OCS EIS/EA
BOEM 2017-0006

# Cape Wind Energy Project

## Draft Supplemental Environmental Impact Statement

**U.S. Department of the Interior**
**Bureau of Ocean Energy Management**
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## Draft Supplemental Environmental Impact Statement

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Office of Renewable Energy Programs

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# CAPE WIND ENERGY PROJECT
# SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

**Draft (X)** **Final ( )**

**Type of Action: Administrative (X)** **Legislative ( )**

**Areas of Potential Impact:** Offshore marine environment and the coastal counties of Barnstable County, Nantucket County, and Dukes County in Massachusetts, and Washington County, Rhode Island.

**Responsible Agency:** U.S. Department of the Interior
Bureau of Ocean Energy Management
45600 Woodland Avenue
Sterling, VA 20166-9216

## Abstract:

The Bureau of Ocean Energy Management (BOEM) is publishing this draft Supplemental Environmental Impact Statement in response to a remand order of the U.S. Court of Appeals issued on July 5, 2016. The Court vacated BOEM's 2009 *Cape Wind Project Final Environmental Impact Statement* (FEIS), and remanded it back to BOEM in order to supplement the FEIS with sufficient data regarding the suitability of the seafloor to support wind turbines. The FEIS analyzed the Proposed Action by examining the effects of the construction, operation and maintenance, and decommissioning of a wind energy project on the Outer Continental Shelf in Nantucket Sound, off the coast of Massachusetts, consistent with the requirements of the Outer Continental Shelf Lands Act (67 Stat. 462, as amended, 43 U.S.C. §1331 *et seq*.), and the National Environmental Policy Act of 1969. The 2017 Proposed Action of this draft Supplemental Impact Statement remains the same, which, given the Court's remand order, means that BOEM would leave undisturbed the decision to issue the Cape Wind lease, and decisions that flowed from that, like the Construction and Operations Plan approval. In addition to the 2017 Proposed Action, one alternative is evaluated in detail: the No Action Alternative. Given the Court's remand order, the No Action Alternative means that BOEM would rescind the Cape Wind lease.

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| BOEM | Bureau of Ocean Energy Management |
| BOEMRE | Bureau of Ocean Energy Management, Regulation and Enforcement |
| COP | Construction and Operations Plan |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CPT | cone penetration test |
| CVA | certified verification agent |
| CWA | Cape Wind Associates, LLC |
| DEIS | Draft Environmental Impact Statement |
| DOI | U.S. Department of the Interior |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EPAct | Energy Policy Act |
| ESP | electrical service platform |
| FDR | Facilities Design Report |
| FEIS | Final Environmental Impact Statement |
| FIR | Fabrication and Installation Report |
| FONNSI | Finding of No New Significant Impact |
| FR | Federal Register |
| ft | feet |
| HRG | high-resolution geophysical |
| km | kilometer |
| m | meter |
| $m^2$ | square meter |
| MMS | Minerals Management Service |
| NEPA | National Environmental Policy Act |
| nm | nautical mile |
| NOA | Notice of Availability |
| OCS | Outer Continental Shelf |
| OCSLA | Outer Continental Shelf Lands Act |
| ROD | Record of Decision |
| U.S.C. | U.S. Code |
| U.S. | United States |
| SEIS | Supplemental Environmental Impact Statement |
| USACE | U.S. Army Corps of Engineers |
| USGS | U.S. Geological Survey |
| WTG | wind turbine generator |

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## PROGRAM MANAGER'S NOTE

In November 2001, Cape Wind Associates, LLC, applied for a permit with the U.S. Army Corps of Engineers (USACE) to construct and operate a wind-powered electrical generating facility (Cape Wind Energy Project) on Horseshoe Shoal in Nantucket Sound, Massachusetts. In November 2004, the USACE completed the Draft Environmental Impact Statement (DEIS) that examined the potential impacts of the proposed Cape Wind Energy Project. In 2005, section 338(a) of the Energy Policy Act of 2005 (EPAct) became law (Public Law No: 109-58), which added a subsection to section 8 of the Outer Continental Shelf Lands Act (43 U.S.C. § 1337(p)). The new subsection, 8(p), gave the U.S. Department of the Interior (DOI) the authority to issue leases, easements, and rights-of-way for activities related to renewable energy on the Outer Continental Shelf (OCS). As a result, DOI took over responsibility for determining whether or not to approve the Cape Wind Energy Project. Late in 2005, the Minerals Management Service (predecessor to the Bureau of Ocean Energy [BOEM]) reviewed the proposed Cape Wind Energy Project and determined to proceed with the review by preparing a new DEIS.

BOEM's 2009 *Cape Wind Energy Project Final Environmental Impact Statement* (FEIS) provides a detailed description of the Proposed Action, including the construction, operation and maintenance, and decommissioning phases of the proposed Cape Wind Energy Project. On July 5, 2016, the U.S. Court of Appeals vacated the 2009 FEIS and remanded it back to BOEM in order to supplement the FEIS with sufficient data regarding the suitability of the seafloor to support wind turbines. In response to the Court's order, this draft Supplemental Environmental Impact Statement analyzes the geotechnical information related to the area of the Cape Wind lease that BOEM has obtained since 2009.

BOEM's Office of Renewable Energy Programs (OREP) and its predecessors have been conducting environmental analyses of the potential effects of OCS renewable energy development activities since the passing of the EPAct, including a programmatic FEIS and more than a dozen environmental assessments. The National Environmental Policy Act process provides OREP a balanced forum, and an opportunity for early identification and resolution of potential conflicts. OREP welcomes comment on this document from the public and all concerned parties.

James F. Bennett, Program Manager
Office of Renewable Energy Programs
Bureau of Ocean Energy Management

March 15, 2017
Date

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# EXECUTIVE SUMMARY

In 2005, under authority of section 8(p) of the Outer Continental Shelf Lands Act (43 U.S.C. § 1337(p)), the U.S. Department of the Interior's Minerals Management Service (now the Bureau of Ocean Energy Management [BOEM]) began preparing an Environmental Impact Statement (EIS) to evaluate an application submitted by Cape Wind Associates, LLC (CWA), which proposed to construct, operate, and eventually decommission an offshore wind power facility on Horseshoe Shoal in Nantucket Sound off the coast of Massachusetts (71 FR 30693). BOEM published the Final EIS (FEIS) for the Cape Wind Energy Project in 2009 (74 FR 3635). In April 2010, BOEM recorded its decision to issue a lease for the Cape Wind Energy Project after publication of the 2010 Environmental Assessment (EA) and its Finding of No New Significant Impact (FONNSI). In April, 2011, BOEM recorded its decision to approve the Cape Wind Construction and Operations Plan (COP) after publication of an EA and FONNSI.

In 2014, the U.S. District Court for the District of Columbia granted BOEM summary judgment dismissing all claims challenging BOEM's issuance of the Cape Wind lease and approval of the COP, including challenges to the adequacy of the FEIS. However, in 2016, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated that FEIS, and required BOEM to supplement it with additional information concerning the suitability of the seafloor to support the wind turbines before construction of the project could proceed. *Public Emples. for Envtl. Responsibility v. Hopper*, 827 F.3d 1077, 1084 (D.C. Cir. 2016). The Court specifically did not vacate the lease and BOEM's approval of the COP.

However, the Court noted that the additional geotechnical surveys that were subsequently gathered after 2009 as part of the COP, Fabrication and Installation Report (FIR), and Facilities Design Report (FDR), could be used to supplement the 2009 FEIS if they adequately addressed the concerns regarding the ability of the seafloor to support wind turbine generator (WTG) structures. (*Id*. fn. 5). In the years after the 2009 FEIS, CWA submitted geotechnical surveys and reports for the specific purpose of reaffirming the suitability of the construction sites and structure designs within the project area. These geotechnical surveys and reports are discussed in this draft Supplemental EIS (SEIS). In order to prepare the geotechnical surveys and reports, CWA cored and tested the seafloor at every construction location in order to assess its ability to support the project's designed WTG structures. A 3rd party Certified Verification Agent (CVA) reviewed the geotechnical surveys and reports (per 30 Code of Federal Regulations [CFR] 585.705), and determined that the designs and construction methods proposed by CWA were suitable and were well-established within the industry, and had been utilized heavily in Europe.

Since the Court specifically did not vacate the lease and BOEM's approval of the COP, the only alternatives considered in the 2009 FEIS that are still applicable are: 1) the Proposed Action; and 2) the No Action Alternative. Given the Court's remand order, the 2017 Proposed Action means that BOEM would leave undisturbed the decision to issue the Cape Wind lease and subsequent decisions. Likewise, the No Action Alternative means that BOEM would rescind the Cape Wind lease. Table 4 of this draft SEIS summarizes the impacts associated with the construction and operation of the Cape Wind Energy Project.

The additional geotechnical information that BOEM has obtained since 2009 does not change the details and circumstances concerning the seafloor analyzed in the FEIS, nor does it change the details and circumstances concerning the seafloor that BOEM considered when it decided to issue a lease to CWA in 2010. Geotechnical and design analyses in CWA's FDR and FIR

concluded that the structures in the proposed project are consistent with design specification and accepted engineering practices, and BOEM verified this conclusion. The 2017 Proposed Action of this draft SEIS means that the decision to issue the lease will remain undisturbed as well as subsequent decisions that flowed from that, like the COP approval. Thus, the irreversible or irretrievable commitments of resources from the Proposed Action would remain loss of material resources and use of fuel for construction and operation vessels, as well as the irretrievable loss of 11.4 acres (45,134 $m^2$) of soft-bottom benthic habitat, as discussed in Section 8 of the 2009 FEIS. The direct and indirect effects and their respective significance, possible conflicts, energy requirements and conservation potential, natural or depletable resource requirements and conservation potential, circumstances of urban quality and historic and cultural resources, and means of mitigation remain the same, as discussed in the collective analysis for the Proposed Action and alternative actions of the 2009 FEIS, and subsequent EAs prepared by BOEM. The impact factors, as discussed in the 2009 FEIS, are listed in Table 3 of this draft SEIS. A summary of impacts of the Proposed Action is listed in Table 4 of this draft SEIS.

