage of commercial shellfish landings in Nantucket Sound, they are reported as abundant in shallow coastal estuaries that empty into Nantucket Sound (MacKenzie, 1997) and are an important fishery within Massachusetts (MDMF, 2001). In 2001, MDMF instituted a regulated permit for this species. According to MDMF staff (MDMF, 2001), a heavily populated northern quahog area exists in the shoals to the east of Horseshoe Shoal. This area is referred to as the "quahog grounds," and is specifically targeted by commercial fishers (MDMF, 2001).

Bay scallops (*Argopecten irradians*) occur in shallow waters of Nantucket Sound, primarily in areas near seagrass beds. According to MDMF (2001), bay scallops are a negligible fishery within Massachusetts. However, sea scallops (*Placopecten magellanicus*) are a commercially viable species reportedly occurring offshore in the Mid-Atlantic, Georges Bank and the Gulf of Maine with the area of greatest abundance being Georges Bank (Packer et al., 1999).

As presented in detail in ESS and Battelle (2005), approximately 27.1 million pounds of shellfish were harvested from Area 10, Nantucket Sound from 1990 through 2004 with sea scallops (without shells) comprising approximately 0.002% (~413 total lbs landed) of the total shellfish landings in Nantucket Sound reported to MDMF. There is no evidence of a viable commercial fishery for scallops within Nantucket Sound.

SECTION C:
DESCRIPTION OF THE BIOLOGICAL AND PHYSICAL ENVIRONMENT

American Lobster Fishery in Nantucket Sound

The American lobster (*Homarus americanus*) is found throughout New England, and a commercial fishery for this species exists in all coastal states from Delaware to Maine. Commercial permits for American lobster are issued for both inshore fishermen (within the 3-nautical mile (5.6 km) territorial limit) and offshore fishermen (outside of the 3-nautical mile (5.6 km) territorial limit). There are 14 areas designated by MDMF in the nearshore waters of Massachusetts for reporting lobster catch. The Project area lies within MDMF Area 10, which encompasses Nantucket Sound.

A relatively small lobster fishery exists within the waters of Nantucket Sound. McBride and Hoopes (1999) report that the Area 10 lobster fishery supplied only 0.4% (of nearly 10 million pounds) of the total Massachusetts inshore waters harvest in 1999. The yield from adjacent areas (Areas 9 and 11-14) was low, with each contributing less than 4% of the total harvest. Areas 2 through 8, along the northern coast above Cape Cod Bay, overwhelmingly produced the highest catches.

Total lobster landings for Area 10 from 1990 through 2004 are estimated at approximately 457,000 pounds, or an annual average of approximately 31,000 pounds. From 1990 to 1993, lobster landings increased from 8,000 pounds to approximately 50,000 pounds. Landings declined again in 1994 and 1995, appeared to climb in 1996 and 1998, but declined to below 20,000 pounds in 2000, the lowest landings observed since 1992. Lobsters migrate inshore and offshore with response to changes in water temperature. Therefore, although the commercial season for lobster is open year round in Nantucket Sound, peak landings occur during the summer months from June through August and into September when water temperatures are warmer and lobsters are likely to be more abundant in the relatively shallow waters of Nantucket Sound.

Shellfish Resources in Nearshore Areas

Nearshore areas, including Lewis Bay where cable landfall is proposed, contain many shellfish resources and are utilized for both commercial and recreational shellfishing (See ESS Group, 2003a for a detailed field assessment of Lewis Bay). Shellfishing activities in Massachusetts are mainly managed through local shellfish constables within each town.

The small portion of the submarine cable route within Town of Barnstable jurisdiction is primarily in the outer portions of Lewis Bay and offshore where there is no substantial commercial or recreational shellfish harvesting or aquaculture activity (Marcotti, 2002). This portion of Lewis Bay contains some quahogs, scallops, and soft shell clams. Some scalloping activity occurs in the vicinity of Egg Island, and the Town is considering opening up some of the offshore areas for quahog harvest (Marcotti, 2002). There are no shellfish propagation projects or privately-licensed shellfish grants in this outer portion of Lewis Bay within Town of Barnstable jurisdiction (Marcotti, 2002).

Lewis Bay contains hard shell clams/quahogs (*Mercenaria mercenaria*), soft shell clams (*Mya arenaria*), scallops, and a limited number of eastern oysters (*Crassostrea virginica)*. Quahogs are, by far, the most prevalent shellfish species in Lewis Bay. Most of these resources occur in Lewis Bay in areas managed through the Town of Yarmouth's shellfish propagation program or in privately licensed shellfish grant areas (Caia, 2002). Lewis Bay is utilized for both commercial and recreational fishing.

The Town of Yarmouth has several designated recreational shellfish areas that are open only for recreational purposes to Town residents. The proposed submarine cable route coincides with approximately 600 feet (183 meters) of the designated recreational shellfish area in Lewis Bay. This shellfish area is a summer relay area for the depuration of contaminated shellfish from Fall River and Mount Hope Bay. The Town of Yarmouth does have a second summer relay area located in Lewis Pond, outside of the Project area. Contaminated shellfish are typically relayed to these designated areas by mid-June and are required to remain there for a period of one year, during which harvesting from these areas is prohibited. Recreational harvesting in these areas occurs every other year corresponding to the cycle and schedule of relay activities (Caia, 2002).

There are also several privately licensed shellfish areas or grants in Lewis Bay that are managed or farmed privately for certain species of shellfish. None of these grants is located within the direct path of the proposed submarine cable route.

Studies Completed

Comprehensive benthic field investigations were conducted by the Applicant in support of the Project in addition to a literature review of benthic conditions within Nantucket Sound and agency consultations. As an initial step, benthic fauna data available for Nantucket Shoals and Georges Bank were obtained and reviewed by Battelle (2001). While a wide range of existing data and reports were available for many areas within Nantucket Sound, recently collected data were found to be somewhat limited, particularly in the Project area. Therefore, the Applicant conducted four separate field surveys in the Project area:

- 2001 Benthic Macroinvertebrate Field Sampling Program (ESS, 2001b)
- 2002 Benthic Macroinvertebrate Field Sampling Program (ESS, 2002)
- 2003 Shellfish and Benthic Macroinvertebrate Survey of Lewis Bay (ESS, 2003a)
- 2005 Benthic Macroinvertebrate Field Sampling Program

C4. FINFISH RESOURCES AND COMMERCIAL/RECREATIONAL FISHERIES

Finfish Resources

The waters of Nantucket Sound support a diverse fish community. Both commercial and recreational fishing are conducted in the Sound. During the summer months, a temperature gradient forms off the east coast of Cape Cod that demarcates the cold-water fishes to the north and warmer water fishes to the south (Freeman and Walford, 1974). Due to its geographic location and the temperature gradient observed along Cape Cod, Nantucket Sound serves as a migratory pathway for many warm-water species that pass through the Sound moving into Cape Cod Bay and Massachusetts Bay. The area also serves as a northern border for several summer migrants including scup, northern fluke and black sea bass.

Massachusetts Division of Marine Fisheries (*MarineFisheries*) has conducted bi-annual bottom trawl surveys within Massachusetts' territorial waters (including both state and federal waters in Nantucket Sound) during the spring and fall since 1978. Spring surveys are conducted in May and fall surveys are conducted in September. The surveys are timed to coincide with seasons when either adults or juveniles are available inshore. Trawls are conducted using otter trawls and consist of 20-minute tows at a speed of 2.5 knots. The net contains a 6.4 mm cod end liner to retain smaller juveniles. The objective of this sampling, the east coast's longest ongoing inshore survey, is to obtain fishery independent data on the distribution, abundance, size and age composition of finfish as well as some crustaceans and mollusks (http://www.mass.gov/dfwele/dmf/programsandprojects/ resource).

The *MarineFisheries* research trawl survey dataset is one of the most complete datasets available to characterize finfish resources in the Project area and was used to provide an understanding of finfish resources in the Project area. It is important to note that the timing of the surveys (May and September) does not allow the surveys to represent the abundance and distribution of finfish over the entire year, but is timed to coincide with seasons when either adults or juveniles are available inshore. Additionally, the gear type (otter trawls) and methods used during the survey are similar to gear used by commercial fishermen and are more effective at collecting demersal and semi-pelagic species. True pelagics (i.e., Atlantic mackerel) and highly migratory species such as bluefin tuna are not frequently caught in bottom trawls and may therefore be under-represented in the *MarineFisheries* resource trawl data. Despite these limitations, *MarineFisheries* resource trawl surveys represent the best long-term monitoring data for this area and provide seasonal finfish data when adults or juveniles are available inshore. *MarineFisheries* staff use the survey information to prepare scientific reports and give technical presentations to fishery managers for use in developing policies governing the use and protection of fishery resources (http://www.mass.gov/dfwele/dmf/programsandprojects/resource).

Trawl data from 1978 through 2004, a 27-year period, were obtained from *MarineFisheries* for all of Nantucket Sound. Data fields obtained included catch number, pounds, species, and location. Size composition data were not requested.

A total of 122 species were observed in the bi-annual resource trawl dataset in Nantucket Sound between 1978 and 2004. The spring surveys collected 74 species and the fall surveys collected 105 species over the 27-year sampling period. Total annual fall catch numbers were higher than total annual spring catch numbers; however, total annual fall catch weight was lower than total annual spring catch weight over the 27-year period. This is likely due to the large presence of juveniles that typically pass through Nantucket Sound in the fall (ESS and Battelle, 2005).

The finfish and squid species that were in the top 10 for catch weight or catch number during the two seasons included Atlantic herring, bay anchovy, black seabass, butterfish, little skate, longfin squid, northern searobin, scup, smooth dogfish, striped anchovy, summer flounder, tautog, windowpane, winter flounder, and winter skate. The life history of these species as well as key fish species (EFH managed species, ASMFC managed species, commercially and recreationally-important species, and forage species) are described in detail in ESS (2005b).

Commercial Fisheries

Both federal and state agencies monitor certain commercial fishing activities within Nantucket Sound. NOAA Fisheries monitors federally-permitted commercial fishing activities in all coastal states throughout the United States. The Commonwealth of Massachusetts monitors state-permitted commercial fishing activities in its coastal waters for certain fisheries and gear types. Federal (NOAA Fisheries) and state agencies (*MarineFisheries*) responsible for collecting commercial fishing data in Massachusetts collect both independent and overlapping data and the mechanisms for collecting data are different. NOAA Fisheries uses a trip-based report and all species and gear types are surveyed, but for federal permit holders only. *MarineFisheries* uses an annual report system and a gear-based report, but only collects information on certain fisheries (lobster, striped bass, fish weir, gillnet, fish-pot (sea bass, scup & conch) and shellfish).

NOAA Fisheries Commercial Vessel Trip Report Data

From 1994 through 2004, approximately 7.8 million pounds of commercial finfish and squid landings subject to federal VTR reporting were harvested from Nantucket Sound (NMFS vessel trip report data for area 075). Squid, both *Loligo* and *Illex*, are important commercial fisheries in this region and are reported with the finfish landings. Of the species reported on NMFS VTRs, the top ten species of finfish and squid harvested by commercial fishermen in Nantucket Sound (Sub-area 075) from 1994 through 2004, included *Loligo* squid, Atlantic mackerel, summer flounder, black sea bass, scup, squid (species not specified), menhaden, *Ilex* squid, winter flounder, and butterfish (ESS and Battelle, 2005).

Gear types reported on VTRs for the harvest of finfish and squid species in Nantucket Sound from 1994-2004 included otter trawls, weirs, dredges, seines, various types of pots/traps, as well as hand lines. Finfish landings reported for the specific gear types from NMFS vessel trip reports indicate that the greatest landings were from otter trawls (ESS and Battelle, 2005).

MarineFisheries Commercial Fisheries Data

MarineFisheries has been collecting commercial landings and catch and effort data for over thirty years. Data collection efforts focus on certain fisheries: lobster, shellfish, striped bass, fish weir, gillnet, and fish-pot (sea bass, scup & conch). A summary of reported commercial catch results for these fisheries is provided below and described in detail in ESS and Battelle (2005).

- Fish Weir Fishery: Between 1992 and 2004, only three to five fishermen subject to annual state catch reporting requirements reported using fish weirs in Nantucket Sound for each of these years. Total state-reported landings from the fish weir fishery in Nantucket Sound from 1990 through 2004 are estimated at 13.7 million pounds, averaging approximately 913,000 pounds per year. Atlantic mackerel, squid and scup are the most common species reported to be harvested from fish weirs.
- Gill Net Fishery: Few fishermen subject to annual state catch reporting requirements participated in the state gill net fishery in Nantucket Sound between 1990-2004. For most years, no gill netting was reported on state catch reports in Nantucket Sound. One fisherman reported using gill nets in 1992, 1995, 1999 and 2002 and three fishermen reported using gill nets in 1993 in Nantucket Sound. Given the low gill net fishing effort, the total landings from the state-permitted gill net fishery in Nantucket Sound totaled only approximately 195 thousand pounds. Dogfish, monkfish and Atlantic mackerel are the most common species reported in state catch reports to be harvested from fish gill nets.
- Fish Pot Fishery: The state-permitted fish pot fishery includes the conch, black sea bass and scup pot fisheries. State-reported conch landings from fish pots between 1992 and 2004 totaled approximately 14.6 million pounds for Nantucket Sound. State-reported sea bass landings from fish pots from 1990 through 2004 totaled approximately 2.8 million pounds for Nantucket Sound. State-reported scup landings from fish pots totaled approximately 1.3 million pounds from 1994 to 2004 for Nantucket Sound.
- Striped Bass Fishery: The state-regulated commercial fishery for striped bass in Nantucket Sound is a hook and line fishery only and the season runs from mid July to mid August. Total state-permitted striped bass landings sold to market for Nantucket Sound from 1990 through 2004 were approximately 574 thousand pounds.
- Shellfish Landings: State-regulated shellfish species harvested from Nantucket Sound from 1990 through 2004 included bay scallops, ocean quahogs, mixed quahog species, cherrystones, littlenecks, mussels, sea clams, sea scallops, soft shell calms, and conch. The total annual landings for shellfish species required to be reported to the state in Nantucket Sound from 1990 through 2004 totaled approximately 27.1 million pounds. Sea clams appear to be the most common species reported by state permitees over the fifteen-year period in Nantucket Sound.
- Lobster Landings: The season for commercial lobstering with pots in Massachusetts' waters is open year long. Approximately 457 thousand pounds of lobster were reported harvested by state permit holders from Nantucket Sound between 1990 and 2004.

Commercial Fishing Telephone Survey

Additional information about commercial fishing activities in Nantucket Sound was gathered by surveying 18 commercial fishermen who have reported landings in Nantucket Sound on federal vessel trip reports (VTRs) or state catch reports over the past five years. The 18 commercial fishermen surveyed reported that they managed or owned a total of 21 boats, mostly with Massachusetts homeports. Most (16, or 72 percent) of the surveyed commercial fishermen hauled mobile gear, with the majority on trawlers (13, or

81 percent of the mobile gear fishermen). Three used hook and line. The remaining 5 fishermen used fixed gear, including 4 fishermen using pots and traps, and one using gill nets. In order of diminishing frequency, the 18 surveyed commercial fishermen reported their 21 boats fished in Nantucket Sound for scup, squid and fluke (summer flounder), sea bass, conch, tautog (blackfish), stripers and bluefish (ESS, 2006a).

Recreational Fisheries

Because of its location adjacent to several key vacation destinations (i.e., Cape Cod, Nantucket, and Martha's Vineyard), Nantucket Sound and the waters around the islands of Nantucket and Martha's Vineyard support a diverse array of recreational fishing activities. The recreational fishing pressure for Nantucket Sound is highest during the warmer months (i.e., June through September) when tourists are vacationing locally. NMFS collects data on recreational fishing using the marine Recreational Fisheries Statistics Survey (MRFSS), which attempts to capture information on the numbers of individuals participating in the various types of recreational fisheries (i.e., hook and line, charter boat, private boat, etc.), the number of trips and hours spent fishing by the anglers, social and economic information of the anglers, as well as the numbers and species of fish caught. Recreational data, as summarized from the MRFSS, was obtained from 1990 through 2004 for the three counties surrounding Nantucket Sound: Nantucket, Dukes, and Barnstable (ESS and Battelle, 2005). This information provides an estimate of the proportion of individuals participating in recreational fishing activities. It is important to note that of those individuals interviewed by NMFS in these three counties, only a portion would have been engaged in recreational fishing activities in Nantucket Sound because these surveys likely include anglers engaged in fishing activities offshore, in waters further out on the Cape, further offshore to the south of Nantucket and Martha's Vineyard, or even in portions of Buzzards Bay.

