COMMONWEALTH OF MASSACHUSETTS
Energy Facilities Siting Board

In the Matter of the Petition of Cape Wind Associates, LLC and Commonwealth Electric Company, d/b/a NSTAR Electric for Approval to Construct Two 115 kV Electric Transmission Lines	)	EFSB 02-2

FINAL DECISION

M. Kathryn Sedor
Presiding Officer
May 11, 2005

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ABBREVIATIONS

1997 BECo Decision	Boston Edison Company, 6 DOMSB 208 (1997)
1997 Restructuring Act	"the 1997 Electric Restructuring Act" (Chapter 164 of the Acts of 1997)
1998 NEPCo Decision	New England Power Company, 7 DOMSB 333 (1998)
AC	alternating current
ACEC	Area of Critical Environmental Concern
ACOE	U.S. Army Corps of Engineers
Act	Massachusetts Ocean Sanctuaries Act
Alliance	The Alliance to Protect Nantucket Sound, Inc.
ANP Bellingham	ANP Bellingham Energy Company, EFSB 97-1 (1998), 7 DOMSB 39
ANP Blackstone	ANP Blackstone Energy Company, EFSB 97-2/98-2 (1999), 8 DOMSB 1
ANSI	American National Standards Institute
Barnstable Interconnect	project approach of interconnecting to the grid at Barnstable Switching Station
Cape Wind	Cape Wind Associates, LLC
CCC	Cape Cod Commission
CELCo Decision	Cambridge Electric Light Company, 12 DOMSB 305 (2001)
CELT	Capacity, Energy, Loads, & Transmission (yearly reports provided by NEPOOL)
CEMP	comprehensive environmental monitoring program
cm	centimeter
CO_2	carbon dioxide
ComElec Decision	Commonwealth Electric Company, 5 DOMSB 273 (1997)
Commonwealth Electric	Commonwealth Electric Company, d/b/a NSTAR Electric
Company	Cape Wind, and/or Commonwealth Electric Company d/b/a NSTAR Electric
CZM	Massachusetts Office of Coastal Zone Management
dB	decibels, unweighted

dBA	A-weighted decibels
DC	direct current
DEM	Massachusetts Department of Environmental Management
Department	Department of Telecommunications and Energy
DOER	Massachusetts Division of Energy Resources
DOMSB	Decisions and Orders of Massachusetts Energy Facilities Siting Board
DOMSC	Decisions and Orders of Massachusetts Energy Facilities Siting Council
DPW	Town of Yarmouth Department of Public Works
DRI	Development of Regional Impact
D.T.E.	Department of Telecommunications and Energy
EEI	Edison Electric Institute
EFSC	Energy Facilities Siting Council
EFH	Essential Fish Habitat
EIR	Environmental Impact Report [not memorialized]
EIS	Environmental Impact Statement
EMF	electromagnetic field
EMI	EMI Cape, LLC
EOEA	Executive Office of Environmental Affairs
ERL	effects range limited
ESP	electrical service platform
ESS	Environmental Science Services, Inc.
FAA	Federal Aviation Administration
GIS	Generation Information System
GPS	Global Positioning System
GWh	gigawatt-hours
HDD	horizontal directional drill
Hz	hertz (cycles per second)
I&M	installation and maintenance

ICAP	Installed Capacity
ISO-NE	Independent System Operator of New England, Inc.
kV	kilovolts
L_{90}	sound level exceeded 90% of time
L_{eq}	time-averaged sound levels
L_{max}	maximum sound levels
La Capra	La Capra Associates, LLC
LOLE	a one-day-in-ten-years loss-of-load expectation
m/s	meter per second
Mashpee Town Landing	Mashpee Neck Road town landing
Mass Audubon	Massachusetts Audubon Society
MBUAR	Massachusetts Board of Underwater Archaeological Resources
MDEP	Massachusetts Department of Environmental Protection
MDMF	Massachusetts Division of Marine Fisheries
MECo	Massachusetts Electric Company
MECo/NEPCo Decision	Massachusetts Electric Company/New England Power Company, 18 DOMSC 383 (1989)
MEPA	Massachusetts Environmental Protection Act
mG	milligauss
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MHC	Massachusetts Historical Commission
MLLW	mean lower low water
mm	millimeters
MMWEC Decision	Massachusetts Municipal Wholesale Electric Company, EFSB 97-4 (2001), 12 DOMSB 18
mph	miles per hour
MVA	mega-volt-amperes
MVAR	mega-volt-amperes-reactive
MW	megawatts