This draft SEIS focuses on the limited scope of the Court's remand. The Court order required BOEM to supplement its analysis to determine whether the seafloor would support the WTGs. Consequently, this draft SEIS focuses on information relevant to BOEM's geotechnical analysis. To provide the necessary analysis to address the Court's remand for this draft SEIS, BOEM's Geotechnical Engineer reviewed previous geotechnical survey analyses and conclusions drawn by the CVA and previously reviewed by BOEM. The Geotechnical Engineer determined that the geotechnical survey information and analyses provided by CWA, and verified by the CVA, were appropriate for foundation designs and construction methods proposed by CWA, and that no other geotechnical information was necessary to make this determination.

Additionally, BOEM has reviewed and reassessed the initial analyses presented in the 2009 FEIS and subsequent EAs, the findings of the BOEM's 2014 review of the FDR and FIR, and the review and analyses by the CVA, and has found that they are still valid and consistent with BOEM regulations. This draft SEIS determined that the additional survey data collected since 2009 confirms and does not alter the analysis of the Proposed Action of the 2009 FEIS and alternatives, and does not result in significantly different environmental effects from those previously analyzed. Geotechnical data collected since the 2009 FEIS verified the characterization of the seafloor at the proposed location of the WTGs.

# 1 INTRODUCTION

On July 5, 2016, the United States (U.S.) Court of Appeals for the District of Columbia Circuit vacated the 2009 *Cape Wind Energy Project Final Environmental Impact Statement* (FEIS; published in the *Federal Register* [FR] in 2009; 74 FR 3635) and ordered that the Department of the Interior's (DOI) Bureau of Ocean Energy Management (BOEM): "supplement [the Environmental Impact Statement (EIS)] with adequate geological surveys before Cape Wind may begin construction." The Court opined: "[w]ithout adequate geological surveys, the [BOEM] cannot 'ensure that the seafloor [will be] able to support' wind turbines." *Public Emples. for Envtl. Responsibility v. Hopper*, 827 F.3d 1077, 1083 (D.C. Cir. 2016). In complying with the Court order, BOEM prepared this draft Supplemental Environmental Impact Statement (SEIS) with an examination and analysis of geological surveys that are relevant to the issue of whether the seafloor can support wind turbines at the locations proposed by Cape Wind Associates, LLC (CWA), in its application to build and operate the Cape Wind Energy Project.

To provide the necessary analysis to address the Court's remand for this draft SEIS, BOEM's Geotechnical Engineer reviewed previous geotechnical survey analyses and conclusions drawn by a 3rd party Certified Verification Agent (CVA) and previously reviewed by BOEM. The Geotechnical Engineer determined that the geotechnical survey information and analyses provided by CWA, and verified by the CVA, were appropriate for foundation designs and construction methods proposed by CWA, and that no other geotechnical information was necessary to make this determination.

Additionally, for this draft SEIS, BOEM has reviewed and reassessed the initial analyses presented in the 2009 FEIS and subsequent environmental assessments (EA), the findings of BOEM's 2014 review of the Fabrication and Installation Report (FIR) and Facilities Design Report (FDR), and the review and analyses by the CVA has found that they are still valid and consistent with BOEM regulations.

The passage of the Energy Policy Act of 2005 (EPAct) amended the Outer Continental Shelf Lands Act (OCSLA), and granted DOI the authority to issue leases, easements, or rights-of-way for renewable energy projects on the Outer Continental Shelf (OCS). Accordingly, CWA submitted its application to the Minerals Management Service (MMS, now BOEM) in 2005 to construct, operate, and eventually decommission an offshore wind power facility on Horseshoe Shoal in Nantucket Sound on the OCS off the coast of Massachusetts. Since the time of CWA's application, MMS has undergone reorganization and two name changes (Bureau of Ocean Energy Management, Regulation and Enforcement [BOEMRE]; BOEM). For simplicity, all three organizations will be referred to as "BOEM" for the remainder of the document.

Below is a chronological discussion of the key events and decisions leading to this draft SEIS, along with a graphical timeline of the events and decisions once BOEM was given regulatory authority (Figure 1).

- 2001: CWA filed a permit application with the U.S. Army Corps of Engineers (USACE) seeking to construct and operate a wind energy project in Nantucket Sound, Massachusetts.
- 2004: USACE published the Draft Environmental Impact Statement (DEIS) for the Cape Wind Energy Project, which considered initial geotechnical surveys conducted by CWA in 2001, 2002, 2003, and 2005 (Table 1 in Chapter 7) to evaluate the seafloor's ability to support wind turbine generators (WTGs; USACE, 2004).

- 2005-2009: After the passage of EPAct in 2005, BOEM initiated the preparation of an EIS in order to evaluate the CWA's application to build the Cape Wind Energy Project. BOEM published a DEIS for the Cape Wind Energy Project (73 FR 3482) on January 18, 2008. BOEM published the FEIS (74 FR 3635) on January 21, 2009, which is available at https://www.boem.gov/Renewable-Energy-Program/Studies/Cape-Wind-FEIS.aspx. In these documents, BOEM included information from the 2004 DEIS published by USACE.

- 2010: BOEM identified new information pertaining to the proposed project, the feasibility of alternatives, and to some of the resources that were analyzed in the FEIS. BOEM prepared an EA to determine whether it needed to prepare an SEIS under the National Environmental Policy Act (NEPA), and is available at https://www.boem.gov/Renewable-Energy-Program/Studies/CapeWindEA-pdf.aspx. BOEM found that there was no new information that would necessitate a reanalysis of the alternatives or the kinds, levels, or locations of the impacts of the Proposed Action on biological, physical, or cultural socioeconomic resources. BOEM concluded that the analyses, potential impacts, and conclusions detailed in the 2009 FEIS remained applicable and valid. No new information pertaining to the seafloor was presented for analysis in this document. BOEM therefore determined that an SEIS was not required, and issued a Finding of No New Significant Impact (FONNSI) on April 28, 2010 (US DOI MMS, 2010a). The Notice of Availability (NOA) of the 2010 EA(75 FR 23798) and the NOA of a Record of Decision (ROD) authorizing the issuance of a lease to CWA (75 FR 34152) were published by BOEM on May 4, 2010, and June 16, 2010, respectively. In October, 2010, BOEM and CWA executed the lease (US DOI BOEMRE, 2010) that granted CWA the right to submit a Construction and Operations Plan (COP) detailing the construction, operation, and decommissioning of its proposed project. CWA submitted its COP to BOEM on October 29, 2010.

  A group of plaintiffs challenged BOEM's decision to issue a lease to CWA and filed a complaint in the U.S. District Court (*Public Employees for Environmental Responsibility et al. v. Bromwich, et al.,* No. 10-cv-01067 (D. D.C.)).

- 2011: After receiving comments on its COP from BOEM, CWA submitted a revised version for BOEM's approval in February 2011 (CWA, 2011). BOEM prepared a second EA and a ROD before deciding whether to approve, approve with modifications, or disapprove CWA's COP (US DOI BOEMRE, 2011a; US DOI BOEMRE, 2011b). The 2011 EA is available at https://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/Studies/EA_FONNSI_4_2011.pdf. The conclusions of the kinds, levels, or locations of impacts described in the 2009 FEIS and 2010 EA remained valid. BOEM again determined that an SEIS was not necessary and issued a FONNSI. In the 2011 ROD, BOEM recorded its decision to approve CWA's COP. BOEM approved the COP on April 18, 2011, with construction contingent on the completion of the remaining geotechnical and shallow hazards surveys as specified within the COP.

- 2012: CWA conducted the additional required geotechnical surveys and sampling. An independent third party CVA began verification of survey work, and CWA initiated laboratory processing and testing of core samples.

- 2013: CWA continued laboratory testing and sampling, and the CVA continued its verification activities. The prepared analyses of these surveys and tests included the geotechnical information, which provided the basis for CWA's engineering design.
- 2014: On March 14, 2014, The U.S. District Court of the District of Columbia upheld the leasing and evaluation process conducted by BOEM and dismissed all of plaintiffs' claims against BOEM. On May 20, CWA submitted the FDR and FIR for the project. As part of its review, BOEM evaluated whether the activities described within the reports represented a change to those described in the approved COP. BOEM found that, in some cases, the activities described in the reports differed from what CWA described in the approved COP. Due to the nature of the proposed changes, and in consideration of the criteria outlined in 30 CFR 585.634, BOEM determined that portions of the approved COP needed to be revised. Hence, BOEM notified CWA that it objected to the FDR and FIR pending CWA's submission of revisions to the COP and resolution of other identified issues.