The majority (99.7%) of recreational anglers surveyed reported hook and line as gear type used for recreational fishing activities, and most recreational anglers reported fishing from a private/personal or rented boat as the type or mode of recreational fishing. The number of anglers reporting the use of party/charter boats was much lower than those reporting the use of private boats or fishing from shore.

Common species caught by the recreational anglers (fishing from private boats and from shore) surveyed by NMFS interviewers included bluefish, Atlantic mackerel, scup, striped bass, winter flounder, and summer flounder. From 1990 through 2004, the number of individual fish that anglers reported catching appears to have increased.

Eight recreational fishermen were interviewed during a walk-up intercept survey in August of 2005. These fishermen reported that they primarily target striped bass and bluefish when fishing in Nantucket Sound. Two of the eight surveyed (or 25 percent) of the recreational fishermen reported fishing on Horseshoe Shoal (ESS, 2006a).

Essential Fish Habitat Assessment

Habitat within the Project area has been designated EFH for 17 federally managed fish and three federally managed invertebrates. Therefore, the Magnuson-Stevens Act requires the assessment of potential impacts to the 17 federally managed fish and three federally managed invertebrates, which include: Atlantic cod (*Gadus morhua*), scup (*Stenotomus chrysops*), black sea bass (*Centropristis striata*), winter flounder (*Pseudopleuronectes americanus*), windowpane (*Scophthalmus aquosus*), summer flounder (*Paralichthys dentatus*), yellowtail flounder (*Limanda ferruginea*), Atlantic butterfish (*Peprilus triacanthus*), Atlantic mackerel (*Scomber scombrus*), blue shark (*Prionace glauca*), shortfin mako shark (*Isurus oxyrhinchus*), bluefin tuna (*Thunnus thynnus*), king mackerel (S*comberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), cobia (*Rachycentron canadum*), little skate (*Leucoraja erinacea*), winter skate (*Leucoraja ocellata*), long-finned squid (*Loligo pealei*), short-finned squid (*Illex illecebrosus*), and the surf clam (*Spisula solidissima*). Only one EFH "Habitat of Particular Concern" (HAPC's) has been identified in the Project area[1]. Eelgrass beds, when located within summer flounder EFH, have been designated as HAPC's by MAFMC. See ESS and Battelle (2004) for a detailed EFH Assessment.

Studies Completed

- Finfish Resources and Commercial/Recreational Fisheries - Available data from studies published by NMFS, *MarineFisheries*, and others for Nantucket Sound were reviewed and prioritized with regard to applicability to the Project. The primary sources of information used to characterize fisheries in Nantucket Sound are summarized below.
    - NOAA Fisheries Commercial VTR Data
    - *MarineFisheries* Commercial Data
    - NOAA Fisheries Recreational VTR Data
    - NOAA Marine Recreational Fisheries Statistics Survey
    - *MarineFisheries* Resource Trawl Data
- Draft Fisheries Report – Cape Wind Energy Project (ESS and Battelle, 2005).
- EFH Assessment (ESS and Battelle, 2004).
- Recreational Intercept Survey (Battelle, 2003).
- Survey Of Commercial And Recreational Fishing Activities in Nantucket Sound (ESS, 2006a).
- Additional Life History Descriptions for commercially and Recreationally Important Species and Forage Species (ESS, 2005b).

C5. PROTECTED MARINE SPECIES

Federally Protected Species

Species covered in this section include those marine animals that are protected under Federal and Massachusetts Endangered Species Acts and the Marine Mammal Protection Act (MMPA) (16 U.S.C. §§ 1361 *et seq.*). The following three federally endangered species of cetaceans may occur in the Nantucket Sound area and could potentially be impacted by the Proposed Project: humpback whales (*Megaptera novaeangliae*), fin whales (*Balaenoptera physalus*), and North Atlantic Right Whales (*Eubalaena glacialis*) (NOAA Fisheries Service, 2002).

Most whales are found in areas where their primary food source can be easily located. The primary feeding grounds for many whales are located further offshore from Nantucket Sound at Stellwagen Bank, in Cape Cod Bay, and in the Gulf of Maine. The bathymetric and oceanographic features that favor dense aggregations of whale prey species are not developed in Nantucket Sound to the same extent that they are farther north, around Stellwagen Bank, Jeffreys Ledge, Browns and Bacaro Banks, and in the Great South Channel (Kenney and Winn, 1986). Historically and at present, Nantucket Sound does not appear to be an important area for these species of whales (See ESS and Battelle, 2006a).

The following three federally endangered or threatened species of marine reptiles are known to occur in Nantucket Sound: loggerhead turtles (*Caretta caretta*), Kemp's ridley turtles (*Lepidochelys kempii*), and leatherback turtles (*Dermochelys coriacea*) (NOAA Fisheries Service, 2002). Loggerhead turtles and leatherback turtles can be expected to be present in Nantucket Sound when water temperatures are favorable, from early summer through late fall. Leatherbacks are more commonly reported in Massachusetts waters than other sea turtle species, and densities are likely associated with inshore concentrations of jellyfish. Kemp's ridley turtles occasionally visit Massachusetts waters, and are known

[1] http://www.nero.noaa.gov/ro/doc/list.htm

to be stunned by cold water in Cape Cod Bay during fall and winter months. Because Kemp's ridley turtles have been observed feeding in shallow waters of Vineyard Sound and Buzzards Bay in summer months, they may also be present in Nantucket Sound during the summer and fall. Additional detail on these federally protected species that may occur in Nantucket Sound can be found in the Biological Assessment (See ESS and Battelle, 2006a).

The federally protected green sea turtle (*Chelonia mydas*) is less likely to be found within Nantucket Sound. The range of the green turtle in the continental United States extends from Massachusetts to Texas. However, as the green turtle is typically a tropical and subtropical species, the occurrence of this species north of Virginia during any month of the year is considered unusual (NOAA 2002; Thompson 1988). Green turtles are typically considered stragglers when found in New England waters (USFWS 2006). Therefore, in comparison to other species that may be seasonally observed in Nantucket Sound (i.e. loggerhead, Kemp's ridley, and leatherback turtles), the green turtle is the least likely to be observed in Nantucket Sound.

State Protected Species
State-listed rare species are protected under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 1331A) and its implementing regulations (321 CMR 10.00) and the Massachusetts Wetlands Protection Act (WPA) (M.G.L. c. 131, s.40) and its implementing regulations (310 CMR 10.00). The same three federally endangered species of cetaceans (humpback whales, fin whales, and North Atlantic right whales) are also state-listed endangered species. The same four federally endangered or threatened species of marine turtles (loggerhead, Kemp's ridley, leatherback, and green) are also state-listed threatened or endangered species and may seasonally occur in Nantucket Sound. (See ESS and Battelle, 2006b for additional detail on these federally and state-protected species)

The gray seal (*Halichoerus grypus*) which was previously listed as a Massachusetts Species of Special Concern is no longer listed as a state species of special concern. The gray seal is, however, still protected under the Marine Mammal Protection Act and is common in the waters of Nantucket Sound. Gray seals have known year-round breeding and pupping grounds in Nantucket Sound at Monomoy and Muskeget Islands (approximately 10.5 nautical miles (19.4 km) and 7.0 nautical miles (13 km), respectively, from the Wind Park site). Though Monomoy and Muskeget islands have been identified as habitat for year-round breeding populations (Waring et al., 2006), winter and spring use of these areas is highest (NHESP, 2002). Since there is no defined migratory behavior for gray seals, a large portion of the population may be present in Nantucket Sound year-round, although the actual numbers are not as plentiful as harbor seals. Generally, there is some adult seal movement north during spring and summer out of Nantucket Sound to the waters of Maine and Canada for pupping, as seen with harbor seals (Waring et al., 2001). During summer and winter avian surveys conducted by Cape Wind, several hundred gray seals were observed on sandbars in the Muskeget Island area. (See ESS and Battelle, 2006b for detailed information on the gray seal)

Marine Mammals
In addition to ESA/MESA-listed marine mammals, several other species of marine mammals may occur in the waters of Nantucket Sound that are protected under the MMPA. These species include the harbor seal, harp seal, hooded seal, white-sided dolphin, striped dolphin, common dolphin, harbor porpoise, long-finned pilot whale, and minke whale.

Harbor Seal
Harbor seals (*Phoca vitulina concolor*) pup in New Hampshire, Maine, and Canadian waters in the spring and summer, but many juveniles overwinter in Nantucket Sound, and adults may be found in the Sound

year round. Tuckernuck and Muskeget Islands (approximately 8.5 nautical miles (15.7 km) and 7.0 nautical miles (13 km), respectively, from the Wind Park site) are important haul-out sites for harbor seals. These islands in Nantucket Sound serve as important overwintering habitat for this species. (See ESS and Battelle, 2006b for detailed information on harbor seals).

Harp Seal

The harp seal (*Phoca groenlandica*) occurs throughout much of the North Atlantic and Arctic Oceans, and in recent years, has been sighted in winter and spring months at the extreme southernmost reaches of its range from mid-Atlantic waters through New England (Waring et al., 2006). Existing data are insufficient to estimate harp seal abundance in U.S. waters (Waring et al., 2006). Given their distribution range, harp seals have the potential to occur in Nantucket Sound. Annual harp seal strandings are increasing and 437 of 1,265 reported strandings occurred in Massachusetts in 1997-2003 (Waring et al., 2004 and 2006). The harp seal is not listed as threatened or endangered under the ESA, and it is not considered a strategic stock under the MMPA.

Hooded Seal

The hooded seal (*Cystophora cristata*) occurs throughout much of the north Atlantic and Arctic Oceans, in deeper water than harp seals are typically found. Hooded seals are highly migratory, and have been sighted as far south as Puerto Rico. In recent years, they have been sighted with increasing frequency in waters from Maine to Florida, in the winter and spring months (Waring et al., 2006). Existing data are insufficient to estimate hooded seal numbers in U.S. waters (Waring et al., 2006). Given their distribution range, it is possible that hooded seals could occur in Nantucket Sound. The hooded seal is not listed as threatened or endangered under the ESA, and it is not considered a strategic stock under the MMPA.

Atlantic White-sided Dolphin

The Atlantic white-sided dolphin (*Lagenorhynchus acutus*) occurs in temperate and polar waters in the North Atlantic, typically over the continental shelf to the 100-meter (328-foot) isobath. The Gulf of Maine stock ranges from Hudson Canyon to Georges Bank, and in the Gulf of Maine to the Bay of Fundy (Waring et al., 2006). The best available estimate for the abundance of the Gulf of Maine stock of Atlantic white-sided dolphins is 51,640 based on a 1999 survey, with a minimum population estimate of 37,904 (Waring et al., 2006). Given their distribution range, Atlantic white-sided dolphins have the potential to occur in Nantucket Sound. The Atlantic white-sided dolphin is not listed as threatened or endangered under the ESA, and it is not considered a strategic stock under the MMPA.

Striped Dolphin

The striped dolphin (*Stenella coeruleoalba*) is distributed worldwide in temperate, tropical, and subtropical seas. In the western North Atlantic, striped dolphins occur from Nova Scotia south into the Caribbean and the Gulf of Mexico, frequently in continental shelf waters along the 1,000-meter (3,281-foot) isobath (Waring et al., 2006). The best available estimate for the abundance of the western Atlantic striped dolphin based on surveys from 2004 is 94,462, with a minimum population estimate of 68,558 (Waring et al., 2006). Given their distribution range, it is possible that striped dolphins could occur in Nantucket Sound. The striped dolphin is not listed as threatened or endangered under the ESA, and it is not considered a strategic stock under the MMPA.

Common Dolphin

The common dolphin (*Delphinus delphis*) is distributed worldwide in temperate, tropical, and subtropical seas. In waters off the northeastern United States, common dolphins are associated with Gulf Stream features and are widespread from Cape Hatteras to Georges Bank over the 656- to 6561-foot (200- to 2000-meter) isobaths or prominent underwater topographic features (Waring et al., 2006). The common dolphin migrates onto Georges Bank, the Scotian Shelf, and the continental shelf off Newfoundland in summer and autumn months. The best 2004 estimate for the abundance of the common dolphin from Florida to the Bay of Fundy is 120,743, with a minimum population estimate of 99,975 (Waring et al., 2006). Given their distribution range, common dolphins have the potential to occur in Nantucket Sound. The common dolphin is not listed as threatened or endangered under the ESA, but is considered a strategic stock under the MMPA.

Harbor Porpoise

The harbor porpoise (*Phocoena phocoena*) is primarily an inshore species. During the summer, harbor porpoises are concentrated in the northern Gulf of Maine and the southern Bay of Fundy region, generally in waters less than 492 feet (150 m) deep. This stock of harbor porpoises, which migrates south into the mid-Atlantic region, is considered one population, separate from three other distinct populations in the Gulf of St. Lawrence, Newfoundland, and Greenland areas (Waring et al., 2006). During fall and spring months, harbor porpoises are widely distributed from New Jersey to Maine. Low densities of harbor porpoises are found in waters off New York and north to Canada in the winter. No specific migratory routes to the Gulf of Maine/Bay of Fundy region have been identified. The best current estimate for the abundance of the Gulf of Maine/Bay of Fundy harbor porpose stock is 89,700 based on 1999 survey results, with a minimum population estimate of 74,695 (Waring et al., 2006). Given their distribution range, it is possible that harbor porpoises could occur in Nantucket Sound.

Long-finned Pilot Whale

The long-finned pilot whale (*Globicephala melas*) occurs along the edge of the U.S. continental shelf in the winter and early spring. A second species of pilot whale, the short-finned pilot whale, also occurs in the western North Atlantic. Difficulty distinguishing the two species in the field prevents separate abundance and mortality estimates. The long-finned pilot whale primarily occurs north of mid-Atlantic waters. Distribution of this species is widespread, ranging from North Carolina to Africa and north to Iceland, Greenland, and the Barents Sea (Waring et al., 2006). The best available estimate for the abundance of both pilot whale species for northern and southern U.S. Atlantic waters is 31,139 based on 2004 surveys, with a minimum estimate of 24,866 (Waring et al., 2006). Given their distribution range, pilot whales have the potential to occur in Nantucket Sound. The long-finned pilot whale is not listed as threatened or endangered under the ESA, but is considered a strategic stock under the MMPA.

Minke Whale

Minke whales (*Balaenoptera acutorostrata*) occur throughout polar, temperate, and tropical waters. The minke whale is the third most abundant great whale in the U.S. Atlantic Exclusive Economic Zone (EEZ) (CeTAP, 1982). Minke whales off the east coast of the U.S. are part of the Canadian east coast population, one of four minke populations recognized in the North Atlantic. The range of this population extends south from Canada to the Gulf of Mexico. During spring and summer, they are primarily concentrated in New England waters. In the fall, fewer minke whales occur in New England waters and by winter, they are mostly absent (Waring et al., 2006). The best available current abundance estimate for minke whales based on the sum of 1999 and 1996 survey estimates is 3,618, with a minimum estimate of 3,113 whales (Waring et al., 2006). Given their distribution range, it is possible that minke whales could occur in Nantucket Sound. The minke whale is not listed as threatened or endangered under the ESA nor is it designated as a strategic stock under the MMPA (Waring et al., 2006).

Studies Completed

- Review of scientific literature, including stock assessment reports, and consultation with resource management agencies, suggest that few studies of protected whale and turtle species have been conducted within Nantucket Sound.