MWh	megawatt-hours
NEPA	National Environmental Policy Act
NEPCo	New England Power Company
NEPOOL	New England Power Pool
NHESP	Natural Heritage and Endangered Species Program
1995 NEPCo Decision	New England Power Company, 4 DOMSB 109 (1995)
1997 Restructuring Act	1997 Electric Restructuring Act
NO_X	nitrogen oxides
NSTAR	Commonwealth Electric Company, d/b/a NSTAR Electric
NPCC	Northeast Power Coordinating Council
Ocean Sanctuaries Act	Massachusetts Ocean Sanctuaries Act
proposed transmission lines	the Company's proposed 115 kV transmission lines
reconnaissance survey	terrestrial reconnaissance archeological survey
ROW	right-of-way
RPS	Renewable Portfolio Standard
Section 72 petition	"A petition pursuant to G.L. c. 164, § 72, seeking a determination that the proposed lines are necessary . . ."
SE Kendall Decision	Southern Energy Kendall, LLC, 11 DOMSB 255 (2000)
Sithe Mystic Decision	Sithe Mystic Development LLC, 9 DOMSB 101 (1999)
Siting Board	Energy Facilities Siting Board
Siting Board petition	joint petition seeking approval to construct the proposed transmission project
SO_2	sulfur dioxide
SPB	Save Popponesset Bay, Inc.
transmission project	the Company's proposed 115 kV transmission lines
Turners Falls Decision	Turners Falls Limited Partnership, 18 DOMSC 141 (1988)
USFWS	U.S. Fish & Wildlife Service
wind farm	offshore wind generating project in Nantucket Sound

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Pursuant to G.L. c. 164, § 69J, the Energy Facilities Siting Board hereby approves, subject to the conditions set forth below, the joint petition of Cape Wind Associates, LLC and Commonwealth Electric Company, d/b/a NSTAR Electric for approval to construct two new 115 kV electric transmission lines, approximately 18 miles in length, for the purpose of interconnecting a proposed offshore wind generating facility in Nantucket Sound with the regional electric grid in New England.

I. INTRODUCTION

A. Summary of the Proposed Project

On September 17, 2002, Cape Wind Associates, LLC ("Cape Wind") and Commonwealth Electric Company, d/b/a NSTAR Electric ("NSTAR") (together, "Company")[1] jointly filed a petition with the Energy Facilities Siting Board ("Siting Board") and a petition with the Department of Telecommunications and Energy ("Department") to construct, operate and maintain two new 115 kilovolt ("kV") electric transmission lines, for the purpose of interconnecting an as yet unconstructed and unpermitted offshore wind generating facility in Nantucket Sound ("wind farm") with the regional electric grid in New England ("proposed transmission lines" or "transmission project").[2] Cape Wind is a Massachusetts limited liability corporation, established for the purpose of developing an offshore wind generating project in Nantucket Sound (Exhs. EFSB-LE-1; CW-1, at 1-3 to 1-4). Commonwealth Electric Company is an electric company pursuant to G.L. c. 164, § 1, and is an operating subsidiary of NSTAR, a Massachusetts business trust (Exhs. EFSB-LE-2; EFSB-LE-3).

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[1] Because Cape Wind and NSTAR are co-applicants, statements of fact generally will not be attributed to an individual company. For ease of reference, "Company" shall mean Cape Wind, NSTAR, or both companies jointly.

[2] The Siting Board lacks jurisdiction to review the proposed wind farm because, as currently proposed, it would lie solely in federal waters. Aspects of the wind farm are discussed in this decision, however, because in determining the need for a transmission line intended to interconnect a non-jurisdictional generating facility to the grid, past Siting Board decisions have required an applicant to consider aspects of the power to be produced by the generating facility. See Appendix A of this Decision.