  Subsequently, on July 25, 2014, CWA submitted revisions to the COP. BOEM prepared a third EA (US DOI BOEM, 2014a), which evaluated only topics for which new information had become available, and which could be material to the decision making process. This included new information regarding boulder mitigation methodologies, scour protection, and pile driving methodologies. The 2014 EA is available at https://www.boem.gov/BOEM-EA-FONNSI-Cape-Wind-COP-Revisions/. BOEM determined that no new significant impacts associated with the proposed revisions to the 2014 COP for the Cape Wind Energy Project were identified that were not already considered in the FEIS. The conclusions of the kinds, levels, or locations of impacts described in the FEIS and EAs prepared in 2010 and 2011 remained valid. As a result, BOEM determined that an SEIS was not required, and issued a FONNSI on September 8, 2014 (US DOI BOEM, 2014a). BOEM issued a letter to CWA removing BOEM's objections to the FDR and FIR on September 9, 2014.

  On December 4, 2014, the U.S. District Court's March 14 ruling was appealed by the plaintiffs.
- 2016: On July 5, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated the 2009 Cape Wind Energy FEIS and ordered that BOEM: "supplement [the EIS] with adequate geological surveys before Cape Wind may begin construction." The Court opined: "[w]ithout adequate geological surveys, the [BOEM] cannot 'ensure that the seafloor [will be] able to support' wind turbines." However, while the Court found that: "[BOEM] therefore had violated NEPA," the Court noted that "… [it] does not necessarily mean that the project must be halted or that Cape Wind must redo the regulatory approval process." *Public Emples. for Envtl. Responsibility v. Hopper*, 827 F.3d 1077, 1083 (D.C. Cir. 2016). The Court explicitly left undisturbed BOEM's 2010 decision to issue the lease and BOEM's 2011 decision to approve the COP. In fact, the Court indicated, in a footnote, that BOEM could refer to surveys conducted after 2009, such as the 2012 surveys, in its revised impact statement if BOEM believed that they adequately addressed the geologic concerns discussed in the Court's opinion. (*Id*. fn. 5). In response to the Court's remand order, BOEM initiated this process to supplement the FEIS analyzing the extensive geotechnical data regarding the project area sediments ability to support planned structures.

- 2017: This draft SEIS incorporates by reference the prior analyses of the 2009 FEIS. The 2009 FEIS analyzed the construction, operation, maintenance, and decommissioning of a wind energy facility on Horseshoe Shoal in Nantucket Sound, on the OCS offshore Massachusetts. The impacts relating to the construction and operation of an offshore wind facility were each evaluated by resource category (Table 4 in Chapter 7). Construction impacts are minor to moderate on marine birds, and negligible to moderate on turbidity. Operation impacts are negligible to moderate on coastal and marine birds, and minor to moderate on Passerines, pollution/potential spills, vessel traffic, avifauna, marinas and recreational boating, commercial fishing, and vessel traffic. Operation impacts on visual resources are moderate on shore, and major in close proximity on-water. All other evaluated impacts are negligible to minor. The potential impacts and cumulative impacts related to geotechnical ground investigations were minor, and because the activities have now already occurred, there is no need to describe them in this document.

  This SEIS focuses on the limited scope of the Court's remand. The Court order required BOEM to supplement its analysis to determine whether the seafloor would support the WTGs. Consequently, this draft SEIS focuses on information relevant to BOEM's geotechnical analysis.

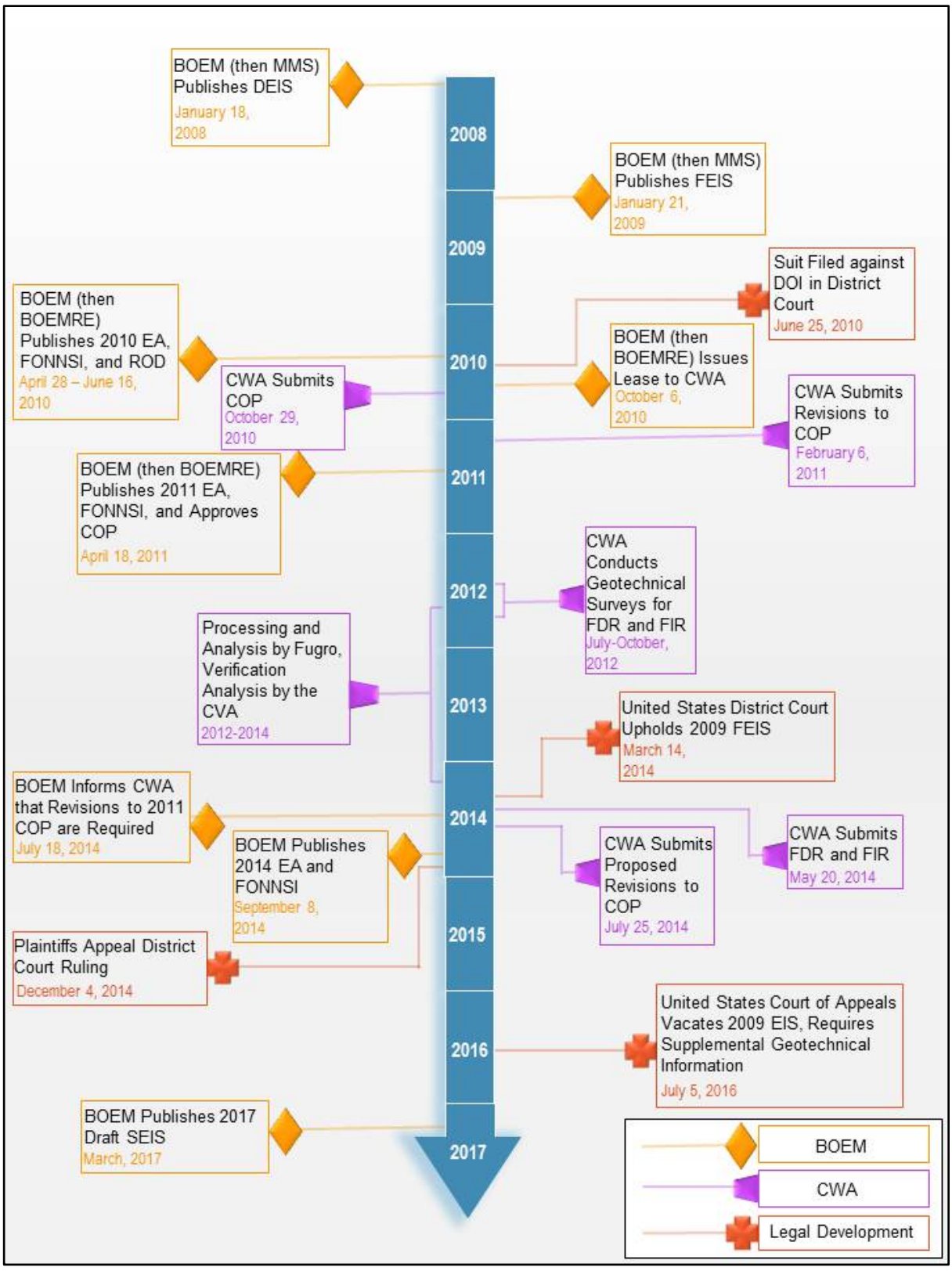


**Figure 1. Timeline of Events Leading to this Supplemental Environmental Impact Statement.**

## 1.1 Purpose and Need

The purpose and need of CWA's request to develop and operate a wind energy facility on the OCS offshore of New England, is to employ technology that is currently available, technically feasible, and economically viable; that can interconnect with and deliver electricity to the New England Power Pool; and make a substantial contribution to enhancing the region's electrical reliability and regional renewable energy portfolio. There has been no change in the purpose and need given that the Cape Wind lease and COP, which were not vacated by the Court, fulfill the purpose and need of the 2009 FEIS. Consequently, the purpose and need remains the same.

# 2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The 2009 FEIS evaluated several alternatives which represented a reasonable range of alternatives at that time. Several of the alternatives analyzed in the 2009 FEIS, however, are not relevant to the scope of the Court's required analysis on remand. This draft SEIS specifically addresses the supplementation required by the Court in analyzing information on the ability of the seafloor to support the proposed operations. The Court did not vacate the lease that BOEM issued to CWA in 2010, nor the COP BOEM approved in 2011. In light of the remand order and the remaining lease and COP, only two alternatives remain relevant to the Court's remand; the 2017 Proposed Action (affirming BOEM's issuance of the existing lease), and the No Action Alternative (requiring BOEM to rescind lease issuance). Given that the Court did not vacate either the lease or the COP, the 2017 Proposed Action means that BOEM would leave undisturbed the issuance of the lease; selection of the No Action Alternative means that BOEM would rescind the decision to issue the lease (No Action).

**Proposed Action (Agency Preferred Alternative)**

The Proposed Action for the 2009 FEIS entailed the construction, operation, and decommissioning of 130 WTGs located in a grid pattern on and near Horseshoe Shoal in Nantucket Sound, Massachusetts, as well as an electrical service platform (ESP), inner-array cables, and two transmission cables. Each of the 130 WTGs would generate electricity independently of each other. Solid dielectric submarine inner-array cables from each WTG would interconnect and terminate at the ESP. The ESP would serve as the common interconnection point for all of the WTGs. The proposed submarine transmission cable system is approximately 10.9 nautical miles (nm; 20.1 kilometers [km]) in length (6.6 nm [12.2 km] within the Massachusetts 3 nm [5.6 km] territorial line) from the ESP to the landfall location in Yarmouth. The two parallel submarine transmission cables 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 in Yarmouth.

For this draft SEIS, the Proposed Action, which remains the same as the 2009 Proposed Action, would leave undisturbed BOEM's decision to issue the lease, and decisions that flowed from that, like the COP approval. The 2017 Proposed Action would allow CWA to enjoy full use of the lease within the terms and conditions that were identified in the lease. BOEM issued the lease to CWA on October 4, 2010, after the publication and circulation of the DEIS, 2009 FEIS, and the 2010 ROD (US DOI MMS, 2010b).