- A comprehensive literature search targeting protected whale, seal, and reptile species in Nantucket Sound and acoustical impacts to marine mammals and reptiles was conducted to obtain information on protected marine species in Nantucket Sound and potential impacts of the proposed Project to these resources.
- Researchers from the Protected Resources Branch at the NMFS Northeast Fisheries Science Center, the Sea Turtle Stranding and Salvage Network, the Center for Coastal Studies, and the University of Rhode Island, were contacted to obtain additional stock assessment, sighting, stranding, and population studies information.
- A Biological Assessment under the Federal ESA was conducted to determine if the proposed action is likely to result in adverse effects to threatened or endangered marine species (ESS and Battelle, 2006a).
- A Pinniped Assessment was performed for two pinniped species that may occur in the vicinity of the Project area: the gray seal (Halichoerus grypus) and the harbor seal (Phoca vitulina concolor) (ESS and Battelle, 2006b).

C6. TERRESTRIAL ECOLOGY, WILDLIFE, AND PROTECTED SPECIES

State-listed rare species are protected under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 1331A) and its implementing regulations (321 CMR 10.00) and the Massachusetts Wetlands Protection Act (WPA) (M.G.L. c. 131, s.40) and its implementing regulations (310 CMR 10.00). To implement MESA and rare species regulations under the WPA, the Natural Heritage and Endangered Species Program (NHESP) provides mapping of rare species habitat, and reviews projects proposed within these mapped habitats. Two forms of habitat maps are provided. Priority Habitats (PH) mapping represents areas of known state-protected rare plant and animal species occurrences in Massachusetts for use with MESA, while Estimated Habitats (WH) mapping depicts habitats of state-protected rare wetlands wildlife for use under the WPA.

Federally-listed rare species are protected under the Federal Endangered Species Act of 1973 (16 USC 1531 et seq.), which prohibits the sale of and traffic in endangered or threatened species. It also prohibits a "take" of a listed species, defined as "to harass, harm, shoot, wound, kill, trap, capture, collect or attempt to engage in any such conduct."

The proposed onshore transmission line route extends within paved roadways from the New Hampshire Avenue landfall in Yarmouth for approximately 4 miles (6.4 km) along Berry Avenue, Higgins Crowell Road, and Willow Street. The route then leaves the roadways, and extends along an existing NSTAR Electric ROW for approximately 2 miles (3.2 km) to the Barnstable Switching Station.

The Massachusetts Natural Heritage Atlas (2003 Edition) and MassGIS data indicate that the proposed onshore transmission line route intersects three Priority/Estimated Habitats of rare species at the following locations:

- Along Higgins Crowell Road, in the vicinity of Jabinettes Pond (PH 1617/WH 7288);
- Along Higgins Crowell Road, northwest of the Middle School (PH 1605/WH 7286); and
- Along Willow Street and the NSTAR Electric ROW, in the vicinity of Long Pond (PH 1567/WH 199).

According to NHESP, these three rare species polygons may contain or be utilized by the following nine state-listed plant species and five state-listed wildlife species:

SECTION C:
DESCRIPTION OF THE BIOLOGICAL AND PHYSICAL ENVIRONMENT

State-Listed Plants

- Inundated Horned-sedge (*Rhynchospora inundata*), a threatened species;
- Long-beaked Bald-sedge (*Rhynchospora scirpoides*), a species of special concern;
- Plymouth Gentian (*Sabatia kennedyana*), a species of special concern;
- Terete Arrowhead (*Sagittaria teres*), a species of special concern;
- Wright's Panic-grass (*Dichanthelium wrightianum*), a species of special concern;
- Common's Panic-grass (*Dichanthelium commonsonianum*), a species of special concern;
- Mattamuskeet Panic-grass (*Dichanthelium mattamuskeetense*), an endangered species;
- Pondshore Knotweed (*Polygonum puritanorum*), a species of special concern; and
- Redroot (*Lachnanthes carolina*), a species of special concern.

State-Listed Wildlife

- Comet Darner (*Anax longipes*), a species of special concern;
- New England Bluet (*Enallagma laterale*), a species of special concern;
- Scarlet Bluet (*Enallagma pictum*), a threatened species;
- Pine Barrens Bluet (*Enallagma recurvatum*), a threatened species; and
- Water-willow Stem Borer (*Papaipema sulphurata*), a threatened species.

According to USFWS, there are no federally-listed or proposed threatened or endangered species located within the proposed onshore transmission line route to the Barnstable Switching Station, with the exception of the occasional transient bald eagle (*Haliaeetus leucocephalus*).

Road Segment

Upland vegetated communities located adjacent to the roadway portion of the proposed transmission line route are primarily pitch pine-oak forests dominated by white oak (*Quercus alba*), pitch pine (*Pinus rigida*), scrub oak (*Quercus ilicifolia*), lowbush blueberry (*Vaccinium angustifolium*), and sassafras (*Sassafras albidum*). Soils in these areas were observed to be sandy and are mapped as Carver coarse sand and Carver loamy coarse sand (NRCS, 1993).

In addition to upland forested habitats, the land adjacent to the roadway route includes commercial and residential properties and wetland communities. These wetlands include Jabinettes Pond, Thornton Brook, red maple swamps, an Atlantic white cedar swamp, and a coastal plain pond.

The diverse vegetative community adjacent to the roadways is expected to support a diverse wildlife population, particularly in areas located away from development and busy roadway intersections. However, the Project area within the paved roadways and roadway shoulders is not expected to provide nesting, breeding, feeding, or overwintering habitat for wildlife species.

ROW Segment

Within the NSTAR Electric ROW, upland vegetation is maintained as scrub/shrub community, with the primary cover consisting of interspersed woody and herbaceous species that vary in density along the ROW. Common species observed include black oak, sassafras, greenbrier (*Smilax glauca*), bearberry (*Arctostaphylos uva-uri*), poison ivy (*Toxicodendron radicans*), and knapweed (*Centaurea jacea*). Soils along the ROW consist of medium to coarse sands, and are mapped as Plymouth-Barnstable complex, very bouldery (NRCS, 1993).

As a result of "edge effect," the maintained NSTAR Electric ROW is likely to provide habitat for a diverse, but not unique, wildlife community. The vegetated uplands within the ROW are expected to provide habitat for a variety of snakes, songbirds, birds-of-prey, and rodents. In addition, white-tailed deer

(*Odocoileus virginianus*), red fox (*Vulpes vulpes*), coyote (*Canis lupis*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*) and raccoon (*Procyon lotor*) are expected to utilize the ROW for browsing and/or hunting. The adjacent Long Pond, located near the intersection of Willow Street and the ROW, may support populations of turtles, amphibians, aquatic insects, and waterfowl, which may use the ROW for nesting or feeding.

Bats

No state- or federally-listed protected bat species are known to occur in southeastern Massachusetts. Southeastern Massachusetts is included in the range of seven bat species (DeGraaf and Yamasaki, 2001). These species are the big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), northern myotis (*Myotis septentrionalis*), eastern pipistrelle (*Pipistrellus subflavus*), little brown myotis (Myotis lucifugus), silver haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*). Four of these species were documented during surveys within the Camp Edwards portion of MMR in 1999 and 2000, including the big brown bat, red bat, northern myotis, and the eastern pipistrelle (Massachusetts Army National Guard, 2001). The distance from MMR to the Barnstable Switching Station is approximately 14 miles (22.5 km); MMR to the proposed landfall is approximately 16 miles (25.7 km); and the distance from MMR to the closest point of the proposed Wind Park (at Horseshoe Shoal) is approximately 14.5 miles (23.3 km).

Due to their generally robust populations throughout their ranges, none of these bats are listed on the Massachusetts or federal lists of rare, threatened, or endangered species. Most of the seven bat species that occur in southeastern Massachusetts are classified as "uncommon to rare" in the southeastern Massachusetts portion of their ranges, and are not known to spend substantial periods over large bodies of open water such as Nantucket Sound (DeGraaf and Yamasaki, 2001).

Studies Completed

- Information included in this section is based on existing published literature, literature review, agency consultation, mapped resources and field review conducted in October 2001 and August 2002. Mapped resources reviewed include the following: USGS aerial photographs dated April 3, 1995; Massachusetts Natural Heritage Atlas (2003 Edition) and MassGIS mapping of rare species; Natural Resource Conservation Service's (formerly the Soil Conservation Service) Soil Survey of Barnstable County (March 1993) and MassGIS mapping of soils; Massachusetts Aerial Photo Survey of Potential Vernal Pools (Spring 2001); and Town of Yarmouth Comprehensive Plan, Coastal Resources (March 20, 1997).
- Additional information was obtained from correspondence with state and federal agencies, including the following: NHESP letters dated November 15, 2001, June 17, 2002, September 4, 2002, and October 23, 2003; USFWS letters dated July 10, 2002, September 25, 2002, and September 10, 2003; and Fact Sheets from the NHESP.
- The Massachusetts Natural Heritage Atlas (2003 edition) and the October 23, 2003 letter from the NHESP indicate that the submarine transmission line route is located entirely within habitat for the Roseate Tern (*Sterna dougallii*) and Common Tern (*Sterna hirundo*), state-listed as endangered and special concern species, respectively. Potential impacts of the proposed work on these species are described in Section C-7. A Biological Evaluation of the Roseate Tern is provided in the ESS et. al., (2004b), and a Biological Review of the Common Tern is provided in the ESS et. al., (2004d).
- A review of available scientific literature pertaining to bat foraging and migratory behavior, echolocation sensory systems, and collision risk associated with wind turbines was conducted for the seven species of bat that are known to occur in southeastern Massachusetts.

C7. AVIAN RESOURCES

There are two Federal regulatory programs which are involved in the management and protection of avian resources: bird species listed by the USFWS as threatened or endangered under the Endangered Species Act, and numerous bird species protected by the USFWS under the Migratory Bird Treaty Act.

Nantucket Sound is rich in avian and other wildlife resources, with hundreds of thousands of birds in residence, at least part of the year, and millions migrating through each spring and fall. The Sound is located within the Atlantic flyway, and its particular location relative to the Gulf Stream and the Atlantic currents, its unique configuration of continental landforms, the input of continental waters, and the region's climate combine to attract millions of birds, fish, and other wildlife to its waters year-round. Two federally-listed bird species--roseate tern and piping plover--are summer residents and migrate through the Sound biannually.

The open waters of Nantucket Sound are known to be an important wintering and migration-staging area for seaducks (eiders, scoters, and long-tailed ducks) that feed principally on bottom-dwelling invertebrates, as well as for diverse fish-eating species that vary by season, including mergansers, gulls, terns, loons, grebes, and others (Kerlinger and Hatch, 2001). Roseate terns are known to be important members of this latter group in summer because they are frequently seen in Nantucket Sound and because of their federal and state protected status. The roseate tern is federally- and state-listed as endangered, while the common and least terns are state-listed species of special concern. In addition, many other species occur on or near the shores of the Sound, including shorebirds such as the federally threatened piping plover, wading birds, and other coastal waterbirds. Landbirds and other migrants (potentially numbering in the millions) pass over Nantucket Sound each spring and fall (Kerlinger and Hatch, 2001). Nantucket Sound is located within the Atlantic flyway, and the shores of Cape Cod and surrounding islands, particularly Monomoy Island, are important migratory stopover areas. According to Veit and Petersen (1993), Monomoy Island (approximately 12 nautical miles (22.2 km) northeast of the WTG site) is the most "spectacular" stopover area in Massachusetts. Migratory shorebirds feed on the flats at the north end of Monomoy while migrating passerines utilize ponds and thickets at the south end of the island (Veit and Petersen, 1993).

For this account, species are divided into two groups: waterbirds and landbirds. Waterbirds are defined as those species that spend the majority of their time in Nantucket Sound away from shore, and may be regular visitors to the study area for purposes of feeding or resting. Landbirds are defined as those species that spend the majority of their time near land or close to shore. In addition to species customarily recognized as "landbirds," this category includes shorebirds and wading birds, as well as migrants that pass overhead. These species may cross the study area and some could be affected by onshore and nearshore components of the Project.

Between March 2002 and February 2004, 42 bird species were documented within the study area during the aerial and boat-based surveys, during which roughly 90% (more than 371,000 of 412,418) of the birds observed (mostly seabirds and other waterbirds) were on the water or flying at heights below 23 ft.

The principal wintering seaducks (common eider, long-tailed duck, and scoters) reported during the two plus years of field observations of offshore parts of the Sound were less abundant on Horseshoe Shoal than other parts of the Sound. The number of individuals observed in Horseshoe Shoal (25,125) comprised 6.8% of total seaducks observed during the aerial surveys, which is substantially lower than the 13% expected if the birds had been evenly distributed across the study area. For Monomoy-

Handkerchief Shoal, the number of individuals observed (22,154) comprised 6.0% of total seaducks observed during the aerial surveys, which is on target with the 6% expected if the birds were evenly distributed across the study area. For Tuckernuck Shoal, the number of individuals observed (34,032) comprised 9.2% of total seaducks observed during the aerial surveys, which is lower than but close to the 11% expected if the birds were evenly distributed across the study area. The largest percentages of seaducks (primarily scoter and eiders) observed were found outside the three shoal areas (287,238 (77.9%)): principally near Monomoy Island and Tuckernuck Island.

For the terns observed during the aerial surveys in the study period (primarily during the summer), 9.6% (277/2,888) were observed in Horseshoe Shoal, 2.6% (76/2,888) in Monomoy-Handkerchief Shoal, 5.7% (164/2,888) in Tuckernuck Shoal, and 82.1% (2,371/2,888) outside the three shoal areas.

Results from the Applicant's field studies indicate that the offshore areas of Nantucket Sound have relatively few species of seabirds and that most landbird migrants pass overhead at high altitudes. Horseshoe Shoal, compared with the other shoal areas studied (Monomoy-Handkerchief Shoal and north of Tuckernuck Shoal) and with other areas of Nantucket Sound, exhibits lower abundance and diversity for species found in the area than the other two shoals. For species such as loons, gulls and razorbills, the proportions in Horseshoe Shoal compared to other areas studied suggest similar abundance and distribution of the three shoals. Studies conducted by the Applicant (year round) and MAS (summer) (Perkins et al., 2003 and Perkins et al., 2004) show that areas near Monomoy Island and the southwestern part of the study area have higher densities of birds present throughout the year compared to Horseshoe Shoal. For example, during the fall 2002 to winter 2003 aerial surveys (ESS et. al., 2003c), eiders were the only species that had a higher density in Horseshoe Shoal (71/km^2) compared to the other two shoal areas (10 and 4/km^2), and there was a much higher density of eiders outside the three shoal areas (195/km^2). Overall tern densities were greatest outside the three shoal areas, with the largest number near Monomoy Island and the southern part of the study area (Hatch, 2003, ESS et. al., 2003b, 2004c,e and Perkins et al., 2003 and Perkins et al. 2004).

Overall, the studies have shown that the diversity and numbers of birds at Horseshoe Shoal is a small subset of those that are found in other parts of Nantucket Sound and the adjacent coast and shoreline. The presence and use of the Horseshoe Shoal area by that subset is limited, indicating that the species or individuals that may be present at Horseshoe Shoal are likely to be present for relatively short periods of time for foraging and migrating through.

Avian radar studies were also conducted during the Spring and Fall of 2002, Spring 2005, and Fall 2006.

Studies Completed

Although incidental observations of birds in Nantucket Sound have been made over many years (Veit and Petersen, 1993), no systematic, quantitative studies had been conducted in the central portion of the Sound where the Project is proposed. The Applicant undertook quantitative studies over the period between 2001 and 2006 to more fully characterize the avian resource in the Project area and its surroundings. The following studies were used to describe avian resources on Horseshoe Shoal and the surrounding environs:

- Preliminary Avian Risk Assessment for the Cape Wind Energy Project: This assessment was conducted in 2001 to determine the Project's potential avian impacts, and included a literature review of studies conducted at other offshore and onshore wind farm facilities located in the United States, Canada, and several European countries for which avian information was available (Kerlinger and Hatch, 2001).