The record shows that the proposed wind farm would consist of 130 interconnected wind turbines spaced approximately one-third to one-half mile apart, encompassing an approximately 24 square-mile area on Horseshoe Shoal in Nantucket Sound (Exhs. CW-1, at 1-4; EFSB-SS-22-S, Att. at Table 5-6, and App. 5-B at 9; Tr. 12, at 1749-1750).[3] The Company indicated that the wind farm would be located 11.0 miles from Great Point, Nantucket; 5.5 miles from Cape Poge and 9.3 miles from Oak Bluffs on Martha's Vineyard; 6.0 miles from Cotuit; 6.8 miles from Craigville Beach; and 4.7 miles from Point Gammon, which would be the closest point of land to the wind farm (Exh. EFSB-RR-23, Att.).

The Company stated that the wind farm would include an electrical service platform ("ESP"), which would connect to the individual wind turbines and step up the voltage from 33 kV to 115 kV (Exhs. CW-1, at 1-4; APNS-N-64). Transmission from the ESP would consist of two parallel 115 kV circuits, with each circuit consisting of two cables, each with three conductors, for a total of four cables and twelve conductors (Exh. CW-1, at 1-5). Each circuit would be buried approximately 6 feet below the sea bottom in a separate trench, and the two trenches would be placed 20 feet apart (id. at 1-8, and Fig. 1-7). At landfall, the twelve conductors would feed into a single underground duct bank for the upland portion of the route (id. at 1-6, and Fig.1-4).

The Company stated that the primary route[4] would be approximately 18.1 miles in length, 12.2 miles of which would be submarine and 5.9 miles of which would be on land (id. at 1-11, 1-12; Exh. EFSB-RR-84). The primary route would extend from the ESP through Nantucket Sound and then through Lewis Bay, making landfall at New Hampshire Avenue in Yarmouth,

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[3] The wind farm initially included 170 turbines; the Company subsequently reduced that number to 130 (Exhs. CW-2, at 1-2; EFSB-SS-22-S, Att. at Table 5-6).

[4] A Siting Board petition to construct a jurisdictional transmission line must present both the applicant's preferred route (primary route) and at least one alternative to that route (alternative route). Published notice of each route is required, and only a route that has been noticed may be approved by the Siting Board. In this case, the Company has noticed two routes: the primary route, through Lewis Bay, and the alternative route, through Popponesset Bay. Maps showing the marine and land-based portions of the primary and alternative routes are attached as Figs. 1, 2, 3 and 4.

and then traveling underground along town streets and an existing NSTAR right-of-way ("ROW") to an interconnection with the grid at NSTAR's Barnstable Switching Station (Exh. CW-1, at 1-1).[5] The Company stated that the alternative route would be approximately 24.2 miles in length, 10 miles of which would be submarine and 14.2 miles of which would be on land (id. at 1-12, 1-13). The Company stated that the alternative route would extend from the ESP through Nantucket Sound, and then beneath Popponesset Spit into Popponesset Bay, through Popponesset Bay to a landfall at the Mashpee Neck Road Town Landing ("Mashpee Town Landing"), traveling underground to NSTAR's existing Mashpee Substation, and then proceeding aboveground for approximately 12.3 miles to the Barnstable Switching Station (id. at 1-13).[6]

Cape Wind stated that it would own, operate and maintain the proposed wind farm, the ESP, the submarine cables connecting the wind farm to the ESP and all on-land facilities up to the point where the proposed transmission lines would enter the NSTAR ROW (Exhs. EFSB-LE-4; EFSB-LE-5; EFSB-11). The Company stated that NSTAR would own, operate, and maintain the transmission facilities in the ROW at Cape Wind's expense (Exh. EFSB-11).