**No Action**

The No Action Alternative for this draft SEIS, which remains the same as the 2009 No Action Alternative, would require BOEM to rescind the decision to issue the lease to CWA. If this alternative were chosen by BOEM, CWA would no longer be able to develop the project as authorized in the lease.

**Alternatives not Considered in Detail**

In the 2009 FEIS (Section 3), BOEM considered two geographic (South of Tuckernuck Island and Monomoy Shoals) and three non-geographic (smaller project, phased development, and condensed array) alternatives. These five alternatives were subjected to detailed analysis, in addition to the Proposed Action, and the No Action Alternative described above.

Except for the Proposed Action and No Action Alternative, all the alternatives subjected to detailed analysis in the 2009 FEIS were eliminated from detailed study in this draft SEIS.

The Court's limited remand involved only supplementing with geological information to ensure that the seafloor will be able to support the WTGs. The Court did not vacate CWA's lease, and therefore the geographic alternatives are not relevant because they consider locations other than the lease area. The nongeographic alternatives concerning project size, phased development, and a condensed array are in the lease area, but are not relevant when determining whether the seafloor will support the WTGs.

# 3 AFFECTED ENVIRONMENT - PREVIOUS AND CURRENT PROPOSED ACTIONS

This discussion of the affected environment focuses on the limited scope of the Court's remand. The Court order required BOEM to supplement its analysis to determine whether the seafloor would support the WTGs. Consequently, the discussion of the affected environment focuses on information relevant to BOEM's geotechnical analysis. A comprehensive discussion of the affected environment of the Cape Wind Energy Project was included in Section 4 of the 2009 FEIS.

## 3.1 Introduction

The most fundamental physical characteristics upon which potential sites for wind energy projects are evaluated are wind conditions and water depth. The greater the water depth, the greater the cost is to install. Nantucket Sound is considered an attractive area for constructing an offshore wind facility partly due to the relatively shallow water depth which falls within the suitable range for established wind turbine foundation design.

Primary Factors Leading to Potential Structure Failure

The major possible factors relating to a seafloor failing to support a pile driven WTG or other marine structure are:

- Liquefaction due to Earthquakes or Wave Action
- Seafloor Suitable for Foundation Type (Monopile)
- Soil Cohesion and Soil Strength
- Repeat Loading (Structural)
- Inadequate Damping (Structural)

*Liquefaction due to Earthquakes or Wave Action* – Earthquakes can produce vibrations that interact with soil particles in such a way that they become suspended while agitated by that energy. While the particles composing soil are suspended, they behave like a liquid, allowing structures attached or imbedded into the seafloor to sink or tip over. The frequency of which this phenomenon can occur is related to the frequency and intensity of earthquake activity within an area, the composition and depth of the soil, and the underlying stratigraphy of the area. To a lesser degree, wave action can also create shallow liquefaction effects depending on wave and sediment characteristics.

*Seafloor Suitable for Foundation Type (Monopile)* – Structures that are to be pile driven into the seafloor must be sited in locations where there is ample loose sediment to allow for it. Some amount of solid rock material intermixed within the sediment can be tolerated through micro-siting or drilling, but other types of foundations and engineering strategies become preferable in excessively rocky conditions. The depth at which a structure is pile driven can be modified to accommodate looser sediments.

*Soil Cohesion and Soil Strength* – The stratigraphy and composition of a seafloor impact how much strength and stiffness are exhibited by the soil. The particles that make up soil vary in compactness, size, and abundance. Material with different proportions of particle sizes will have different properties. If a seafloor is composed of material that lacks cohesion and soil strength,

the surrounding material may deform or displace from forces impacting a structure that has been driven into it.

*Repeat Loading (Structural)* – Loading refers to externally applied forces on a structure. Changes in environmental conditions create wind and wave forces that vary in direction, intensity, and duration. This repeat loading can have a cumulative impact on a structure's ability to stand, and must be accounted for within the design of the structure.

*Inadequate Damping (Structural)* – Structures sway from receiving energy from dynamic wind and wave forces. These oscillations can become amplified over time if they are not mitigated through damping, and can potentially compromise the structure. Damping can be done by increasing the size and depth of the foundation, and by adding components to the structure that act to mitigate or negate loading by absorbing and counter-acting the oscillation.

Types of Geologic Surveys

To determine whether the seafloor can support WTGs, geologic surveys are performed. Geologic surveys can be broadly divided as either physiographic or geotechnical.

*Physiographic surveys* – Physiographic surveys involve passive or remote techniques that provide information about the surface and near-surface of the seafloor, without physically contacting it. Examples of these physiographic surveying techniques include hydrographic, sonar, and magnetometer surveying.

*Geotechnical surveys* – Geotechnical surveys physically sample and penetrate the seafloor. These are the surveys that provide the information most pertinent to the ability of the seafloor to support a given type of foundation design. Two types of geotechnical surveys, borings and vibracores, are techniques that extract material from below the seafloor that can have their composition and characteristics analyzed in a laboratory. Cone penetration tests (CPTs) provide information about the layers of material under the seafloor surface including bearing capacity and soil strength of the sediment by measuring the pressure and resistance as the instrument is driven into the seafloor. Benthic grabs directly pick up sediment samples at the surface of the seafloor. All of these direct samplings and measurements provide input to the computer modeling which CWA used to assessed the ability of the WTGs to be supported by the seafloor, and was reported in the FDR and FIR.

Foundation Types

When selecting the foundation type and design for a wind energy project, water depth and the underlying material of the seafloor are some of the most important considerations. Structural problems can be avoided by matching foundation design to site characteristics. The most widely used foundation type is a monopile that is driven into the seafloor in locations with sufficiently thick sediment over bedrock, have few boulders, and are in less than 100 feet (ft; 30 meter [m]) of water. Early geologic surveys conducted by CWA prior to the 2009 FEIS demonstrated that monopile foundations were a suitable design for a wind energy facility in Nantucket Sound based on the depth of sediment to bedrock and water depth. Later geotechnical measurements and sampling that CWA conducted at each of the proposed installation location confirmed that monopiles were appropriate to support the WTGs at those specific locations. This is discussed in more detail below.

## 3.2 2009 Final Environmental Impact Statement

The 2009 FEIS described the regional geologic setting and initial field studies that were completed in order to further refine the understanding of the geology at the site of the Proposed Action, in particular, their relation to the seafloor, sub-seafloor, and onshore cable routes. The 2009 FEIS geologic setting has not changed. Moreover, the 2009 FEIS was informed in part by integrated marine geological/hydrographic surveys and geotechnical/sediment sampling programs that were conducted by CWA in 2001, 2002, 2003, 2004, and 2005 on Horseshoe Shoal, and along the proposed transmission cable route from the ESP to the proposed landfall location in Yarmouth. Hydrographic measurements, side-scan sonar, seismic profiling, magnetometer surveys, vibracoring, sediment boring, and test pits were all methods employed in the evaluation of the site.

Earthquake Liquefaction

In general, as the 2009 FEIS described, Cape Cod and Nantucket Sound are areas that are considered at low risk for earthquakes according to the U.S. Geological Survey (USGS) Seismic Hazard Maps for the area of the Proposed Action. Most earthquakes that do occur in the area are too weak to even be felt by residents. During a sufficiently strong earthquake, liquefaction can occur, which is a process whereby the strength and stiffness of a soil and/or sediment is reduced by earthquake shaking or other rapid loading. It is highly unlikely that WTGs in the area would be exposed to this kind of event at a strength sufficient to compromise structures driven deep into the seafloor. The FDR and FIR reports considered earthquake liquefaction, and it is discussed in Chapter 3.3 of this SEIS.

Seafloor Suitable for Pile Driving

As discussed in the 2009 FEIS, shallow hazards surveys data presented a picture of the seafloor that ranges from flat and barren, to rolling with areas of varying height sand waves. The surveys showed localized areas of glacial erratics (pebble to boulder size rock fragments carried by glacial ice), and a concentrated outcrop of possible till (an unstratified glacial deposit that can include clay, silt, sand, cobbles, and boulders). As a result of this information, CWA sited WTGs in order to avoid this possible till deposit during the selection of the final proposed transmission cable alignments.

Soil Cohesion and Soil Strength

To determine if the proposed WTGs would be effected by geologic conditions that are typical in this area, CWA completed geotechnical surveys that characterized the sediment below the seafloor at all of the WTG locations and along electrical transmission cable runs, and provided BOEM the collection, characterization, and analysis of samples collected from 84 vibracores and 22 deep borings on Horseshoe Shoal. The vibracores were advanced up to 20 ft (6.1 m) below the seafloor. Geotechnical borings were advanced below the proposed depth of the WTG foundations (85 ft [26 m]) including one that was extended to 150 ft (47.5 m) below the seafloor. CWA also surveyed the site for the ESP with a CPT to 220 ft (67 m) below the seafloor. In general, geotechnical surveys indicated that subsurface soil conditions within the WTG array on Horseshoe Shoal consist primarily of sands and glacial deposits to greater than 100 ft (30.5 m) below the seafloor, which is suitable for turbine installation.

CWA did not encounter bedrock during the geotechnical investigation. The depth to bedrock beneath the seafloor is estimated at greater than 300 to 900 ft (91.5-274.4 m) below the seafloor

across the area of the Proposed Action, sloping to the southeast. The estimated depth to bedrock is below the deepest foundation proposed (USGS, 1983; USGS, 1990).