- A Comparison of the Years 2002-2003 with the Years 1989-2001, Using Historic Data on Winter Waterbirds (ESS Group and Kerlinger, 2003).
- Preliminary aerial surveys conducted in July and September of 2001 to establish whether large numbers of terns and other summer species utilize the Project area (Hatch, 2003).
- Five aerial surveys and one boat survey conducted from March 17 through April 18, 2002 (ESS et. al., 2003a).
- Six aerial and seven boat surveys conducted from May 1 through August 30, 2002. Also included are results from 13 days of "ground-truthing" boat surveys conducted to complement the radar studies (ESS et. al., 2003b).
- Eleven aerial and two boat surveys conducted from September 25, 2002 through February 21, 2003 (ESS et. al., 2003c).
- Spring/Fall 2002 Avian Radar Studies for the Cape Wind Energy Project (ESS et. al., 2004a).
- An Evaluation of Roseate Terns and Piping Plovers (ESS et. al., 2004b).
- Six aerial surveys and one boat survey conducted from March 19, 2003 through June 2, 2003 and an additional aerial survey conducted outside Nantucket Sound on April 14, 2003 (ESS et. al., 2004c).
- Biological Review of the Common Tern for the Cape Wind Project (ESS et. al., 2004d).
- Six aerial surveys and two boat surveys conducted from June 16, 2003 through August 29, 2003 (ESS et. al., 2004e).
- Twelve aerial surveys and one boat survey conducted from September 15, 2003 through February 27, 2004 (ESS Group, 2004f).
- Bird Monitoring Using the Mobile Avian Radar System (MARS) Nantucket Sound, Massachusetts (Geo-Marine, Inc. Radar Report) (Geo-Marine, Inc., 2004).
- Winter/Nocturnal Duck Survey 2005, Nantucket Sound, Massachusetts (ESS, 2006c).
- Winter/Nocturnal Duck Survey 2005-2006, Nantucket Sound, Massachusetts.

C8. COASTAL AND FRESHWATER WETLAND RESOURCES

Wetland resources present in or near the locations sited for the construction of the Project are described according to their characteristics and jurisdiction under federal, state, and local wetland regulations.

Coastal Resources

Coastal wetlands were identified along the sections of the proposed submarine transmission cable route inside the state territorial limit in Lewis Bay to the proposed landfall location at New Hampshire Avenue in Yarmouth, and the coastal portions of the onshore transmission line route abutting Lewis Bay. The proposed landfall location is a rectangular embayment beach surrounded by a concrete headwall. Residences with associated yards are located directly adjacent (east and west) to the rectangular embayment, and their ocean frontage is fortified by concrete retaining walls and riprap.

Jurisdictional and coastal wetland resource areas observed to occur between the 3-nautical mile (5.6-km) limit and the proposed landfall location include the following:

- **Navigable Waters of the U.S.** (federal jurisdiction)
- **Waters of the U.S.** (federal jurisdiction)
- **Land Under the Ocean** (state and local jurisdiction)
- **Submerged Aquatic Vegetation** (federal, state, and local jurisdiction)
- **Coastal Bank** (state and local jurisdiction)
- **Land Subject to Tidal Action** (state and local jurisdiction)
- **Land Subject to Coastal Storm Flowage** (state and local jurisdiction)

- **Salt Marsh** (state and local jurisdiction)
- **Coastal Beach** (state and local jurisdiction)
- **Land Containing Shellfish** (state and local jurisdiction)
- **Coastal Watershed Areas** (local jurisdiction)

Freshwater Wetlands
The proposed onshore transmission line route runs north from the landfall at New Hampshire Avenue in Yarmouth for approximately four miles along Berry Avenue, Higgins Crowell Road, and Willow Street. The route leaves the roadways and for approximately two miles then heads west and then south along the existing NSTAR Electric ROW to the Barnstable Switching Station. The land along this route is predominantly upland, consisting of roadways and roadway shoulders, and maintained utility ROW. Six freshwater wetland systems were identified within approximately 100 feet (30.5 meters) of the proposed transmission cable route:

- **Wetland 1 – Bordering Vegetated Wetland (BVW), Bank, Waters of the U.S.** (local, state, and federal jurisdiction)
- **Wetland 2 – BVW, Bank, Land Under Waterbodies and Waterways (LUWW), Riverfront Area, Waters of the U.S.** (local, state, and federal jurisdiction)
- **Wetland 3 – BVW, Bank, Waters of the U.S.** (local, state, and federal jurisdiction)
- **Wetland 4 – BVW, Waters of the U.S.** (local, state, and federal jurisdiction).
- **Wetland 5 – BVW, Bank, Waters of the U.S.** (local, state, and federal jurisdiction)

From Willow Street in Yarmouth, the onshore transmission line route leaves the roadway and extends west and south for approximately 2 miles (3.2 km) along the NSTAR Electric ROW to the Barnstable Switching Station. One freshwater vegetated wetland area bordering the south shore of Long Pond in Yarmouth is present along the existing ROW immediately west of Willow Street. No wetland resource areas were identified within 100 feet (30.5 meters) of the ROW transmission route in the Town of Barnstable.

- **Wetland 6 – BVW, Bank, LUWW, Waters of the U.S.** (local, state, and federal jurisdiction)

<u>Studies Completed</u>
Wetlands in the Project area were characterized based on review of mapped resources, wetland field investigations, and related studies completed as part of the Project siting and permitting process. The following sources were reviewed as part of this characterization:

- USGS Topographic Map, Dennis and Hyannis Quadrangles
- USGS Aerial Photos dated March 5, 1995 and April 3, 1995
- MassGIS data on mapped wetland resources
- Lake and Pond Recharge Areas Map, prepared for Town of Yarmouth by IEP, Inc. (August 1988)
- MADEP SAV Mapping Inventory for 1995
- SAV Diver Survey, Woods Hole Group, Inc. July 2003
- Ocean Surveys, Inc. (OSI) Plan Drawing 01ES047.2, Sheet 1 of 7
- Massachusetts Natural Heritage and Endangered Species Program records
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, Town of Yarmouth, Barnstable County, Community Panel Numbers 250015 003C (June 17, 1986) and 250015 005D (July 2, 1992)
- FEMA Flood Insurance Rate Map, Town of Barnstable, Barnstable County, Community Panel Number 250001 0005C (August 19, 1985).

- NRCS (formerly SCS) Soil Survey of Barnstable County, Massachusetts (March 1993)
- NOAA Published Bench Mark Data, Hyannis Harbor, Massachusetts (September 29, 1989)
- Coastal Watersheds Map, prepared for Town of Yarmouth by IEP, Inc. (August 1988)
- Town of Yarmouth GIS database
- Town of Yarmouth Comprehensive Plan, Chapter 7 Coastal Resources (March 20, 1997)

Areas potentially subject to federal, state, or local jurisdiction within 200 feet of the onshore transmission route were field investigated in October 2001, August 2002, and December 2002. Wetlands were delineated in December 2002, in accordance with criteria established by the USACE (Environmental Laboratory, 1987), MADEP (MADEP, 1995), and the Yarmouth Wetlands Protection Regulations (Town of Yarmouth Conservation Commission, 1997). It should be noted that there are no wetland resource areas located along the onshore transmission route within Barnstable. The data transect documentation for the wetland delineations was completed during the summer 2003 growing season and would be appended to federal, state, and local permit applications. Vegetated wetland boundaries were surveyed using Global Positioning System (GPS). These boundaries are subject to approval by federal, state, or local agencies.

C9. WATER QUALITY

Nantucket Sound and Lewis Bay

The primary surface waterbodies in the Project area are Nantucket Sound, Hyannis Harbor, and Lewis Bay. Under Massachusetts Surface Water Quality Standards (314 CMR 4.06(3)), Lewis Bay and surface waters adjacent to Nantucket Island are categorized as Class SA coastal and marine waterbodies. (Other waters of Nantucket Sound in the Project area are not classified.) According to the MADEP standards, Class SA waters are designated as "an excellent source of habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation." Lewis Bay and Hyannis Harbor are listed on the Massachusetts Section 303(d) List of Waters as impaired due to the presence of pathogens in water quality samples. However, no specific sources of pathogen pollution were reported by the state in its 304(b) report to EPA (USEPA, 2002).

The Barnstable County Department of Health and Environment and the Towns of Yarmouth and Barnstable collected water samples offshore of Cape Cod's bathing beaches within proximity to the project landfall, and tested for the bacterial indicator organism E. Coli and enterococci. The beaches sampled were Englewood Beach in Yarmouth; and Veterans Beach, Keys Beaches and Kalmus Beach in Barnstable. None of the results of these samples exceeded established local and Massachusetts Surface Water Quality Standards at 314 CMR 4.06(2)(b) (Barnstable County, 2002).

In addition, the MADEP in conjunction with the University of Massachusetts School for Marine Sciences and Technology (SMAST) and the Three Bays Preservation, Inc. (a local watershed association) have been collecting water quality data from the Three Bays Estuary in Osterville, Cotuit and Marstons Mills since 1999 as part of The Estuaries Project: Southeastern Massachusetts Embayment Restoration (MADEP, 2002). Although this area is located several miles west of the Project area, the findings are typical of other southeastern Massachusetts estuaries evaluated as part of The Estuaries Project. In general, the estuary is exhibiting "poor nutrient related health" largely due to an overabundance of nitrogen inputs (Howes and Hampson, 2000). This is consistent with the findings of other water quality studies on Cape Cod, which found that nitrogen is the key contaminant causing the degradation of water quality within Cape Cod's coastal embayments (Cape Cod Commission, 2002). Fecal coliform exceedences were also found in several areas of the Three Bays Estuary (Howes and Hampson, 2000).

Oil Spill Response Plan (OSRP)
In order to ensure the protection of water quality in the case of accidental spills an OSRP has been prepared. A summary of the OSRP is contained in Attachment C-1.

Waste and Discharge
The wind turbine generators (WTGs) and the Electrical Service Platform (ESP) do not require the use of water for any part of their operations. Neither the WTGs nor the ESP require the use of water to complete scheduled maintenance activities on project equipment.

Temporary living accommodations would be provided on the ESP, intended for use during emergency periods, when crews cannot be removed due to weather issues. These accommodations would utilize waste storage holding tanks for domestic waste that would be pumped to the service vessel for proper disposal. All equipment would be contained within an enclosed weather-protected service area. Thus there will be no discharges of wastewater from project equipment resulting from operations.

Runoff of rainwater from the WTGs and ESP will also not affect water quality. All oil and grease bearing components will be covered and contained such that storm water will not come into contact with oil and grease during periods of rainfall. The ESP would not require a NPDES permit for the discharge of storm water because rainfall runoff from the ESP would not be considered a storm water discharge associated with industrial activity as defined in 40 CFR 122.26(14).

The marine vessels used to transport maintenance workers and equipment will be required to operate under United States Coast Guard (USCG) regulations. Also an OSRP would be in place during Project construction/decommissioning and operation to prevent/control potential impacts to water quality that could result from spills of fuel, lubricating oils, or other substances associated with the use of marine vessels and machinery.

Onshore
MADEP classifies the water resources located along the onshore cable route as Class B, High Quality Water. According to the MADEP standards, Class B waters are designated as "habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation." In approved areas, Class B waters are suitable as a source of public water supply with appropriate treatment.

Portions of the transmission line route would be located within a zone of contribution to the town water supply wells and aquifer protection district. The proposed transmission line route to the intersection with the NSTAR Electric ROW crosses through the Zone I wellhead areas of three public water supply wells, Yarmouth Water Department (YWD) Numbers 1, 2 and 17. The Zone I area for these wells is defined as the area within a 400-foot (122-meter) radius from the public water supply wells, for wells with a greater than 100,000 gallons per day approved yield. The onshore transmission line is approximately 42 feet (12.8 meters) inside the Zone I boundary of YWD 1; approximately 170 feet (51.8 meters) inside the Zone I boundary of YWD 2; and approximately 25 feet (7.6 meters) inside the Zone I boundary of YWD 17. The proposed transmission line route within the NSTAR Electric ROW would not be located within a MADEP-approved Zone I. The proposed onshore transmission line route, including the portion in the NSTAR Electric ROW, also crosses through MADEP-approved Zone II boundaries for several public water supply wells.

MADEP regulations (310 CMR 22.21(1)(b)(5)) state that current and future land uses within the Zone I shall be limited to land uses directly related to the public water system or to other land uses which the public water system has demonstrated would have no adverse impact on water quality. The regulations also state that no new underground storage tanks for petroleum products shall be located within Zone I. According to the MADEP regulations, Zone II is defined as that area of an aquifer that contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at the approved yield, with no recharge from precipitation).

Readily available groundwater elevation information from MassGIS was reviewed relative to topographic elevations along the proposed route, as was readily available information from the U.S. Geological Survey (USGS). Based on the proposed depth of installation (6 to 8 feet (1.8 to 2.4 meters) below grade), shallow groundwater may be encountered along the proposed route to the south of Route 28. It has been determined that groundwater levels between the landfall location and Route 28 are generally below elevation 10 feet (3 meters), and the topographic elevations are generally less than 20 feet (6.1 meters). Therefore, there is the potential to encounter groundwater during this part of the onshore cable installation.

Studies Completed

Water quality information pertaining to the Project was obtained from literature review, agency consultations, and review of existing site investigation data. The following information on water quality in the Project area was reviewed to develop this section:

- MADEP water quality classification maps and narratives for Lewis Bay and Nantucket Sound;
- MADEP regulatory criteria for existing water quality classifications;
- Scientific literature, agency publications, and website postings for Lewis Bay and Nantucket Sound, as available; and
- Local studies of water quality in the vicinity of Lewis Bay by municipalities, Barnstable County Department of Health and Environment, watershed associations, and the University of Massachusetts School for Marine Science and Technology (as part of *The Estuaries Project: Southeastern Massachusetts Embayment Restoration*).
- Simulation of Oil Spills from the Cape Wind Project Electric Service Platform in Nantucket Sound (ASA, 2005a)
- Memo: Weathering (Evaporation) of Spilled Electrical Insulating Oil (ASA, 2006a)
- Environmental FirstSearch™ Report – Transmission Line West Yarmouth MA. 02673 (FirstSearch, 2005)

C10. CULTURAL AND RECREATION RESOURCES, AND VISUAL STUDIES

Overview of the Cultural Context

Nearly 12,000 years of Native American settlement has been documented in the de-glaciated terrestrial terrain of southern New England. Following the retreat of glacial ice from Cape Cod and the Islands, much of Nantucket Sound was exposed and may have been used by small bands of migratory people referred to as Paleo Indians. Evidence of Native American use of shoreline areas may have been destroyed by wave and tidal action associated with rising sea levels.

Sea level had generally stabilized by approximately 4,500 years ago, and by 3,500 years ago many of the coastal marshes had been formed. Archaeological sites from the Middle and Late Archaic Periods (7,500 to 3,000 BP) found on the Cape and Islands indicate growing use of coastal and freshwater resources.

Permanent Colonial settlement of Cape Cod began in the mid-1600s, with the first communities located north of the present day Route 6, along Cape Cod Bay, on lands obtained from the Wampanoag Tribe. The Great Marshes of Cape Cod Bay provided salt hay for livestock, as well as plentiful fish and shellfish.

Early colonial life on Nantucket centered on fishing, whaling, farming and religion. Nantucket began a long-term economic decline in the 19th century, as the nation grew to depend on petroleum over whale oil. This economic decline saved many of the early buildings from demolition and redevelopment.

The economy of Martha's Vineyard, and particularly Edgartown, was centered on agriculture and the maritime trade. During the 1700s, wind-powered gristmills were established on Martha's Vineyard and Cape Cod.

Starting in the early 1700s, seafaring activities grew more prevalent, as coastal trading, whaling, ship building and salt making joined the traditional farming, fishing and shellfishing economies. The southern part of the Cape, with its deeper harbors and proximity to the Nantucket, Martha's Vineyard and New York trade routes, experienced rapid growth that continued into the mid-1800s.

From the mid-1800s through the Great Depression in the 1930s, the Cape and Islands entered a period of gradual economic decline and population loss. Traditional maritime industries such as fishing, whaling, salt making and coastal trading declined. The railroad, which was brought to Hyannis in 1854 to provide reliable service for the maritime industries, started to replace regional coastal shipping. The railroad also provided the means for city dwellers to escape the summer heat and reach the Cape and finally the Islands. By the late 1800s, several hotels had been built on the shores of Nantucket Sound. Summer estates and resort communities were developed. The era of the summer resort, which continues today, had begun.

Cultural and recreational resources within the APE of the Project are described below, by area.

Offshore

Submerged Prehistoric Archaeological Resources

Review of the preliminary geophysical and geotechnical data and a literature and database review obtained as part of the marine archaeological sensitivity assessment indicate that a majority of the offshore study area has a low probability for containing submerged prehistoric cultural resources.