CWA performed numerical modeling and engineering analysis of site specific data related to oceanographic processes to assess, simulate, and predict potential impacts to geologic resources for installation and operation of the Proposed Action. The studies included: Report No. 4.1.1-2 *Simulation of Sediment Transport and Deposition from Cable Burial Operations in Nantucket Sound for the proposed energy Project*; Report No. 4.1.1-3, *Estimates of Seafloor Scar Recovery from Jet Plow Cable Burial Operations and Possible Cable Exposure on Horseshoe Shoal from Sand Wave Migration*; Report No. 4.1.1-4, *Analysis of Effects of Wind Turbine Generator Pile Array of the Project in Nantucket Sound*; Report No. 4.1.1-5, *Revised Scour Report;* Report No. 4.1.1-6, *Conceptual Rock Armor Scour Protection Design*; Report No. 4.1.1-7, *Hydrodynamic Analysis of Scour Effects Around Wind Turbine Generator Piles, Use of Rock Armor and Scour Mats, and Coastal Deposition and Erosion*; and, in Report No. 4.1.1-8, *Seafloor Scour Control Systems Scientific Design Station Report*. A detailed summary of these studies is presented in Section 5.3.1.1 of the 2009 FEIS, and the studies were considered in the context of potential impacts from building the wind energy facility.

The 2010 ROD that approved the issuance of the lease required CWA to conduct geotechnical field surveys to collect sufficient information to further characterize the surface and subsurface geologic conditions in preparation for final design and construction. CWA conducted these additional geotechnical field investigations and a shallow hazards survey in 2012, BOEM reviewed the results (Table 2 in Chapter 7). See discussion in Section 4.3.

## 3.3 2014 Proposed Revisions to the Cape Wind Construction and Operations Plan

When BOEM reviewed the FDR and FIR, it determined that certain activities proposed in the FDR and FIR, including boulder mitigation methodologies, were not described in the BOEM-approved 2011 COP, or evaluated in the 2011 EA (US DOI BOEMRE, 2011a). Therefore, BOEM informed CWA that revisions to the 2011 COP were required pursuant to the regulations (30 CFR 585.634), providing more information about the environmental impacts of the drilling that was proposed with the boulder mitigation plan.

Seafloor Suitable for Pile Driving

Included in the revisions to the COP, CWA described boulder mitigation methodologies for driving turbine monopiles into the seafloor (CWA, 2014c; FIR Section 2.2.3.d). If boulders were encountered during installation, CWA proposed the use of impact and vibratory hammers to drive through boulders, as well as drilling through boulders as mitigation methodologies if they were encountered during installation. Foundation monopiles are designed to be driven to full penetration with a hydraulic impact hammer, which can present problems if boulders are present. CWA's boulder mitigation methodologies included options such as vibratory hammers, which require a decision to be made about their use in advance of pile driving.

## 3.4 2014 Facilities Design Report and Fabrication and Installation Report

CWA conducted a multi-phase, integrated high-resolution geophysical (HRG) survey and various types of geotechnical ground investigations of the Cape Wind Project area during the

summer and fall of 2012. In the FDR and FIR, CWA's CVA evaluated the surveys and investigations provided by CWA and the CVA's evaluations to BOEM. The CVA determined the FDR and FIR were appropriate and reliable for offshore construction of a wind facility in the Cape Wind Project area. The CVA documented its findings in a report submitted to BOEM for review (DNV, 2014). CWA conducted geotechnical ground investigations, which were scoped to provide design-level characterization of the physical seafloor and subsurface conditions, interpretations, and recommendations. These investigations are relevant for the design and construction of the completed project. CWA defined the scope of the program and methods used. The methods included vibracoring, CPTs, and sample borings. CWA cored and tested every potential turbine foundation site. BOEM reviewed the scope and methods, and accepted them. A summary of the activities are presented in Table 2 (Chapter 7).

Soil Cohesion and Soil Strength

CWA conducted field and laboratory testing of sediment properties as part of a testing program. The testing program included extensive classification tests, strength measurements, and consolidation-compressibility measurements.

Repeat Loading and Damping

To design for repeated loading, CWA modeled the project's selected structure design using data from these lab and survey tests. BOEM and the CVA used these data, and the calculated model outputs they factored into, to evaluate CWA's FDR and FIR.

Earthquake Liquefaction

Modeling of the project structure designs and measurements from the geotechnical surveys conducted by CWA in 2012 indicated liquefaction is not expected to occur in underlying sands in Nantucket Sound during the sizes of earthquakes most likely to occur within the project's life; however, if a stronger earthquake occurred, minor liquefaction might occur at a depth of 26 to 33 ft (8-10 m; GZA, 2012). Relative to the loading from gravity and environmental (wind, wave, and current) sources on a wind turbine, the loading from earthquakes in this area is not considered a significant factor (Foley, 2014). CWA also modeled the design structure of the ESP to be stable under expected loading conditions from wind, waves, and potentially ice and/or seismic events (MN, 2013).

As required by BOEM (30 CFR 585.705), an independent 3rd party CVA also analyzed the results and findings and determined if the WTGs were designed in accordance with accepted standards. The scope of the CVA review included the design, fabrication, and installation of all offshore structures, including the submarine electric cables (DNV, 2014). The verification of the site conditions was based on reported wind, oceanographic, and geotechnical data for the project. The verification focused on principles and methods pertaining to data acquisition, applied statistical methods, and determination of design parameters. In order to fulfill the above-mentioned role, the CVA performed the following activities:

- Verified the structural adequacy of each structural element for the intended operations through technical audits, spot checks, and review of the designer's documentation.
- Verified that the critical load cases and combinations have been captured.
- Verified that the structural load transfer between interfaces is appropriate and consistent.

- Verified compliance with relevant codes and standards for structural and material adequacy.
- Spot checked critical structural details through review of key drawings to verify consistency with design assumptions.
- Performed an independent model analysis of both the WTG/tower/foundation structure and the ESP structure.

Based on their verification of the FDR and FIR documents, the CVA concluded that the design and installation methods set forth in the FDR and FIR were consistent with the requirements stipulated in 30 CFR 585 Subpart G, and the revised BOEM-approved COP for the project.

Information from FDR/FIR Review

BOEM conducted a review of the FDR and FIR. BOEM identified six main questions, three of which were relevant to geotechnical information, and all of which were satisfactorily answered (US DOI BOEM, 2014b).

The first question relevant to geotechnical information stemmed from ensuring that damping was being modeled sufficiently. CWA addressed this issue to BOEM's satisfaction by providing information to verify that the design utilized an appropriate estimate of damping. Each WTG would have an adequate damping system in place to mitigate or negate oscillations from environmental forces acting upon the WTGs.

The second question concerned the possible effect of liquefaction of seafloor sediments by wave action on the turbines standing, and whether CWA had accounted for this in project design. CWA presented data supporting how its engineering design accounted for this potential hazard. CWA also described how the proposed scour protection system would also help mitigate this type of impact. CWA committed to routinely monitoring for settling and, if necessary, remediate if they detected settling.

The third question concerned the modeling of and the interaction between piles and surrounding sediment. This is important because the sediments and seafloor need to be analyzed to determine that the seafloor will support the turbines as wind and wave forces are impacting them. CWA responded that appropriate analyses were performed based on the specific soil properties measured at the project site that showed that the seafloor was suitable for supporting WTGs and in accordance with the applicable standards used in the industry. According to CWA, the design method and geotechnical parameters were comparable to those used under similar conditions in other wind farm projects, and the WTG designer judged them to be suitable for the proposed design. The CVA verified CWA's analysis. CWA's response satisfactorily clarified this matter for BOEM.

BOEM prepared the 2014 EA to determine whether BOEM was required to prepare an SEIS (40 CFR 1502.9(c)) before deciding whether to approve, approve with modifications, or disapprove proposed revisions to the COP. BOEM considered whether: 1) the revisions to the COP described in Section 3 of the 2014 EA, as identified by CWA, are substantial changes in the Proposed Action that are relevant to environmental concerns; and, 2) there are significant new circumstances or information relevant to environmental concerns and bearing on the Proposed Action or its impacts, including activity and equipment details provided in the FDR and FIR.

BOEM evaluated only topics for which new information had become available, and which could be material to the decision making process. On the basis of its analysis in the EA, BOEM issued a FONNSI on September 8, 2014, and gave notice of having no objections to the revisions to the COP, FDR, and FIR on September 9, 2014.

## 3.5 Supplemental Environmental Impact Statement Conclusion

The geology of the affected environment of the Cape Wind Project area has not changed for this draft SEIS. Additional geotechnical information reported as part of the revised COP, FDR, and FIR confirmed that the original survey information was valid, and the foundation design and installation methods proposed were appropriate.

Initial geotechnical and geophysical surveys conducted during the early 2000's revealed the proposed project area in Nantucket Sound has over 300 ft (90 m) of suitable seafloor material overlying bedrock, which is well beyond the installation depth of the proposed foundations. Several studies were conducted prior to the 2009 FEIS that examined the conditions of the seafloor and its ability to support offshore wind energy structures. The 2009 FEIS identified the need for further geotechnical data collection and analysis in CWA's FDR and FIR. CWA completed geotechnical data collection and analysis in 2012-2014.