No submerged prehistoric archaeological sites have been previously reported in the offshore Project area. Application of published rates of sea level rise since the end of glaciation to the present elevations of the sea floor suggest that much of the offshore Horseshoe Shoal area may have been exposed and available for human occupation and use from about 12,500 to 7,000 years BP. The marine archaeological sensitivity assessment (PAL, 2003, 2004b) found that prehistoric archaeological deposits with contextual integrity might be present within limited parts of the eastern offshore study area where former natural soil strata (paleosols) may be present.

Review of the geophysical and geological field data collected in 2001, 2003 and 2005, and referenced published studies, also indicates that a majority of the offshore Project area has a low probability for containing submerged prehistoric cultural resources; again, due to extensive disturbance to the pre-inundation landscape that resulted from wave and storm action during the post-glacial marine transgression.

However, descriptions of three vibratory cores, suggested several small zones of shallow submerged sediments in the eastern portion of the Project area may contain intact paleosols and, thus, the potential for submerged prehistoric cultural resources.

Additional vibracores, advanced during the 2003 survey at locations recommended by the marine archaeologist to delineate the relatively small zone identified as potentially sensitive on the eastern side of the WTG array area, confirmed that the origin of the organic deposits observed in several vibratory samples were terrestrial in nature and contextually intact. These paleosol deposits were examined microscopically by a marine geologist/limnologist at the University of Rhode Island Graduate School of Oceanography and the depositional environment interpreted as a preserved forest floor (VC03-05), fresh water wetlands (VC01-G4), and a shallow fresh water pond (VC03-04) (see the reconnaissance survey report in PAL, 2003, 2004b). The 2005 survey, however, concluded "the detected anomalies and area with sub-bottom profiler reflectors are considered to have little or no probability of representing potentially significant archaeological deposits or archaeological sensitive paleosols" (PAL, 2005a). The revised Project layout avoids these potentially sensitive areas.

Submerged Historic Archaeological Resources
Review of available literature and databases indicate the offshore Project area is within a region of extensive historic maritime activity in the post-European Contact (historic) period. Review of shipwreck databases indicate that 45 vessels may have been reported lost in the vicinity of the Project area (PAL, 2003, 2004b). No evidence of shipwrecks was apparent in the preliminary geophysical or geotechnical data obtained in 2001, according to the marine archaeologist at PAL who reviewed the data.

Based upon the potential for the offshore study area to contain submerged historic cultural resources such as shipwrecks, a marine remote sensing (geophysical) archaeological survey was recommended within the Project area and along the proposed cable route to Lewis Bay. The field survey was completed during the summer and fall of 2003.

Analyses of the post-processed data produced three targets with moderate probability of representing submerged Euro-American (historic) cultural resources. All are in the vicinity of Horseshoe Shoal. PAL recommended avoidance of ground disturbing activities around the detectable limits of each of these three potentially archaeologically sensitive targets. Project components have been redesigned to avoid disturbance to shallow geophysical anomalies that may mark potential archaeologically sensitive paleosols and the revised layout fully accomplishes avoidance of requested areas.

Recreational Resources
Fishing, water skiing, wind surfing, jet skiing, power and sailboat cruising and racing are common pastimes among boaters in state waters of Nantucket Sound. Scuba diving is limited in the area because the soft sediment habitat is generally uninteresting.

The offshore waters of Nantucket Sound are used by recreational boaters and fishermen, as well as commercial vessels engaged in waterborne commerce. Peak usage by recreational vessels is during the warmer months of the year (typically April through October). For additional information on marine transportation please refer to Section C-12.

Changes in water depths over short distances, and strong tidal currents (with peak currents often exceeding two knots), tend to create steep waves that break on the shoal, causing many boaters to avoid the area. Project staff performing other field investigations in the vicinity of the shoals have reported seeing few vessels operating on Horseshoe Shoal, which has been corroborated by field surveys specifically designed to document recreational boating activities during peak summer weekend days.

Visual Character and Setting

The existing seascape in near-shore state waters of Nantucket Sound contains an expanse of open but sheltered water, rimmed by the generally low landforms of the Cape and Islands. Within state waters, existing structures and development along the nearest shoreline are more noticeable than in federal waters. The enhancement of summer tourism is a major economic force. Visible in the summer months are many recreational and fishing boats and ferries using state waters, as well as navigational aids and aircraft flying overhead. The aircraft include small airplanes towing large advertising banners over area beaches on sunny days. Tankers, freighters and other large commercial ships typically avoid the shallow drafts and shoals of the Sound.

Further offshore in federal waters within Nantucket Sound, the existing seascape contains a large expanse of open water, rimmed by the low-lying landforms of the Cape and the Islands. The character of the viewscape is not fragmented, and is consistent with a natural unified nearshore southern New England seascape. Activity is limited to recreational and fishing boats, ferries, navigational aids, and aircraft flying overhead. Tankers, freighters and other large commercial ships typically avoid the shallow drafts and shoals of the Sound.

<u>Onshore</u>

Prehistoric Archaeological Resources

Two archaeological surveys have been completed along the onshore cable route under MHC permits. The first, a terrestrial (onshore) reconnaissance survey to assess the archaeological sensitivity of two alternative upland routes, was completed in the Spring of 2003. The second, an intensive (locational) archaeological field survey of the Yarmouth upland route to assess the presence or absence of archaeological sites, was completed in November 2003. In summary, no archaeological sites meeting the criteria for eligibility for listing on the NRHP were found along the proposed upland route; no further archaeological investigations were recommended. MHC concurred with these recommendations.

Historic Archaeological Resources

No known historic archaeological sites are located within 1.5 miles (2.4 km) of the proposed onshore cable route. An intensive (locational) survey to identify previously unknown archaeological sites within the APE along the cable route was conducted during the fall of 2003. No evidence of historic structures was identified in the Project's APE through the documentary research or subsurface testing. No historic archaeological sites were identified during the survey, and PAL recommended no additional archaeological investigation along the onshore cable route.

Historic Structures and Districts, Visual Character and Setting

Since the cable route would be located beneath public roadways or within the existing NSTAR easement, no historic properties listed or eligible for listing on the National Register are located within the Project's APE for ground disturbance along the onshore route.

Two historic buildings and an historic cemetery are located in Barnstable, approximately 0.25 to 0.75 miles (0.4 to 1.2 km) north of the cable route along the NSTAR ROW. Both historic buildings are off Marstons Lane; the cemetery is located on Mary Dunn Road.

Historic Structures and Districts Within Viewshed

Twelve existing historic structures and districts listed or eligible for listing on the National Register that may potentially be visually affected by the built Wind Park were identified. Based upon field reconnaissance, background research, and review of NRHP Inventory Nomination Forms, (where available), and other documentation in MHC files, a description of the visual character and setting at each of the 12 locations was developed. Visual simulations showing the built Project from each of the 12 locations were then developed. Recreational resources in the vicinity of each simulated viewpoint were also identified.

Locations simulated include:

South Side of Cape Cod
- *Nobska Point Light Station, Woods Hole, Falmouth*
- *Cotuit*
- *Wianno*
- *Craigville, Town of Barnstable*
- *Hyannis Port, Town of Barnstable*
- *Monomoy Point Lighthouse, Town of Chatham*

North and East Sides of Martha's Vineyard
- *Oak Bluffs, Martha's Vineyard*
- *Edgartown, Martha's Vineyard*
- *Cape Poge, Edgartown, Martha's Vineyard*

North Side of Nantucket
- *Nantucket Cliffs along Cliff Road, North of Nantucket Village Center*
- *Great Point, Nantucket*
- *Tuckernuck Island*

Onshore Recreational Resources
Onshore Cape Cod, Nantucket, Martha's Vineyard (and the state waters of Nantucket Sound) are well known for coastal recreational and summer tourism activities including beach going, swimming, boating, fishing, hiking, biking, picnicking, golfing and bird watching. Marinas, yachts clubs and public boat ramps line most of the harbors and inlets with sufficient water depths.

The shorelines around Nantucket Sound are generally developed with large seasonal shorefront homes or shorefront resorts and associated private beaches, most constructed during the 20th century. The public beaches attract thousands of recreational users in the summer months. Large areas of undeveloped protected shoreline are found along Monomoy Island south of Chatham, Cape Poge on Chappaquiddick Island on Martha's Vineyard, and Tuckernuck Island and Great Point in Nantucket. Representative simulations were prepared for each of these three locations, as well.

Studies Completed
- Visual Simulation Methodology (EDR, 2003)
- Known Historic Properties Within Potential Visual Range of the Wind Park (PAL, 2002)
- Marine Archaeological Sensitivity Assessment (PAL, 2003,2004b)
- Marine Archaeological Reconnaissance Survey (PAL, 2003,2004b)
- Terrestrial Cultural Resource Report by PAL: Terrestrial Archaeological Reconnaissance Survey Terrestrial Route Alternatives #1 and #2, and Intensive (Locational) Archaeological Survey, Terrestrial Route Alternative #1 (PAL, 2004c)
- PAL's Supplemental Marine Archaeological Reconnaissance Survey of Revised Layout: Offshore Project Area (Locational information omitted in copies for public distribution) (PAL, 2005a)
- Visual Impact Assessment Technical Memorandum for Revised Layout (PAL, 2005b)

- Updated Visual Simulations (New Layout, Far Fields plus 2 additional recreational sites 15-18 miles distant (EDR, 2005A)
- Seascape and Shoreline Visibility Assessment (EDR, 2005b)

C11. NOISE

Sound Levels at Two Offshore Sites

Existing daytime sound level measurements were made above water at two locations in the areas where recreational boaters travel: at Buoy G5 in the North Shipping Channel about one mile north of the edge of the proposed location of the Wind Park, and at Buoy R20 at the edge of the Main Channel about 1/3 mile south of the proposed location. These data were collected on October 22, 2002 between 10 a.m. and 12 Noon. The boat engine was shut-off during the measurements and the dominant sounds were wave interaction with the boat hull (the boat was allowed to drift), periodic over flying aircraft and distant boat traffic.

The background (L_{90}) sound levels were 35 and 37 dBA, respectively, at Buoys G5 and R20. The corresponding average (L_{eq}) sound levels were 46 and 51 dBA. To estimate the existing sound levels for the design wind speed condition of the proposed Wind Park, the measured levels were increased by 14dBA, the average observed difference between the two wind conditions for long term monitoring done at three shoreline locations as described below.

Short-term existing daytime sound level measurements were made underwater at the same two offshore locations in the areas where recreational boaters travel: at Buoy G5 and at Buoy R20. These data were also collected on October 22, 2002 between 10 a.m. and 12 Noon.

The underwater L_{eq} levels were 90 and 93 dBL, respectively, at Buoys G5 and R20. The sound level at Buoy R20 is slightly higher due to the shallower water and greater current. To estimate existing underwater sound levels for the design wind speed condition of the Proposed Wind Park, the measured levels were scaled by a factor of 7.2 dBL per doubling of wind speed, as has been observed in coastal water sound studies.[2] The estimated underwater L_{eq} level for the design wind speed condition therefore extrapolates to 107.2 dBL.

Sound Level at Horseshoe Shoal

Underwater sound measurements were made on Horseshoe Shoal at the site of the Scientific Measurement Device Station (SMDS) for the Project during the time when three support piles were driven into the seabed (Tech Environmental, 2004). The measured existing underwater L_{max} level (no pile driving) was 123 dBL.

Sound Levels at Three Representative Coastal Sites

Baseline sound monitoring locations were selected at the nearest representative locations along the south coast of Barnstable and Yarmouth and the east coast of the Vineyard. The three monitoring sites were located on the coast at **Point Gammon** in Yarmouth (5.2 miles from the closest WTG at the northeast corner of the Proposed Alternative location of the Wind Park), at **Oregon Beach**, Cotuit in Barnstable (5.5 miles from the closest WTG at the northwest corner of the Proposed Alternative location of the Wind Park), and at **Cape Poge Wildlife Refuge** at the tip of Cape Poge on Martha's Vineyard (5.4 miles from the closest WTG at the southwest corner of the Proposed Alternative location of the Wind Park).

[2] Urick, R., Principles of Underwater Sound, 3rd Edition, McGraw-Hill, 1983, p.213.

Point Gammon is on a private peninsula (Great Island) in Yarmouth that sticks out into Nantucket Sound. The principal sounds at this site were the wind and ocean waves, periodic over-flying aircraft, and an occasional passing ferryboat. There was no vehicle or pedestrian access to this location during the continuous measurement program that lasted seven days from November 15 to 22, 2002.

Oregon Beach is a public beach located off Main Street and Oregon Way, south of Cotuit Center in Barnstable. The coast generally faces southeast at this point on the Cape. The principal sounds at this site were the wind and ocean waves, sea birds, periodic over-flying aircraft, and occasional motor vehicles and pedestrians accessing the beach area. Monitoring lasted more than four days from November 14 to 18, 2002.

Cape Poge Wildlife Refuge on Chappaquidick Island, Martha's Vineyard is a wildlife refuge and recreational area with facilities for swimming and shore fishing. It is a very isolated location, travel to which requires a four-wheel drive vehicle. The coast faces east towards the ocean at the monitoring location that was setup near the lighthouse above the beach. The principal sounds at this site were the wind and ocean waves, and sea birds. Continuous measurements were taken for seven days from November 25 through December 2, 2002.

The baseline measurement of existing sound conditions were examined in detail for the following wind conditions: the **cut-in wind speed** of the WTGs (a steady wind speed of 8 mph at hub height, equivalent to 5 mph at 3 meters above ground)[3] and the **design wind speed** of the WTGs (a steady wind speed of 30 mph at hub height, equivalent to 16 mph at 3 meters above the ground). The WTGs would not operate under wind speeds below 8 mph.

The baseline measurements of existing conditions covered a full range of meteorological conditions from calm to high winds, with wind directions blowing both onshore and offshore and average wind speeds of 0 to 28 mph. The baseline measurements reveal background (L_{90}) sound levels as low as 27 dBA (at Point Gammon) and in the 30's at the other two sites, which are representative of quiet rural areas. Since the measurements also covered periods of time when steady winds were up to 28 mph (wind gusts were higher), higher baseline sound levels are expected, and these higher levels would be measured at any location.

At Point Gammon (November 15-22), measured background (L_{90}) levels ranged from 27 to 66 dBA, and average (L_{eq}) levels were 35 to 71 dBA. At Oregon Beach (November 14-18), measured background (L_{90}) levels ranged from 34 to 57 dBA, and average (L_{eq}) levels were 41 to 61 dBA. At Cape Poge (November 25-December 2) measured background (L_{90}) levels ranged from 37 to 70 dBA, and average (L_{eq}) levels were 40 to 73 dBA. At all three sites, existing sound levels are directly correlated to surface wind speed, and on-shore winds produce slightly higher sound levels than offshore winds.

<u>Studies Completed</u>

- Noise Report (Tech Environmental, 2004)
- Noise Analysis for Revised WTG Layout (Tech Environmental, 2005)

[3] The increase of wind speed with height above the ground is calculated in Tech Environmental 2004, section 3.2.

C12. TRANSPORTATION AND NAVIGATION

Marine

Nantucket Sound is bounded to the south by the islands of Martha's Vineyard and Nantucket, and to the north by Cape Cod. To the west of Nantucket Sound is Vineyard Sound, and to the east is the Atlantic Ocean. Horseshoe Shoal is located in the approximate middle of Nantucket Sound, with its geometric center at approximately 41°30'N; 70°20'W. The northeasterly tip of the shoal is known as "Broken Ground." The southeasterly tip of the shoal is known as "Halfmoon Shoal."

Nantucket Sound is used for navigation by recreational watercraft, commercial fishing vessels and commercial vessels engaged in waterborne commerce. Peak usage by recreational watercraft and commercial fishing vessels is during the warmer months of the year (typically April through October). Pilotage is not typically required for vessels transiting through central and eastern Nantucket Sound. There are two main shipping lanes, the Main Channel and the North Channel, used for safe navigation by larger vessels in Nantucket Sound. USCG marks both of these areas with aids-to-navigation (buoys, lights, etc.). These shipping lanes are described as follows:

- The Main Channel in Nantucket Sound is located south of Horseshoe Shoal. This channel is used by most of the vessels transiting through Nantucket Sound. It is reported that vessels using the channel seldom exceed a draft of 24 feet (7.3 meters) (NOAA, 1994).
- The North Channel runs along the north side of Nantucket Sound, on either side of Bishop and Clerks, northward of Horseshoe Shoal, between Wreck Shoal and Eldridge Shoal, northward of L'Hommedieu Shoal, and through one of the openings in the shoals westward of L'Hommedieu Shoal into Vineyard Sound. This channel is used mostly by vessels bound for the south shore of Cape Cod, and by vessels transiting the Sound during northerly winds. The shallowest depth in the channel is approximately 16 feet (4.9 meters) at Mean Lower Low Water (MLLW).

In addition to these shipping channels, privately and federally maintained channels are located at the approaches to Cotuit Bay, Centerville Harbor, and Hyannis Harbor.

The area between the Main Channel and the Cape Cod shoreline, including Horseshoe Shoal, is designated as an anchorage ground, known as "Anchorage I." Floats or buoys for marking anchors or moorings in place are allowed in this area. Fixed mooring piles or stakes are prohibited (NOAA, 1994).

Passenger and freight ferries (including high-speed ferries) bound for both Nantucket and Martha's Vineyard operate out of Hyannis Inner Harbor and transit the area near Horseshoe Shoal. Steamship Authority vessels do not transit over Horseshoe Shoal. Ferries bound for Nantucket transit to the east of Horseshoe Shoal, while ferries bound for Martha's Vineyard transit to the north and west of the shoal. According to USACE data for the 1998 through 2000 timeframe, an annual average of 1,305 vessel trips for vessels engaged in waterborne commerce were reported as passing Cross Rip Shoal, which is to the south of Horseshoe Shoal and the Main Channel.

There do not appear to be historical records on the frequency of sea ice events in Nantucket Sound. The National Weather Service in Taunton, MA stated they do not keep sea ice records, and are not aware of other agencies that maintain such records for Nantucket Sound (NWS, 2003). The *Coast Pilot* makes one passing reference to ice in Nantucket Sound when it mentions that northerly winds keep the north shore of the Sound free from drift ice (NOAA, 1994), which further suggests that sea ice events in Nantucket Sound do not occur with any regular frequency. Anecdotal evidence suggests that large-scale sea ice events have occurred less frequently in Nantucket Sound during the past decade; however, sea ice was common in Nantucket Sound during the winters of 2002-2003 and 2003-2004.

Icing events affecting the wind turbines in the Project area are most likely to occur as the result of precipitation in the form of glaze (freezing rain or drizzle) or wet snow. Less likely to occur in Nantucket Sound is in-cloud icing such as rime ice. Rime ice occurs when surfaces below the freezing point are exposed to clouds or fog composed of supercooled water droplets[4]. The intensity of rime ice accumulation is a function of cloud base heights, structure elevation, local variations in cloudiness, size and amount of supercooled water droplets, air temperature and wind speed. Conditions favorable for rime ice formation may occasionally be found within Nantucket Sound, however they are more likely to occur in arctic and high elevation locations. While fog and low cloud cover in Nantucket Sound is a frequent occurrence during the summer months, the winters typically have better visibility and less fog. The Cape Wind met tower has been in place for the past three winters (including the winter of 2003-2004 during which the Sound did experience some sea ice) and has experienced no ice damage.

During the winter of 2003-2004, an extensive sea ice event occurred in Nantucket Sound. While the majority of the icing took place in and around Hyannis Harbor and Nantucket Harbor, ice was reported throughout most of Nantucket Sound during the event (Blount, 2005). According to USCG records of the ice event provided to ESS by the USCG, fast ice was present in Hyannis Harbor, the Nantucket Harbor entrance channel, and in Nantucket Harbor between January 16, 2004 and February 17, 2004. The heaviest icing took place in the harbors between January 26, 2004 and February 3, 2004. During this period, ice thicknesses were approximately 12 inches in Hyannis Harbor, 18 inches in Nantucket Harbor, and 30 to 48 inches in the entrance channel to Nantucket Harbor. The exact extent and location of sea ice in Nantucket Sound during that time was not recorded. However, ESS has been told that there was a period of about one week during the ice event when most of the Sound, including the Main Channel, was affected by ice (Blount, 2005). Both commercial and USCG ice breakers were used during this time to escort vessels (including ferries and fuel barges) in and out of the harbors, and in some cases, across Nantucket Sound. Wave measurements at the SMDS were significantly affected by floating ice between mid-January and mid-February 2004 (WHG, 2004c). This would indicate that the ice extended to the north of the Main Channel as least far as the location of the SMDS.

Along the proposed submarine cable system route from Nantucket Sound through Lewis Bay to the preferred landfall in Yarmouth, water depths reach a maximum of 35 feet (10.7 meters) MLLW near the seaward end of the route and gently slope upward to the landfall location. The entrance to Lewis Bay is sufficiently wide enough to allow access by cable-laying vessels, and there are no shoals or obstructions along the route that would hinder travel or maneuverability. For their own safety, other vessels would be asked to navigate around the installation barge's anchors, which will be marked by buoys. Given the relatively shallow water depths at the entrance to Lewis Bay and the cable route's location to the side of the Federal Channel, the presence of the anchors is not expected to adversely affect vessel traffic entering or leaving Lewis Bay

Aeronautical

The proposed WTG array is generally located approximately 9 miles (14.5 km) south of Barnstable Municipal Airport, approximately 17 miles (27.4 km) northwest of Nantucket Memorial Airport, and 13 miles (21 km) northeast of Martha's Vineyard Airport. These three airports provide service connections from the mainland to the Islands of Nantucket and Martha's Vineyard. Other surrounding airports include Provincetown Municipal Airport on the Outer Cape, Otis Air Force Base in Sandwich, New Bedford

[4] Lacrox A., and Manwell, J. (2000), "Wind Energy: Cold Weather Issues", University of Massachusetts at Amherst

Regional Airport, Logan International Airport in Boston, and T.F. Green Airport in Providence, Rhode Island. These airport facilities also have connecting flights to the Barnstable, Nantucket, and Martha's Vineyard airports.

In addition to commuter and general aviation aircraft, the airspace over Nantucket Sound is used by military aircraft for training, by USCG aircraft for Search and Rescue (SAR) and other operations, by commercial fish spotter planes, and by commuter helicopters.

Onshore

The proposed onshore transmission line route to its intersection with the NSTAR Electric ROW would be located entirely along existing paved ROWs where other underground utilities already exist. All of the roadways within Yarmouth and Barnstable in which the proposed transmission line would be placed are town owned and maintained roads with the exception of Routes 6 and 28, which are owned and maintained by MHD. A portion of the onshore transmission line route would also be located underground within the existing maintained NSTAR Electric ROW.

Studies Completed

- Consultation with the FAA
- The FAA assessed the effect of the proposed Wind Park location on existing established FAA Instrument Flight Rule (IFR) and Visual Flight Rules (VFR) routes, and navigational aids.
- Review of NOAA navigation charts (#13237) and USACE publications
- Consultations with the USCG
- Meetings with the Massachusetts Steamship Authority and private ferry operators transiting this area of Nantucket Sound
- Completed detailed hydrographic studies of the area to confirm water depths and safe navigation conditions on Horseshoe Shoal
- Field observations of vessel traffic in the Project area during aerial surveys, boat transits, and other operations related to Project development.
- Review of mapped resources and a field review: USGS topographic maps (Hyannis and Dennis Quadrangles); and USGS aerial photos dated March 5 and April 3, 1995.
- Navigational Risk Assessment (ESS Group, 2003b)

C13. ELECTRICAL AND MAGNETIC FIELDS

Wherever electricity is generated, transmitted or used, electric and magnetic fields are present. It is not possible to produce or use electric power without creating these fields; therefore, they are a common and ubiquitous occurrence anywhere electric energy is in use. Electric fields are created by differences in the amount of charge at different points in space, which exert a force on nearby charged particles. The strength of these fields is typically measured in volts per meter (V/m). Magnetic fields are created by the flow of electric current, and are measured in tesla (T) or Gauss (G), but are more often described in terms of mG (one 1000^{th} of a Gauss).

EMFs decrease in size as the distance from the source (the electric charges or currents) increases. For electrical cables, EMF would be highest adjacent to the cable and would decrease as the distance from the cable increases. Electric fields are attenuated by objects, and are completely shielded by electrically conducting material such as metal, the earth, or the surface of the body. Magnetic fields, on the other hand, penetrate most materials. The earth's atmosphere produces slowly varying electric fields (about 0.1 to 10 kV/m) that occasionally manifest themselves as lightning. The earth's core produces a steady magnetic field, as can be readily demonstrated with a compass needle. The earth's magnetic field ranges in strength from about 470 mG to 590 mG over the United States, and is about 560 mG in the Northeast. Knowing the strength of the earth's fields provides a perspective on the size of the magnetic field measurements from an electric transmission cable.

Humans are exposed to a wide variety of natural and man-made electric and magnetic fields. Natural fields are associated with common items we use such as magnets and, as previously noted, we are continuously exposed to the geomagnetic field of the earth. These fields are static and therefore do not switch back and forth, as do power frequency fields. Overhead transmission and distribution lines are a common source of exposure to electric and magnetic fields. High voltage transmission lines can generate relatively high electric fields. However, because high voltage transmission lines are constructed along ROWs, and because electric fields drop off quickly with distance and are shielded by structures, electric fields experienced by people within dwellings are typically dominated by the internal wiring and the use of appliances. Magnetic fields from transmission lines, although not able to be shielded by structures, drop off quickly with distance. Therefore, magnetic fields within dwellings are also typically dominated by nearby distribution system wiring, house wiring, or appliance use. Electric and magnetic fields from different sources (e.g., adjacent wires) may partially cancel or be additive at a given location. Results of studies have shown that electric fields in the home, on average, range from zero to ten volts per meter and magnetic fields range from 0.6 to three mG (EMF RAPID Program Report, 2002).

- **Existing Conditions Offshore**: There are no known sources of power line frequency (60 Hz) fields currently in the waters of Nantucket Sound in the vicinity of Horseshoe Shoal at the proposed location of the Wind Park, or along the proposed cable route to shore, and therefore no predicted electric fields. The magnetic field existing in the location of the proposed 115 kV submarine transmission cable is the natural geo-magnetic field of the earth, which is a static DC field that is oriented toward the North and downward into the earth.

- **Existing Conditions Upland (Landfall to NSTAR Electric ROW)**: The primary sources of existing power frequency magnetic fields along the street portion of the proposed onshore transmission line route are the existing overhead distribution lines. Their nominal operating voltage is 23 kV phase-to-phase/13.2 kV phase-to-ground. They are fed radially from Distribution Line 92, which emanates from Hyannis Junction Substation. Proceeding in a southerly direction down the route (away from the substation and towards the landfall location), the load current on the lines decreases, there is branching to other distribution circuits, and (at New Hampshire Avenue) the line changes from 3-phase to single phase. Measured magnetic field strength at the edge of the pavement closest to the overhead line ranged from 1 to 21 mG along the length of the route, generally increasing in a northerly direction consistent with increasing current. Representative measurements directly under the lines did not exceed these values by more than 1 mG. At the time of the measurements, total load on Line 92 was about 14 MW. Line 92 experienced a 27 MW load during the historical system peak on August 9, 2001 [Personal Communication, NSTAR]. Extrapolating to these load levels produces maximum magnetic fields in the range of 2 to 40 mG, although local field strengths may vary depending on conductor geometry and individual loads. The measured field strength directly under the lines in front of the Marguerite E. Small School was 5 mG or 9 mG when extrapolated to peak load. Calculated existing electric field strengths in and adjacent to the streets along this route range between 0.01 and 0.09 kV/m.

- **Existing Conditions Upland (Within the NSTAR Electric ROW):** Magnetic field strength was measured under existing 115 kV lines 118 and 119 and existing 23 kV lines in the NSTAR Electric ROW where it crosses Willow Street at the low point in the lines. Measuring at this location results in the highest field strength. The location is representative of the field strengths on the existing ROW between Harwich Tap and Barnstable Switching Station. Current flow at the time of the measurements was 296 Amps in line 118 and 143 Amps in Line 119. The magnetic field strength was highest under the 118/119 lines, at 26 mG, falling to 18 mG at the north edge of the ROW, and 6 mG at the south edge of the ROW. Using the same line geometry (which is much better defined and more consistent than for the in-street distribution circuits), the corresponding magnetic field strengths were calculated at NSTAR Electric's forecast peak loading (without the Project) of 643 Amps on line 118 and 311 Amps on line 119. This resulted in 127 mG directly under the lines, 56 mG at the north edge of the ROW, and 12 mG at the south edge of the ROW. Calculated existing electric field strength directly under the 115 kV overhead lines 118 and 119 is 2.0 kV/m. At the north edge of the ROW, this falls to 0.2 kV/m, and is less than 0.1 kV/m at south edge of ROW.

Studies Completed

- Preliminary Assessment of the Electric and Magnetic Field Impacts Associated with the Cape Wind Park for the Preferred Alternative (E/PRO, 2004)

C14. TELECOMMUNICATIONS

Radio and microwave frequency fields, which are common in telecommunication (including cellular systems), have frequencies that range from thousands of hertz to several billion hertz. Generally, telecommunication systems operate on a line-of-sight basis; therefore, structures have the ability to interfere with communication signals if they are within the line-of-sight between a transmitter and receiver. The Federal Communication Commission (FCC) licenses communication systems that use these frequencies to ensure proper compliance with standards.

A search of the FCC database for existing and proposed telecommunication towers resulted in identification of 41 existing FCC permitted antenna towers in the study area, 31 on the Cape Cod mainland, five on Martha's Vineyard, and five on Nantucket. Another 17 towers have been permitted that were not yet built at the time of the analysis, but were included in the results. Two of these locations where towers are planned are on Nantucket, with the remainder located on Cape Cod.

The permitted antennae (existing and proposed) in the study area are made up of cellular phone towers, local emergency response communication towers, radio towers, and television towers. Also included in the study area are mobile sources of radio transmissions such as marine VHF radios.

Antennae operate at different frequency ranges depending on the service they provide. AM Radio transmits at 540 to 1605 kHz, and FM Radio at 88 to 108 MHz. VHF television transmits at 30 to 300 MHz, and UHF television at 300 to 3,000 MHz. Analog mobile phone signals are approximately 900 MHz, while PCS mobile phone signals range from 1,800 to 2,000 MHz (Cell Tower Operating Frequency http://www.mcw.edu/gcrc/cop/cell-phone-health-FAQ/toc.html#8).

Recreational boating activity occurs in Nantucket Sound and is most prevalent during the months of May through September. Commercial fishing and marine cargo ships also traverse Nantucket Sound. These vessels use marine radios operating at a range of 156.05 to 157.425 MHz. Shore radios operate at approximately 156.85 to 162.025 MHz. The NOAA weather service operates between 162.4 to 162.55 MHz (Marine Radio Operating Frequency http://www.naval.com/marvhf.htm; http://www.m1cvc.uklinux.net/radio_frqlst_mrn.html).

The closest NEXRAD weather radar is located in Taunton, Massachusetts and is approximately 40 statute miles northeast of the Project. According to National Weather Service staff at the Taunton radar station, the NEXRAD weather radar has an upward projection of up to 5 degrees and the radar beam would be approximately 2500 – 3000 feet above the water as it passes over the wind turbines. The Project elements will be well below the beam of the NEXRAD weather radar at Taunton, and are expected to have no impact on the radar's operation.

Studies Completed

- Licensed Microwave Search and Worst Case Fresnel Zone Analysis (ComSearch, 2005)
- Report on Horns-Rev VHF Radio and Marine Radar (Elsam Engineering, 2004)
- Notice of Affirmation of Determination of No Hazard to Air Navigation (USDOT, 2005).