The additional geotechnical information reported as part of the revised COP, FDR, and FIR confirmed that the original foundation designs were appropriate for the actual site conditions. In addition, they provided information about the installation methods that would be employed, and verified the safety and appropriateness of the project's design. After evaluating the FDR and FIR, and engaging with CWA, BOEM concluded that local conditions of the sediment were considered in the design, and they were not a significant concern (US DOI BOEM memo - engineering review dated September 8, 2014b). These later geotechnical measurements and sampling that CWA conducted at each of the proposed installation location confirmed that monopiles were appropriate to support the WTGs at those specific locations. Each location had suitable soil cohesion and strength and a seafloor on which pile driving would be effective. Since installation is tailored to each specific location's conditions, the length of monopile, insertion depth, and foundation elevation varies depending on the location, taking into account water depth and structural and geotechnical parameters. The design plan of the WTGs included appropriate damping and would withstand reasonably expected repeat loading. The CVA concluded, and BOEM concurred, that it is not reasonably likely that the WTGs would be compromised by earthquake liquefaction in this area.

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# 4 ENVIRONMENTAL CONSEQUENCES

Environmental consequences were identified and described in the 2009 FEIS (Section 5). Subsequent EAs described possible changes to the environmental consequences described in the 2009 FEIS based on new information in the COP, FDR, and FIR, or minor changes in the initial project plan. Section 4.1 reviews previous analyses of past environmental documents. Section 4.2 presents a new analysis of environmental consequences of the 2017 Proposed Action, and Section 4.3 presents an analysis of environmental consequences of the No Action Alternative.

## 4.1 Previous Analyses

### 4.1.1 2009 Final Environmental Impact Statement

The identification and description of activities, equipment, materials, and processes that have the potential to create impacts on natural and human resources in areas proposed for use by the Proposed Action pertaining to geotechnical evaluations and studies are discussed in the 2009 FEIS (Sections 5.1 and 5.2). These factors are then used, as appropriate, in characterizing resource impacts in Sections 5.3 and 5.4 of the 2009 FEIS, as well as to some extent in Section 6. It is important to note that these factors need to be considered within the larger context of other sources of the same or similar impact-producing factors that have occurred in the recent past, currently occur, or could reasonably be expected to occur in the near future, within the site of the Proposed Action (Table 3 in Chapter 7).

Anticipated impacts to physical, biological, socioeconomic resources, land use, and navigation and transportation from the Proposed Action are categorized as negligible, minor, moderate, or major. These impact levels are used in the impact section of the FEIS to provide consistency in the assessment of environmental impacts and socioeconomic issues. The four impact levels are defined in the executive summary of the 2009 FEIS, and remain consistent in subsequent EAs (US DOI MMS, 2009).

The potential impacts and cumulative impacts related to geotechnical ground investigations were minor, and because the activities have now already occurred there is no need to describe them in this document. The impacts relating to the construction and operation of an offshore wind facility were each evaluated by resource category (Table 4 in Chapter 7).

CWA surveyed sediment depth to bedrock and sediment characteristics within the area of the Proposed Action for the purpose of evaluating the suitability of the area for development. These data were included and discussed in the 2009 FEIS. Based on the available geological and geotechnical data and the results from these surveys, the CVA found the structure and design of the Proposed Action was consistent with established methods within the industry. BOEM had no objection to this conclusion of the CVA. The conclusions reached from the analyses of the 2009 FEIS are unchanged by the additional geotechnical information that CWA gathered subsequently. The 2009 FEIS described the environmental impacts of the Proposed Action, which included consideration of the general design of the wind turbines and associated structures, and the best available information concerning the seafloor from prior surveys taken early in the project's planning (USACE, 2004).

### 4.1.2 2010 Environmental Assessment - Lease Issuance

On May 4, 2010, BOEM published the NOA of the 2010 EA (US DOI BOEMRE, 2010; 75 FR 23798) and the NOA of the 2010 ROD, which authorized the issuance of a lease to CWA (75 FR 34152). In accordance with Council on Environmental Quality (CEQ) regulations (40 CFR 1502.9), the 2010 EA examined whether there were any "substantial changes in the Proposed Action" or "significant new circumstances or information" that did not exist at the time BOEM issued the Cape Wind FEIS in January 2009. BOEM examined the new information that had become available to determine if it was "relevant to environmental concerns and bearing on the Proposed Action or its impacts" (40 CFR 1502.9(c)(ii)). In the 2010 EA, BOEM examined resources such as air quality, cultural resources, avifauna, and marine mammals, among others. There was no new geotechnical information at this time. Input for the 2010 EA came from BOEM research and review of new scientific and technical information, in comments received on the FEIS, and through intergovernmental coordination and communications. The 2010 EA evaluated only the topics in the 2009 Cape Wind FEIS for which new information had become available since the BOEM published the FEIS. The analysis of the 2009 FEIS pertaining to geotechnical activities and the feasibility of the proposed structures remained unchanged because there was no new geotechnical information.

### 4.1.3 2011 Environmental Assessment - Construction and Operations Plan

Pursuant to the terms of the lease and the 2010 ROD, CWA submitted a COP to BOEM on October 29, 2010, and a revised version of its COP on February 4, 2011. BOEM prepared an EA (US DOI BOEMRE, 2011a) to determine whether BOEM could make a FONNSI, or should prepare an SEIS before deciding whether to approve, approve with modifications, or disapprove the COP.

The COP contained a detailed analysis of the geotechnical surveys and tests that CWA had conducted to that point. The surveys found that the depth to bedrock was greater than the foundation design depth. The sediment column consisted mostly of sand and glacial deposits and was suitable for supporting WTGs.

For the purpose of ensuring that the structural design of the project is sound, the ROD and the lease required CWA to conduct more intensive surveys prior to construction (US DOI BOEMRE, 2011a: ROD pp. 29, 41, 42; Lease Addendum C, pp. C-3 to C-14). Like in the FEIS, these supplemental offshore field surveys included geotechnical surveys (i.e., soil borings, CPTs, and vibracores). The COP provided detailed information as to equipment type and additional surveys to be performed (CWA, 2014c). An additional 80 vibracores (for a total of 130, i.e., one at each turbine location) and 110 CPTs (or alternative subsurface evaluation technique) were required by the 2010 ROD and Cape Wind lease. BOEM concluded that the effects of these additional vibracores and CPTs on the marine environment generally (e.g., water quality and benthic communities) were likely be insubstantial, due primarily to the temporary and localized nature of the effects of these activities.

This EA concluded that the impacts of the additional vibracores and CPTs would be similar to those described in the 2009 FEIS (p.5-13), and would result only in minor localized temporary increases in turbidity near each bore hole. As a result, the increase in the number of borings required by the ROD and Cape Wind lease did not present significant new circumstances regarding impacts to benthic resources or fish populations.

### 4.1.4 2014 Environmental Assessment- Fabrication and Installation Report and Facilities Design Report, Revised Construction and Operations Plan

Under BOEM regulations, CWA was required to submit a FDR (CWA, 2014a) and FIR (CWA, 2014b) to BOEM before installing facilities described in its approved COP (30 CFR 585.632), which CWA did on May 20, 2014. These documents specified in detail the size and type of monopile to be used, and how these structures would be installed. On July 18, 2014, BOEM determined that certain activities proposed in the FDR and FIR were not described in the 2011 COP, such as cable configuration and scour protection around piles. BOEM informed CWA that revisions to the 2011 COP were required pursuant to the regulations (30 CFR 585.634). On July 25, 2014, CWA submitted proposed revisions to the COP for BOEM's approval. The proposed revisions to the COP contained minor revisions that became apparent during BOEM's review of CWA's FDR and FIR.

BOEM prepared the 2014 EA to determine whether BOEM was required to prepare an SEIS (40 CFR 1502.9(c)), before deciding whether to approve, approve with modifications, or disapprove proposed revisions to the COP. In the EA BOEM considered: 1) if the revisions to the COP, as identified by CWA, are substantial changes in the Proposed Action that are relevant to environmental concerns; and, 2) if there are significant new circumstances or information relevant to environmental concerns and bearing on the Proposed Action or its impacts, including activity and equipment details provided in the FDR and FIR. BOEM evaluated only topics for which new information had become available, and which could be material to the decision making process. The geotechnical surveys that CWA performed in 2012 and 2013 provided additional information for the engineering design and the installation of the WTGs. Based on this new information, CWA proposed new equipment when discussing methodologies for handling boulders that was different from that previously assessed (FEIS Appendix G), BOEM analyzed these new methodologies and equipment in the 2014 EA, prior to determining whether the objections to the FDR and FIR were resolved to BOEM's satisfaction.

According to the 2014 EA, given that the distribution of subsurface boulders is expected to resemble the distribution of boulders on the surface, CWA's Site Characterization Report (FDR Section 4.4.6) revealed that there should be ample room to install the monopile foundations without encountering boulders. Out of the options presented by CWA for boulder mitigation, vibratory hammers would have the most impact on water quality. The suspended material from the impact of vibratory hammers to boulders would affect water quality during monopile installation. As concluded in the FEIS, the effects of sediment disturbance during project construction would be temporary and localized, and overall effects to water quality would be minor. BOEM published the 2014 EA and FONNSI and approved the revised COP. With receipt of the revised COP and FDR/FIR, BOEM had received all information and data necessary to determine whether the seafloor would support WTGs.