C15. AIR AND CLIMATE

The USEPA has established National Ambient Air Quality Standards (NAAQS) for criteria pollutants that are intended to protect public health and the environment. Currently, Massachusetts air quality, including the area of Eastern Massachusetts within which the Project is proposed, is in attainment with the NAAQS for all of the criteria pollutants except ozone. Air monitoring data from the "Commonwealth of Massachusetts 2000 Air Quality Monitoring Report" (MADEP, undated) indicates that monitors in both eastern and western Massachusetts show exceedances of the current one-hour ozone standard and the recently promulgated eight-hour standard. On April 15, 2004, the US EPA announced their designation of the entire Commonwealth as being in moderate nonattainment with the 8-hour standard. This designation became effective on June 15, 2004. Ground level ozone is created through chemical reactions involving precursor pollutants (NO_x and VOCs) in the presence of sunlight. Motor vehicles and fossil fuel fired power plants are among the major contributors to ozone precursor emissions.

Although Massachusetts is in attainment with the NAAQS for particulate matter larger than 10 microns in diameter (PM-10), USEPA has promulgated a new standard for particulate matter less than 2.5 microns in (2.5) diameter. USEPA agrees with the recommendation of the Commonwealth of Massachusetts that the Commonwealth be designated as "Attainment/Unclassifiable" for this standard. Attainment/Unclassifiable refers to the situation where the Commonwealth of Massachusetts does not meet the minimum data requirement, but the data which has been collected indicates that they are in attainment for this standard.

In addition to being in nonattainment with the ozone standard, other challenges threaten the maintenance of air quality in the region (i.e. acid rain, visibility impairment, and air toxics) and highlight the need to develop clean energy systems. New England is part of the Ozone Transport Region (OTR), which was established in recognition of the challenges the region faces due to transport of pollutants emitted in upwind states, located to the west and south of the region. Additional emission requirements are imposed upon states within the OTR to help offset the impacts of pollutants transported from outside the region.

Emissions of Air Contaminants from the Project

The WTGs will not emit any air contaminants. There will be two small emergency generators on the ESP that will operate only in the event of loss of power from the grid. However, the construction, operation, maintenance and decommissioning of the project will result in the temporary and intermittent emissions of air contaminants from the construction equipment and support vessels. These temporary, intermittent mobile source emissions will occur offshore and the diesel engines of the construction vessels will have similar emission characteristics to the fishing vessels, passenger ferries and other working vessels that travel throughout Nantucket Sound everyday.

Even though these emissions are almost exclusively mobile source emissions from support vessels and construction equipment, the project is required to quantify the emissions and obtain an OCS air permit from USEPA. The following estimated emissions from equipment and support vessels are calculated from conservative USEPA published emission factors:

For the 2-year construction period:
Carbon monoxide – 123 tons
Particulate Matter – 18 tons
Sulfur Dioxide – 74 tons
Nitrogen Oxides – 565 tons
Volatile Organic Compounds – 19 tons

For the operational period (annually):
Carbon monoxide – 6 tons
Particulate Matter – 1 ton
Sulfur Dioxide – 3 tons
Nitrogen Oxides – 27 tons
Volatile Organic Compounds – 1 ton

Air emissions related to decommissioning activities are anticipated to be similar or less than those from construction.

As part of the air permitting process the emissions from construction equipment and support vessels are anticipated to be modeled as a series of volume sources in order to predict compliance with applicable state and federal ambient air quality standards. A modeling protocol will be prepared and submitted to USEPA along with the NOI required for the OCS air permit.

Wind Resources
Mean wind speeds within the Horseshoe Shoal area have been predicted to range from 17.9 – 20.1 mph (8.0 -9.0 m/s) at 230 feet asl (70 m) according to Wind Energy Resource Mapping commissioned by the Massachusetts Technology Collaborative and completed by AWS Truewind. For purposes of estimating energy output from the proposed wind farm the wind resource average of 19.75 mph (8.8 m/s) has been used.

C16. SOCIOECONOMICS

The following data characterizes the socioeconomic conditions in the Project Area:

Public Funding and Tax Credits: The Project has not requested public funding or grants. It could, however, become eligible for Federal Renewable Energy Production Tax Credits (PTC) under Section 45 of the Internal Revenue Code. The PTC provides a general business tax credit for commercial and industrial producers of wind and certain other types of renewable energy, similar to tax credits available for other industries. The Energy Policy Act of 2005 has extended the PTC through December 2007. However, since the Project is likely not to be in service by that time, it would not be eligible to receive the PTC unless Congress extends the time for projects to be placed in service.

Electricity Rates and Reliability: New England is well ahead of much of the nation in deregulating its electricity market, and using advanced technology to provide reliable and less expensive sources of electricity. On March 1, 2003, ISO New England (ISO-NE), the independent system operator that administers the New England wholesale system under the supervision of the Federal Energy Regulatory Commission (FERC), implemented its System Market Design (SMD). The SMD is a set of market rules and procedures that the ISO-NE implemented to meet the FERC's rules for standardizing wholesale electric markets nationwide.

Under the SMD, electricity producers bid in their available electricity resources on an hourly basis. Producers base their bids primarily on the cost of their fuel, although other operating costs are part of the bid. The ISO-NE then stacks bids by price, and dispatches enough electric producers to fill the forecasted demand at various points on the system. Each supplier then receives the highest bid dispatched to satisfy the forecasted demand. Intermediate and long-term power purchases may be negotiated between electricity producer and electricity purchaser. These contracts fix prices for periods of time ranging from days to years.

The renewable energy portfolio standard (RPS) was incorporated in the Massachusetts Electric Industry Restructuring Act of 1997. The RPS requires electricity suppliers to obtain certain minimum percentages of its supply from qualified renewable sources, which include wind energy. The RPS requirements began in 2003 with each supplier obligated to obtain at least one percent of its supply from new renewable sources and then increasing that supply to four percent by 2009. Retail electricity suppliers are required to purchase Renewable Energy Credits (RECs) to fulfill these requirements.

Public Health Impacts and Power Plant Emissions: A Harvard School of Public Health study (Levy et al., 2000) investigated the public health effects from pollutant air emissions from power plants that had been grandfathered under the Clean Air Act. Some of the health impacts estimated in the study include:

- 30 premature deaths per year from Salem Harbor and 80 premature deaths per year from Brayton Point;
- 570 emergency room visits per year from Salem Harbor and 1,140 emergency room visits per year from Brayton Point;
- 14,400 asthma attacks per year from Salem Harbor and 28,900 asthma attacks per year from Brayton Point;
- 99,000 daily incidents of upper respiratory symptoms from Salem Harbor and 199,000 daily incidents of upper respiratory symptoms from Brayton Point.

An analysis of the economic costs of these health impacts was also conducted in the Harvard study. Monetary values were assigned to sickness, disease, and hospital visits using willingness to pay studies, cost of illness studies, and medical cost databases. These values represent the productivity and utility losses that people face, along with medical and associated economic costs. The total economic costs of the health impacts (illness and premature deaths) from the Salem and Brayton Point plants are estimated to be $135.8 million and $345.8 million per year, respectively (Levy et al, 2000; Levy and Spengler, 2002; New York Times, 2003). Potentially, these economic costs could be reduced by obtaining emissions offsets from another existing power plant or through replacement of the power generated by fossil fuel fired facilities such as Salem and Brayton Point (a power offset) by a new renewable energy source such as the proposed Project.

Local Economy: Barnstable County, Massachusetts was selected as the region of impact because the majority of the direct construction and operation impacts will be concentrated there.

- Population: as of March 2003 the Barnstable County population was estimated at 227,600; Barnstable County's population grew at an annual rate of 1.71% between 1990 and 2002, well above the statewide growth rate of 0.5%.
- Income: Barnstable County's real personal income (in 1996 dollars) was estimated at $7.7 billion in 2002, representing a 2% increase over the previous year. By contrast, total nominal personal income in Barnstable County in 2002 was up 3.4% over 2001, compared to only 1.4% in Massachusetts. According to the Bureau of Labor Statistics, the average annual pay per covered worker in Barnstable County during 2001 was $31,020, up 4.4% from the year before. The average wage per job in Barnstable County estimated in 2003 was $34,600, well below the Massachusetts figure of $47,400.
- Employment: Employment in Barnstable County is heavily dependent upon the tourism sector, with a resulting concentration of lower paying jobs in the retail and services sectors. Unemployment in Barnstable County in June 2003 was 4%.
- Economic Activity: Barnstable County's employment is concentrated in the retail trade sector (28.8%) and services sector (31.6%). The retail trade employment share was much higher in Barnstable County compared to Massachusetts, while the services sector share was slightly lower. The data also show that the construction sector accounted for 7.1% of total Barnstable County employment in 2002, well above the statewide share of 4.2%. In addition, these data indicate that the annual growth rates in employment, number of establishments, and nominal output in Barnstable County between 1990 and 2002 were greater than in Massachusetts.
- Tax Revenues and other fiscal Impacts: the local governments that would be most affected by construction and operation of the Project are the towns of Barnstable and Yarmouth. Information on local tax revenues and fiscal information for each of these towns is presented below.
  - **Barnstable:** Barnstable had an estimated population of 47,821 in 2000 according to the US Census. Fiscal Year (FY) 2002 data indicate that the number of single-family parcels was 20,521 and the overall tax rate was 9.26 in the town of Barnstable. Actual revenues (FY 2000) were approximately $91 million, with expenditures of approximately $88.5 million. The Town of Barnstable Comprehensive Annual Financial Report indicated that real property tax revenues for FY 2003 were $69,272,770.
  - **Yarmouth:** Yarmouth had an estimated population of 24,807 in 2000 according to the US Census. FY 2002 data indicate that the number of single-family parcels was 12,480 and the overall tax rate was 11.10 in the town of Yarmouth. Actual revenues (FY 2000) were approximately $39 million, with expenditures of approximately $41 million. A personal communication with the Yarmouth Town Hall on March 29th, 2004 indicated that real property tax revenues for FY 2003 were $30,598,438.

Housing and Coastal Property Values: Home prices on the Cape and Islands continue to rise as they have for more than ten years. Average prices and percent increase in prices on the Cape and Islands are generally higher than the statewide average.

Tourism and Recreation: Currently Cape Cod and the Islands receive a high percentage of their revenue from the tourism industry. The focus of most area tourism is the high quality recreational activities that the area offers. The Cape Cod Chamber of Commerce estimates that approximately 44% of the economic base for Cape Cod comes from seasonal tourism. An estimated six million tourists visit Cape Cod annually and will spend nearly one billion dollars. Almost two-thirds of these visitors vacation during the summer and fall seasons (MDED, 2002). Tourism on the Cape and Islands includes recreational activities such as: beach going, fishing, boating (including windsurfing and jet skiing), boat racing, golfing, hiking, picnicking, sightseeing (light houses and other historic areas, etc.), and shopping.

Guided tours or charters are available for many of these activities including fishing; whale watching; wildlife, kayaking, canoeing tours and bike tours.

Boating: Boating on Nantucket Sound consists of a mix of commercial and recreational activity. Commercial activity includes passenger ferries, vessels, and barges carrying liquid and dry bulk goods, occasional cruise ship visits, commercial fishing vessels, charter fishing vessels, and research activity. Recreational activity includes fishing, sailing, cruising, boat racing, jet skiing (nearshore), kayaking (nearshore), and canoeing (nearshore). Coastwise and recreational vessels tend to use the Main Channel (south of Horseshoe Shoal) when transiting Nantucket Sound for points within Nantucket Sound and for the Atlantic Ocean.

Fishing: Nantucket Sound supports a commercial fishery for various finfish species, squid, shellfish (including conch) and lobster. From 1994 through 2004, approximately 7.8 million pounds of finfish and squid were harvested from Nantucket Sound (NMFS vessel trip report data for area 075). The top ten species of finfish and squid landed by commercial fishermen in Nantucket Sound (Sub-area 075), as reported from NMFS vessel trip reports from 1994 through 2004, include *Loligo* squid, Atlantic mackerel, summer flounder, black sea bass, scup, squid (species not specified), menhaden, *Ilex* squid, winter flounder, and butterfish. Additional information on commercial fisheries in Nantucket Sound can be found in Section C-4.

Nantucket Sound and the waters around the islands of Nantucket and Martha's Vineyard support a diverse array of recreational fishing activities. Data on recreational fishing are monitored by NMFS. The majority (99.7%) of recreational anglers surveyed reported hook and line as gear type used for recreational fishing activities, and most recreational anglers reported fishing from a private/personal or rented boat as the type or mode of recreational fishing. The number of anglers reporting the use of party/charter boats was much lower than those reporting the use of private boats or fishing from shore.

Environmental Justice: Presidential Executive Order 12898 directs federal agencies to consider environmental justice issues by identifying and addressing disproportionately high and adverse human health and environmental effects on minority populations and low-income populations in the United States. A second objective of the Executive Order is to ensure effective public participation and access to information during development and design of a federal or federally permitted project within the NEPA process.

The Massachusetts Executive Office of Environmental Affairs (EOEA) issued state guidance entitled "Environmental Justice Policy of the Executive Office of Environmental Affairs." The Commonwealth's Environmental Justice Policy, issued by the EOEA on October 9, 2002, applies to EOEA actions under MGL Chapter 21A, Section 2. Section 2 provides, generally, that "the office and its appropriate divisions shall carry out the state environmental policy and in doing so they shall…develop policies, plans, and programs for carrying out their assigned duties." Although certain areas of the Cape and Islands have been identified by EOEA as containing environmental justice populations, review of the Cape Wind Project with respect to Policy requirements indicates that the Project does not trigger thresholds requiring environmental justice analysis under the EOEA Policy.

Studies Completed

- Correspondence with assessors, municipalities, or other organizations adjacent to existing wind farms.

- Project-specific economic studies included modeling and electricity market analyses conducted by La Capra Associates to assess the impact of the Project on the New England electricity market (U.S.DOE, 2005),
- Impact Analysis of the Cape Wind Off-Shore Renewable Energy Project on Local, State, and Regional Economies (Global Insight, 2003)
- The primary sources of information obtained from existing publications included:
  - A study conducted by Harvard School of Public Health and Sullivan Environmental Consulting entitled "Estimated Public Health Impacts of Criteria Pollutant Air Emissions from the Salem Harbor and Brayton Point Power Plants" (Levy et al., 2000);
  - A technical paper by Levy and Spengler (Harvard School of Public Health) entitled "Modeling the Benefits of Power Plant Emission Controls in Massachusetts" (Levy and Spengler, 2002);
  - A Report conducted by the UMASS Center for Policy Analysis entitled "Cape & Islands Workforce Investment Board: Workforce Development Policy Blueprint." (UMASS, 2002);
  - A report on New England's Fishing Communities published by MIT Sea Grant (Hall-Arber et al., 2001);
- Survey Of Commercial And Recreational Fishing Activities in Nantucket Sound (ESS, 2006a)
- Cape Wind 462 MW Generation, Stability and Short Circuit System Impact Study (NSTAR, 2005a)
- Cape Wind 462 MW Generation, Thermal and Voltage System Impact Study (NSTAR, 2005b)

ATTACHMENT C-1
OIL SPILL RESPONSE AND CHEMICAL INFORMATION

ATTACHMENT C-1
OIL SPILL RESPONSE AND CHEMICAL INFORMATION

C-1.1. OIL SPILL RESPONSE PLAN (OSRP) INFORMATION

An Oil Spill Response Plan (OSRP) has been prepared by Cape Wind Associates, LLC (Cape Wind) in accordance with the Department of the Interior Minerals Management Service's (MMS) regulations at 30 CFR 254, "Oil Spill Response Requirements for Facilities Located Seaward of the Coastline." These regulations require owners/operators of oil handling, storage, or transportation facilities located seaward of the coastline to submit a spill response plan to MMS for approval prior to facility operation.

In accordance with the requirements of 30 CFR 254, this OSRP demonstrates that Cape Wind can respond quickly and effectively in the unlikely event that oil is discharged from the facility. As recommended by the MMS, this OSRP is consistent with MMS Notice to Lessee No. 2002-G09, dated October 1, 2002, which includes the Guidelines for Preparing Regional and Subregional Oil Spill Response Plans.

The Cape Wind facility will be in the lowest potential worst-case discharge rating (Rating A: 0 to 1,000 barrels as defined in the regulations at 30 CFR 254 and associated Guidelines). In the unlikely event of a release of oil to the ocean, Cape Wind employees, its contractors, and its responders will refer to this OSRP to ensure that the appropriate spill response actions are taken in a timely manner to prevent impacts to sensitive receptors. It is noted that, although 30 CFR 254 is only applicable to oil storage and usage, Cape Wind has chosen to incorporate additional materials into this OSRP because the corporate response mechanisms and the spill response measures employed would be similar for all materials at the site.