### 4.1.5 Analysis and Conclusion

BOEM reviewed and analyzed geological surveys in the 2009 FEIS which characterized the depth and composition of sediment within the area of the Proposed Action. These surveys were conducted by CWA for the purpose of evaluating the suitability of the area for development, utilizing a specific size of WTG and supporting monopile. While both CWA and BOEM found that the data gathered and referenced in the 2009 FEIS gave no indication that the area of the Proposed Action was not generally capable of supporting WTG's, BOEM required additional

geotechnical data be gathered at the specific proposed construction sites prior to construction to confirm these findings, which CWA provided in the FDR and FIR. The additional geotechnical data and the design basis for the WTG foundations was provided by CWA from using the information from the surveys conducted in 2012 as well as survey information from previous surveys, fulfilling BOEM's requirement for additional geotechnical data as outlined in the 2010 ROD. The CVA reviewed and confirmed this data and analysis. The CVA recommended that BOEM accept the FDR and FIR based on the CVA's review of the design and installation methods set forth in the FDR and FIR (confidential report dated May 16, 2014). BOEM concluded that the CVA's recommendation was consistent with the findings of previous analyses by BOEM since it did not change the analysis and conclusions of the 2009 FEIS and 2010 ROD to issue CWA a lease.

## 4.2 Proposed Action

### 4.2.1 Impacts of the 2017 Proposed Action

The impacts of the Proposed Action in this draft SEIS remain the same as the impacts of the Proposed Action of the 2009 FEIS, as this 2017 Proposed Action is to leave the decision to issue a lease in place. A summary of all impacts of the Proposed Action can be found in Table 4 in Chapter 7 of this SEIS.

Direct and Indirect Effects

The 2017 Proposed Action would allow CWA to install 130 WTGs within the lease area. The initial analyses by BOEM in the 2009 FEIS used information about WTGs standing from reports analyzing the *Revised Scour Report*, Report No. 4.1.1-5; *Conceptual Rock Armor Scour Protection Design*, Report No. 4.1.1-6; *Hydrodynamic Analysis of Scour Effects Around Wind Turbine Generator Piles, Use of Rock Armor and Scour Mats, and Coastal Deposition and Erosion*, Report No. 4.1.1-7, and various other field coring and boring field testing results and analyses that were performed during the design of this project (USACE, 2004) to determine that the WTGs would stand if installed the lease area. As part of the approval for the lease, BOEM required CWA to obtain additional information about the seafloor through geotechnical surveys which involved obtaining corings and borings to reaffirm the conclusions drawn from the initial suite of surveys (FEIS 5.1.4.11; US DOI BOEMRE, 2011b). CWA provided this information to BOEM in the form of the FDR and FIR. BOEM reviewed and analyzed this additional information and concluded that BOEM had no objections to the methodologies proposed or the engineering design contained in the FDR and FIR (see Section 3 for discussion of methodologies; US DOI BOEM memo - engineering review dated September 8, 2014b).

*Direct Effects* – Riprap will be deposited around constructed structures, changing the local benthic environment. The installation of monopiles will temporarily alter the shape of the seafloor through creating holes during installation and immediately after deconstruction. During installation, a minor amount of sediment will be disturbed and displaced along cable routes and the sites of structures.

*Indirect Effects* – The transport of suspended sediments will be altered during the lifetime of the proposed wind energy facility. Scouring will occur around the base of the structures. The shearing strength of the currents on sediment on the current-facing side of the structures will be enhanced. Increased deposition will occur on the leeward side of the structures.

#### *4.2.1.1 Cumulative Impacts*

No new activities or natural events occurred that may have altered the geologic setting of the area of the 2017 Proposed Action. The 2009 FEIS cumulative impacts analysis of the Proposed Action considered the 2012 geotechnical survey activity. Thus, these surveys do not incrementally or holistically change the conclusion regarding cumulative impacts that were identified in the 2009 FEIS analysis.

#### *4.2.1.2 Irreversible or Irretrievable Commitments of Resources*

As identified in Section 8 of the 2009 FEIS, the irreversible or irretrievable commitments of resources from the 2017 Proposed Action would still be the loss of energy, construction materials, and some biological resources, including the irretrievable loss of 11.4 ac (45,134 m2) of soft-bottom benthic habitat.

### 4.2.2 Analysis and Conclusion

BOEM has reviewed and reassessed the initial analyses presented in the 2009 FEIS and subsequent EAs, the findings of the BOEM's 2014 review of the FDR and FIR, and the review and analyses by the CVA, and has found that they are still valid and consistent with BOEM regulations. The additional geotechnical data that CWA gathered in 2012 for preparation of the FDR and FIR does not alter the 2009 FEIS analysis of the Proposed Action and relevant alternatives. The direct and indirect effects, and their respective significance, possible conflicts, energy requirements and conservation potential, natural or depletable resource requirements and conservation potential, circumstances of urban quality and historic and cultural resources, and means of mitigation remain the same as discussed in the collective analysis for the Proposed Action and alternative actions of the 2009 FEIS, and subsequent EAs. The environmental consequences of the 2017 Proposed Action considered in this draft SEIS that allows the lease to remain in place, do not differ from the initial findings in the 2009 FEIS and the subsequent ROD, where BOEM made the decision to offer CWA a lease, with conditions. This is also consistent with the findings of the 2011 COP and subsequent 2011 ROD.

## 4.3 Alternative: No Action

### 4.3.1 Impacts of the No Action Alternative

The impacts of the No Action Alternative (rescinding the lease) considered in this draft SEIS are the same as the impacts of the No Action Alternative of the Proposed Action of the 2009 FEIS (do not issue lease). The minor environmental impacts summarized in Table 4 of Chapter 7 in this draft SEIS, the job creation associated with the construction, operation, and decommissioning of the wind energy facility, and the $780,000 effort to restore Bird Island would not occur. The information pertaining to impacts of the No Action Alternative of the 2009 FEIS is incorporated by reference.

The 2010 ROD found that the No Action Alternative did not meet the Purpose and Need for the 2009 FEIS. The No Action Alternative did not provide the New England region with alternative sources of power other than fossil fuels. Impacts from this No Action Alternative do not fall within the scope of this draft SEIS, as this analysis is concerned with the geological environment and its ability to support WTGs. Rescinding the CWA lease will not meet the Purpose and Need for the 2009 FEIS, and as such will not meet the Purpose and Need for this analysis.

Assessing cumulative impacts of the No Action Alternative includes analysis of past, present, and reasonably foreseeable future actions that will continue or may occur in the cumulative impact study area of the Proposed Action. Cumulative impacts associated with adopting this alternative instead of the Proposed Action would be derived from the absence of an alternative energy source. There are no foreseeable impacts to geological resources from the No Action Alternative.

# 5 CONSULTATION AND COORDINATION

As described in Section 1.3.1 of the 2009 FEIS, Section 5.3 of the 2011 EA, and Section 1 of the 2014 EA, BOEM conducted extensive public outreach with public involvement and notification throughout its environmental review of the Cape Wind Project, as described below.

Consistent with 40 CFR 1501.7, scoping was employed early in the process to identify significant issues. The scope of the Proposed Action and the circumstances as described in the 2009 FEIS have remained substantially the same, and need not be duplicated (40 CFR 1500.4(b)). Consistent with 40 CFR 1501.4(e)(2)(ii), BOEM solicited comments on the 2010 EA and draft FONNSI (March 8, 2010; 75 FR 10500), which examined environmental impacts for the issuance of the Cape Wind lease, since this was the first offshore commercial renewable energy lease and was without precedent. On May 4, 2010, BOEM notified the public of the availability of the 2010 EA and FONNSI (75 FR 23798). On February 22, 2011, BOEM provided an opportunity for public input (i.e., suggesting new issues or contributing information with regard to potential environmental effects) prior to completion of the 2011 EA and a decision by the responsible official. A record of this opportunity is available online at http://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/Studies/CapeWind NOI_022211.pdf.

On April 22, 2011, BOEM notified the public of the availability of the 2011 EA, FONNSI, and ROD (76 FR 22719). BOEM did not conduct public scoping on that EA or the 2014 EA, as the issues under consideration were already clearly defined (revisions to the COP as described in Section 2.2 of the 2014 EA). As it did with the 2011 EA, BOEM made the 2014 EA available to the public on its website at http://www.boem.gov/Renewable-Energy-Program/Studies/Cape-Wind.aspx.

Scoping was not conducted (82 FR 12636). The Court's Order specified that the scope of the supplemental information is regarding whether or not the seafloor can support WTGs.

BOEM will publish an NOA of this draft SEIS in the FR to notify stakeholders of this draft SEIS's availability, pursuant to 40 CFR 1506.6(b)(3). A 45-day public comment period will be held for this draft SEIS, consistent with 40 CFR 1506.10(c). Chapter 8 lists the entities to whom copies were sent.

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# 7 TABLES

**Table 1**

**Geotechnical Evaluation Field Activities prior to 2009 Final Environmental Impact Statement**

| Study | Date |
|---|---|
| Geological/Hydrographic Survey | June to August 2001 |
| Vibracore and Benthic Grab Program | Summer 2001 |
| Deep Borings | April 2002 |
| Supplemental Geological Survey | August 2002 |
| Supplemental Geological Survey of Horseshoe Shoal and Proposed Submarine Cable Route | June to July 2003 |
| Deep Borings | October 2003 |
| Geotechnical Field Evaluations | November 2005 |

*Source: Report No. 4.1.1-1.*

**Table 2**

**Facilities Design Report and Fabrication and Installation Report Geotechnical Evaluation Field Activities**

| | Number of Locations | Start Date | End Date |
|---|---|---|---|
| Vibracore sampling | 131 | July 26, 2012 | August 17, 2012 |
| Seafloor CPT soundings | 130 | August 22, 2012 | September 30, 2012 |
| Initial sample borings | 7 | September 12, 2012 | September 22, 2012 |
| Top-push CPT | 31 | September 23, 2012 | October 22, 2012 |
| Final sample borings | 6 | October 23, 2012 | November 2, 2012 |

*Source: CWA, 2014a; 2014b.*

## Table 3

## Cape Wind Project 2009 FEIS
## Impact Producing Factors Summary Table

| Impact- Producing Factor | Oceanography | Geology & Sediments | Air Quality | Water Quality | Terrestrial Environment | T & E | Fisheries | Avian Resources | Noise | EMF | Archeology | Cultural | Recreation | Transportation & Navigation | Visual | Economics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vessel Activity | | X | X | X | | X | X | X | X | | | | X | X | X | |
| Heliport Facilities | | | X | | | | | | X | | | | | | | |
| Staging Facilities | | | X | X | | | | | X | | | | | X | X | X |
| WTG, ESP, and Offshore Cable Installation | X | X | X | X | | X | X | X | X | | X | X | X | X | X | X |
| Offshore Wind Park Operations | | | X | | | X | X | X | X | X | X | X | X | X | X | X |
| Offshore Wind Park Decommissioning | X | X | X | X | | X | X | | X | | X | X | X | X | X | X |
| Onshore Transmission Cable Installation | | X | X | | X | | | X | X | | X | X | | X | X | |
| Onshore Transmission Cable Operation | | | | | | | | | | X | | | | | | X |
| Onshore Transmission Cable Decommissioning | | X | X | X | X | X | X | | X | | X | | X | X | X | X |

X = Potential Impact Exists

*Source: Table 5.1.1-1 from US DOI MMS, 2009.*

## Table 4

## Cape Wind Project 2009 FEIS
## Summary of Impacts

| Resource | Impacts | |
|---|---|---|
| | ***Construction Impacts*** | ***Operation Impacts*** |
| Regional Geologic Setting | minor | minor |
| Noise | *Onshore:* minor<br>*Offshore:* minor<br>*Underwater:* minor | *Onshore:* negligible<br>*Offshore:* negligible<br>*Underwater:* negligible |
| Oceanography | *Currents:* negligible<br>*Waves:* negligible<br>*Salinity:* negligible<br>*Temperature:* negligible<br>*Sediment Transport:* minor<br>*Water depth/bathymetry:* minor | *Currents:* minor<br>*Waves:* negligible<br>*Salinity:* negligible<br>*Temperature:* negligible<br>*Sediment Transport:* minor<br>*Water depth/bathymetry:* minor |
| Climate and Meteorology | minor | negligible |
| Air Quality | *Public Health:* negligible<br>*Visibility:* negligible<br>*Emissions:* minor | *Public Health:* negligible<br>*Visibility:* negligible<br>*Emissions:* minor (beneficial to climate change) |
| Water Quality | minor | negligible (with the exception of spills) |
| Electric and Magnetic Fields | negligible | negligible |
| Terrestrial Vegetation | negligible to minor | negligible to minor |
| Coastal and Intertidal Vegetation | negligible to minor | negligible (negligible to minor for repairs, depending on location) |
| Terrestrial and Coastal Faunas other than Birds | negligible to minor | negligible (minor for migratory bats) |
| Avifauna | *Terrestrial Birds:*<br>Raptors – negligible<br>Passerines - minor<br>*Coastal Birds:* negligible to minor<br>*Marine Birds:* minor to moderate<br>Pelagic Species - minor<br>Waterfowl and Non-Pelagic Water Birds - moderate | *Terrestrial Birds:*<br>Raptors - negligible.<br>Passerines – minor to moderate.<br>*Coastal Birds:* negligible to moderate<br>*Marine Birds:* negligible to moderate*<br>Pelagic Species - minor<br>Waterfowl and Non-Pelagic Water Birds - moderate |
| Subtidal Offshore Resources | *Soft-Bottom Benthic Invertebrate Communities:* minor<br>*Shellfish:* minor<br>*Meiofauna:* minor<br>*Plankton:* negligible | *Soft-Bottom Benthic Invertebrate communities:* minor<br>*Shellfish:* minor<br>*Meiofauna:* minor<br>*Plankton:* minor |

## Table 4

## Cape Wind Project 2009 FEIS
## Summary of Impacts

| Resource | Impacts | |
|---|---|---|
| | ***Construction Impacts*** | ***Operation Impacts*** |
| Non-ESA Marine Mammals | *Acoustical Harassment:* minor<br>*Vessel Strikes:* minor<br>*Vessel Harassment:* minor<br>*Temporary Reduced Habitat:* minor<br>*Turbidity:* negligible to moderate (due to pile driving)<br>*Pollution/ Potential Spills:* minor | *Acoustical Harassment:* negligible<br>*EMF:* negligible<br>*Pollution/ Potential Spills:* minor to moderate<br>*Vessel Strikes:* minor<br>*Vessel Harassment:* minor<br>*Fouling Communities:* negligible to minor |
| Fisheries | *Finfish:* minor<br>*Finfish (juveniles)*: minor<br>*Demersal Eggs and Larvae:* moderate<br>*Commercial & Recreational Fishing/Gear:* minor | *Commercial & Recreational Fishing/Gear:* Negligible to minor<br>*Sound and Vibration:* negligible to minor<br>*Vessel Traffic:* negligible<br>*EMF:* negligible<br>*Lighting:* negligible/none<br>*Alterations to Waves, Currents, Circulation:* negligible<br>*Habitat Change:* minor<br>*Displacement of Prey:* none |
| EFH | *Benthic/Demersal:* negligible to minor<br>*Water Column:* negligible to minor<br>*SAV/Eelgrass:* negligible to minor | *Benthic/Demersal:* negligible to minor<br>*Water Column:* negligible to minor<br>*SAV/Eelgrass:* negligible to minor |
| T&E | *Sea turtles:* negligible to minor<br>*Cetaceans:* negligible to minor<br>*Avifauna:* negligible to minor<br>*Eastern Cottontail Rabbit:* negligible | *Sea Turtles:* negligible to minor<br>*Cetaceans:* negligible to minor<br>*Avifauna:* minor to moderate<br>*Eastern Cottontail Rabbit:* negligible |
| Urban and Suburban Infrastructure | negligible to minor | negligible |
| Population and Economics | minor | minor |
| Environmental Justice | negligible (i.e., not a disproportionately high impact on minority or low income populations) | negligible (i.e., not a disproportionately high impact on minority or low income populations) |
| Visual Resources | minor | moderate Impacts on Shore (major impacts on-water in close proximity to the Proposed Action) |
| Cultural Resources | minor | Pending on the outcome of Section 106 process** |
| Recreation and Tourism | minor | minor |
| Competing Uses of Waters and Seafloor | minor | minor (except for impacts to Figawi Race which are moderate) |

## Table 4

## Cape Wind Project 2009 FEIS
## Summary of Impacts

| Resource | Impacts | |
|---|---|---|
| | ***Construction Impacts*** | ***Operation Impacts*** |
| Overland Transportation Arteries | minor | negligible |
| Airport Facilities and Aviation Traffic | negligible to minor | minor |
| Port Facilities and Vessel Traffic | minor | minor (sailing vessel impact expected to be moderate) |
| Communications: EMF, Signals, and Beacons | minor<br><br>*The published 2009 FEIS read "negligible to major" in error, and is actually "negligible to moderate," as in MMS, 2010. | minor<br><br>**For the outcome of the Section 106 process and more information regarding the evaluation of impacts cultural resources relating to this project, see BOEM's Cape Wind Project website at https://www.boem.gov/Renewable-Energy-Program/Studies/Cape-Wind.aspx |

*Source: Table E-1 from US DOI MMS, 2009.*

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# 8 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT WERE SENT

| | |
|---|---|
| **Federal Agencies** | |
| U.S. Air Force | U.S. Army Corps of Engineers<br>New England District |
| U.S. Coast Guard<br>Marine Safety Office Providence | U.S. Department of Commerce<br>National Oceanic and Atmospheric Administration<br>National Marine Fisheries Service<br>Northeast Region |
| U.S. Department of Energy<br>Wind Power Technologies Office | U.S. Environmental Protection Agency<br>Region 1 |
| U.S. Federal Aviation Administration<br>New England Region | U.S. Fish and Wildlife Service<br>New England Field Office |
| U.S. Geological Survey<br>Office of Communication | National Park Service |
| **State Agencies** | |
| Massachusetts Department of Environmental Protection, Southeast Regional Office | Massachusetts Executive Office of Environmental Affairs |
| Massachusetts Historical Commission | Massachusetts Office of Coastal Zone Management |
| Massachusetts Office of Environmental Policy and Compliance | |
| **Local Entities** | |
| Cape Cod Commission | |
| **Applicant** | |
| Cape Wind Associates, LLC | |
| **Federally Recognized Tribes** | |
| Mashpee Wampanoag Tribe | Wampanoag Tribe of Gay Head (Aquinnah) |
| **Libraries** | |
| Boston Public Library (Central Library) | Edgartown Public Library |
| Eldredge Public Library | Falmouth Public Library (Main Branch) |
| Hyannis Public Library | Nantucket Atheneum Library |
| U.S. Department of Interior<br>Library Natural Resources Library | |

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# INDEX

## The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the sound use of our land and water resources, protecting our fish, wildlife and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island communities.

## The Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management (BOEM) works to manage the exploration and development of the nation's offshore resources in a way that appropriately balances economic development, energy independence, and environmental protection through oil and gas leases, renewable energy development and environmental reviews and studies.

**www.boem.gov**