C-1.2. OIL SPILL RESPONSE ORGANIZATIONS (OSRO)

Cape Wind Associates LLC is the sole developer/owner of the project, and will be the sole operator for the facility. Oil Spill Response Organizations that may provide support services may include:

- Clean Harbors, Inc. (or other firm with equivalent capabilities) – Spill Response Contractor. Cape Wind will directly respond only to incidental spills. Incidental spills do not pose a hazard to human health or the environment beyond the hazards associated with normal facility operations. These would include minor drips or leaks that are contained within bermed areas, can be easily cleaned and controlled with minimal amount of sorbents, and are not released to the ocean.
- Applied Science Associates, Inc. (ASA) (or other firm with equivalent capabilities) – Marine Science Consulting. Cape Wind will contract ASA or other qualified entity with similar expertise to provide the computer modeling tools necessary to address oil spills, including trajectory analyses.

C-1.3. WORST CASE SCENARIO DISCUSSION

A Worst Case Discharge Scenario of no more than 42,000 gallons (1,000 barrels) is appropriate for this facility. This is the maximum amount expected to be stored on the ESP and is the largest spill that could reasonably be expected to occur at Cape Wind. This worst case discharge corresponds to the lowest rating of spill, Rating A, and is consistent with guidance provided by the GOMR. Note that Cape Wind will not have any oil-containing ROW pipelines, oil production platforms or satellite structures in OCS waters.

ATTACHMENT C-1
OIL SPILL RESPONSE AND CHEMICAL INFORMATION

Electric Service Platform (ESP)

The primary oil storage at the Cape Wind facility will be located on the ESP, which is expected to house the transformers, fire protection equipment, emergency backup generators, and other ancillary systems. Total maximum oil storage on the ESP is expected to be approximately 42,000 gallons at any given time. Therefore, Cape Wind will be in the lowest potential worst-case discharge rating (Rating A). The ESP will be designed to include a boat landing dock and a helicopter pad for accessibility. Below is a summary of the ESP and expected materials storage/usage, a general description of each material, the volumetric capacity, and type of product.

Component	Fluid Medium Function	Fluid Type	Approximate Quantity
Oil Storage:			
Four 115 Kv Power Transformers	Insulation/Heat Transfer	Naphthenic Mineral Oil	10,000 Gallons Each 40,000 Gallons Total
Two Diesel Engines	Internal Component Lubrication	Motor Oil	5 Gallons Each 10 Gallons Total
Two Diesel Engine Day Tanks	Emergency Generation Fuel	Diesel Oil	100 Gallons Each 200 Gallons Total
One Fuel Oil Storage Tank	Emergency Generation Fuel Supply	Diesel Oil	1,000 Gallons Total
Non-Oil Storage:			
Two Diesel Engine Radiators	Heat Transfer	Water/Glycol	15 Gallons Each 30 Gallons Total
Uninterruptible Power Supply (Ups - Direct Current Battery System)	Electrolyte	Sulfuric Acid	355 Gallons Total

The ESP is equipped with a number of oil collection systems to prevent oil from being released into the environment in the event of a leak from oil-storing equipment. The entire ESP has sealed, leak-proof decks that act as fluid containment. At least 110% secondary containment is provided for the oil-storing equipment on the ESP, including the transformers, diesel engine storage tank, and diesel engines/day tanks. These containment areas will be routinely checked and maintained to ensure maximum storage capacity in the event of a spill.

Wind Turbine Generators (WTGs)

In addition to the materials stored on the ESP, the WTGs will house certain system components within the nacelle that contain smaller amounts of lubricants and cooling fluid. Total oil storage at each WTG is expected to be approximately 214 gallons at any given time (27,820 gallons for all 130 WTGs). Each WTG will be accessible by service boats. Below is a list of the Wind Park systems and a summary of the expected materials usage for each system, including a general description, volumetric capacity, and type of product.

Component	Fluid Medium Function	Fluid Type	Approximate Quantity Per WTG
Oil Storage:			
Drive Train Main Bearing	Bearing Lubrication	Mobil Sch 632	19 Gallons
Drive Train Main Gear Box	Gear Lubrication	Optimol Synthetic A320	140 Gallons
Drive Train Cooling Systems	Cooling & Lubrication	Optimol Synthetic A320	21 Gallons
Hydraulic System Brake	Brake Fluid	Mobil Dte 25	2 Gallons
Hydraulic System Rotor Lock	Hydraulic Fluid	Mobil Dte 25	19 Gallons
Hydraulic Crane Cylinder	Transmission Fluid	Atf 66	5 Gallons
Yaw System (Drive Gear)	Gear Lubrication	Mobil SHC 630	7 Gallons
Pitch System (Pitch Gear)	Gear Lubrication	MOBIL SHC XMP 220	0.25 Gal
Pitch System (Pitch Gear)	Gear Lubrication	Mobil SHC XMP 460	1 Gallons
Non-Oil Storage:			
Oil Coolers	Heat Dissipation	Water/Glycol	20 Gallons

The WTGs are equipped with a number of oil collection systems to prevent oil from being released into the environment in the event of a leak. Oil sumps or guide plates will be located underneath the main bearing and oil cooler of each WTG. The oil they collect runs into a central oil sump that is integrated into the top tower platform and is collected and disposed of as necessary.

Potential Spill Volume

Based on conversations with the GOMR, and assuming all material is released from the ESP, the worst case scenario is 42,000 gallons. Given the controls and countermeasure in place, this is an unlikely scenario. The oils used at the facility are easily dispersible (often on their own) and would typically float on the surface. Because the operation is a static one with no potential for continuous discharge, a spill from the facility will be easily managed and controlled. The facility will be located more than five miles from shore. An oil spill trajectory analysis that was performed is provided in the OSRP.

C-1.4. SPILL DETECTION, SOURCE IDENTIFICATION AND CONTROL

Cape Wind's primary objective is to minimize facility impacts as much as feasible. This includes impacts to the environment, personnel health and safety, and sensitive areas. Other operational response objectives include responding to any incident as quickly and efficiently as possible and ensuring the safety of response personnel, through training and equipment. The procedures identified in the OSRP are provided in order to ensure that Cape Wind meets all of these objectives.

During normal sea conditions, Cape Wind will make routine maintenance visits to the off-shore facility; anticipated at least three days per week to the ESP and five days a week to various sections of the wind farm. During these visits, Cape Wind staff will conduct routine maintenance and assess the equipment for any evidence of leaks, damages, or other problems. Due to the frequency of off-shore visits, it is likely that Cape Wind will be the initial responder in the event of a release.

Any Cape Wind employee detecting a release will immediately notify the QI. The QI will then assess safety precautions, initiate response procedures (including contacting response contractors), and make oral notifications to required agencies. A list of such agencies is provided in the Emergency Contact List provided at the front of the OSRP.

The 33 kV inner-array cables and the 115 kV submarine transmission cables are specially designed for marine environments and will not require pressurized dielectric fluid circulation for insulating or cooling purposes. For the ESP and wind park, the following measures ensure that spills are minimized and spill detection, response, and control will be conducted in a timely manner to minimize shoreline impacts:

- All equipment and storage tanks are designed to minimize the possibility of discharges or releases and are equipped with secondary containment.
- The ESP houses spill response equipment including spill pads, kits, and socks, which can be used for minor spills or releases.
- Alarms and monitoring devices are used to identify material losses in tanks and equipment.
- Cape Wind will use oils that are lighter than water to aid in on-water recovery techniques.
- Cape Wind will maintain work boats and response equipment at the Operations Center allowing for quick response.
- A response contractor will be contracted to conduct all response and recovery procedures, using Cape Wind staff and resources as appropriate.
- ASA (or other firm with equivalent capabilities) will be contracted to assist in trajectory analysis. ASA has conducted an oil spill trajectory analysis based upon preliminary information to assist in project planning and regulatory review.

C-1.5. REPORTING PROCEDURES AND OSRO NOTIFICATIONS

Reporting Procedures

Incidental oil spills are those that do not pose a hazard to human health or the environment beyond the hazards associated with normal facility operations. These would include minor drips or leaks that are contained within bermed areas, can be easily cleaned and controlled with minimal amount of sorbents, and are not released to the ocean.

In the event of an incidental spill, the Cape Wind employee who discovers the spill will contact the Cape Wind QI (or alternate QI if the QI is not available). This contact will likely be made using pre-determined radio frequency communication. The QI will then be responsible for contacting the appropriate SMT and SROT members. Since incidental spills are not released to the ocean, the use of outside contractors will not be required. Incidental spills do not require reporting to federal, state, or local authorities, but should be recorded on internal spill logs.

In the event of a non-incidental spill of any size, additional reporting procedures will be required. Non-incidental oil spills are those that may pose a hazard to human health or the environment beyond the hazards associated with normal facility operations. Any spill that results in any quantity of oil being released to the ocean will be considered a non-incidental spill and will be reportable. These procedures are defined in the OSRP. It is noted that the spill response procedures for all spills is identical, although the method of spill clean-up will vary depending on spill size and sea state.

OSRO Contact Information

Cape Wind will be primarily responsible for the first response and for the initiation of the emergency response system. Financial burden for spills that are the responsibility of Cape Wind will be incurred by Cape Wind. If appropriate, additional response actions may be provided by private, federal, state, and local agencies. Roles, qualifications, and responsibilities of the OSRO's are provided in the OSRP. Contact Information will be provided in the quick reference in Section 1 of the OSRP, where appropriate.

C-1.6 SPILL DISCUSSION FOR NEPA ANALYSIS

Cape Wind is dedicated to protecting the nearby beaches, waterfowl, wildlife, marine and shoreline resources, and other areas of special economic or environmental importance. Because of the type of oil used at the off-shore site, spilled materials are expected to float and will be easily recoverable via mechanical methods. Response times are expected to be quick and will ensure that oils do not reach sensitive areas.

A key step in the initial response actions is the determination of whether shorelines require protection. Cape Wind will be responsible for making this assessment, with assistance from the response contractors, environmental and civil engineering consultants, and a marine and freshwater environmental modeling firm.

The oils used at Cape Wind are lighter than water and exhibit less harmful characteristics than crude oils that are typically transported on passing sea vessels. Due to short response times, spilled oil is expected to be easily collected. Initial assessment and defensive response actions are expected to occur within two hours of spill detection and full spill response is expected to occur within eight to twelve hours.

In the event of a release that has the potential for shoreline impacts, Cape Wind and the response contractors will employ all available resources to prevent oil from reaching the shore and limit the damage to potentially affected areas. Such resources may include the use of exclusion booming, to keep oil out of a sensitive area, or deflection booming, to divert oil away from a sensitive area or toward a collection point.

Should shoreline cleanup operations become necessary, Cape Wind will work with federal, state, and local authorities to ensure that appropriate techniques are employed in a timely and environmentally-sensitive manner. Such techniques may include:

- Natural recovery
- Manual removal
- Mechanical removal
- Collection with sorbents
- Vacuum
- Sediment reworking/tilling
- Vegetation cutting/removal
- Water washing
- Sand blasting

The response procedures established in this OSRP ensure that all releases are quickly identified, addressed, and recovered. In the unusual event that impact to sensitive areas or wildlife occur, Cape Wind will dedicate the necessary resources (with assistance from the response contractor) and will work with federal, state, and local authorities to fully remedy the impacts.

Quick mobilization is a key component to response and recovery. In order to minimize the initial response time, Cape Wind will maintain work boats and response equipment at the Operations Center.

This will allow initial assessment and defensive response actions to occur within approximately two hours of spill detection and full spill response to occur within approximately eight to twelve hours of spill detection.

Cape Wind has allocated resources and established an emergency response system that will ensure that adequate containment equipment, recovery equipment, and response personnel are mobilized and deployed at the spill site and projected impact locations. To ensure the shortest possible response time, Cape Wind will stock spill equipment at its Operation Center and will use a local response company to provide emergency response and cleanup. The route to the off-shore facility is essentially a direct one.

All emergency response (other than cleanup of incidental leaks and spills) will be conducted by the response contractor.

SECTION D:
ENVIRONMENTAL IMPACT ANALYSIS

D1. IMPACT PRODUCING FACTORS (IPFs)

The activities required to construct, operate, maintain, and decommission the project have the potential to result, in varying degrees, in air emissions, effluents, physical disturbances and accidents. These air emissions, effluents, physical disturbances and accidents are considered to be Impact Producing Factors (IPFs). The IPFs may result in effects to the environmental resources of the project area. The table below indicates which IPF has some potential to have an effect on the project area's environmental resources (described earlier in Section C). An X appears in the box for a particular environmental resource if the IPF is expected to have some potential to result in an impact on that resource. The table is not meant to indicate the magnitude of the potential impact, nor whether it is temporary or permanent in nature. The magnitude, duration and significance of the potential impacts caused by the IPFs will be addressed in the Draft Environmental Impact Statement (DEIS) being prepared by the Minerals Management Service (MMS).

The IPFs can generally be characterized as follows:

Emissions – Activities such as pile driving will result in increases in noise levels and air contaminants from construction equipment. The physical striking of the pile driver will result in sound levels above normal ambient. The diesel engines associated with the pile drivers and support vessels will emit air contaminants to the atmosphere.

Effluents – Stormwater runoff from project components will be discharged during rainfall events. Stormwater discharges for the upland components of the project will be subject to a federal NPDES general permit. Stormwater discharges from offshore components are expected to be clean rainwater runoff and are not subject to NPDES permitting. It is also possible that some bentonite fluid from directional drilling at the cable landfall could breakout and become a liquid effluent to the environment.

Physical Disturbances – Activities such as cable embedment, vessel anchoring and cable landfall cofferdam installation will result in a physical disturbance to the seafloor. These disturbances will result in impacts such as sediment transport and displacement of living organisms (e.g. benthic, fish and/or marine mammals). Activities such as ROW clearing, cable trenching and backfilling will result in the physical disturbance of upland areas. These disturbances will result in impacts such as sedimentation and temporary displacement of terrestrial wildlife.

Accidents – Activities such as refueling of equipment, vessels and vehicles, transferring of lubricating oils and general maintenance activities may result in spills of chemicals or oils. These spills can have a negative effect on organisms and their habitats.

SECTION D:
ENVIRONMENTAL IMPACT ANALYSIS

	Impact Producing Factors			
Environmental Resource	Emissions (noise, air, light, etc)	Effluents (stormwater, bentonite)	Physical Disturbances to the seafloor or upland	Accidents (oil spills, chemical spills, etc)
Geology and Sediments Conditions	[1]	X	X	X
Physical Oceanographic Conditions	[1]	[2]	X	[3]
Benthic and Shellfish Resources	[1]	X	X	X
Finfish Resources and Commercial/Recreational Fisheries	X	X	X	X
Protected Marine Species	X	X	X	X
Terrestrial Ecology, Wildlife, and Protected Species	X	[2]	X	X
Avian Resources	X	[2]	X	X
Coastal and Freshwater Wetlands	[1]	X	X	X
Water Quality	[1]	X	X	X
Cultural and Recreational Resources, and Visual Studies	X	[2]	[4]	X
Noise	X	[2]	X	[3]
Transportation and Navigation	X	[2]	X	X
Electrical and Magnetic Fields	[1]	[2]	[4]	[3]
Telecommunications	[1]	[2]	[4]	[3]
Air and Climate	X	[2]	[4]	[3]
Socioeconomics	X	[2]	[4]	X

[1] The emissions of noise, air contaminants or light will not alter the biological, chemical, or physical characteristics of the resource.
[2] Stormwater runoff is the primary liquid effluent expected from project activities. The quality and the quantity of stormwater discharge related to the limited additional impervious surface attributed to project components (WTGs, and ESP) will not significantly alter the biological, chemical, or physical characteristics of the resource.
[3] Interaction with Oil and /or chemicals resulting from accidental spills are not likely to alter the biological, chemical, or physical characteristics of the resource
[4] The physical manipulation of seafloor sediments and/or upland soils will not alter the biological, chemical, or physical characteristics of the resource.

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