B. Procedural History

1. Consolidation of Dockets

On September 17, 2002, Cape Wind and NSTAR filed a joint petition with the Siting Board seeking approval, pursuant to G.L. c. 164, § 69J, to construct the proposed transmission project ("Siting Board petition"). The Siting Board petition was docketed as EFSB 02-2. The Company also filed a petition with the Department, pursuant to G.L. c. 164, § 72, seeking a determination that the proposed transmission lines are necessary, would serve the

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[5] The Company also noticed an alternative landfall for the primary route, on a parcel of privately owned property at 43 Shore Road in Yarmouth. The Company did not pursue this alternative in the adjudicatory hearing, and we accordingly neither review nor approve the Shore Road landfall as an alternative to the New Hampshire Avenue landfall.

[6] Figure 1 shows the location of the proposed wind farm relative to certain onshore locations, and relative to the primary and alternative transmission line routes.

public convenience, and would be consistent with the public interest ("Section 72 petition"). The Section 72 petition was docketed as D.T.E. 02-53.

At the time the Company filed its Siting Board and Section 72 petitions, it requested that the petitions be consolidated for consideration by the Siting Board in a single adjudicatory proceeding. On September 27, 2002, the Chairman of the Department granted the Company's request, issuing a Consolidation Order which directed the Siting Board to render a final decision in both cases ("consolidated proceeding"). The consolidated proceeding was docketed as EFSB 02-2/D.T.E. 02-53. Accordingly, the Siting Board conducted a single adjudicatory proceeding, and a single evidentiary record was developed.

2. Siting Board Adjudicatory Proceeding

The Siting Board formally commenced the consolidated proceeding with a public comment hearing on the Company's petitions in the Town of Barnstable on November 12, 2002.[7] On December 20, 2002, the Presiding Officer issued a ruling granting five petitions to intervene and four petitions for limited participant status in the proceeding. The Town of Yarmouth, the Massachusetts Department of Environmental Management ("DEM") Ocean Sanctuaries Program,[8] the Alliance to Protect Nantucket Sound ("Alliance"), Save Popponesset Bay, Inc. ("Save Popponesset Bay") and the Massachusetts Audubon Society ("Mass Audubon")[9] were granted intervenor status. Nantucket Electric Company, the Cape Cod Commission ("CCC"), Mr. Emil Masotto, and Dr. Charles Levy were granted limited participant status.[10] The Siting

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[7] Siting Board staff, including the Presiding Officer, also conducted a site visit on the same day as the public comment hearing. The site visit included views of the on-land portion of the primary and alternative routes, and of the proposed landfalls for both routes.

[8] In July 2003, DEM merged with the Metropolitan District Commission to form the Massachusetts Department of Conservation and Recreation.

[9] Mass Audubon is the owner of property on Sampson Island and Egg Island, in the vicinity of the primary route (Exh. MA-ALJ at 2). Mass Audubon also owns a portion of Popponesset Spit, on the alternative route (Audubon Brief at 2).

[10] See Ruling re Petitions to Intervene and Petitions to Participate, December 20, 2002; (continued...)

Board staff, the Alliance, Mass Audubon, and Save Popponesset Bay each issued two sets of information requests to the Company. The Town of Yarmouth issued one set of information requests to the Company. The Siting Board and the Company each issued Information Requests to the Alliance, Save Popponesset Bay, and Mass Audubon.

a. Prefiled Testimony

i. Company

On February 14, 2003, the Company submitted its direct case, in the form of written prefiled direct testimony. Cape Wind presented the testimony of nine witnesses: Craig Olmsted, Vice President of Projects for EMI Cape, LLC ("EMI"),[11] who testified regarding multiple aspects of the proposed transmission project, including project approach, route selection, and comparison of the proposed facilities along the primary and alternative routes; Leonard J. Fagan, Vice President of Engineering for EMI, who provided testimony regarding project approach and route selection; Charles J. Natale, Jr., Senior Vice President and Principal Scientist at Environmental Science Services, Inc. ("ESS"), and Stephen B. Wood, Vice President and Senior Project Manager at ESS, who provided testimony regarding project approach, route selection, comparison of the proposed facilities along the primary and alternative routes, and consistency with current health, environmental protection and resource use and development policies for the Commonwealth; Douglas C. Smith, Technical Director of La Capra Associates ("La Capra"), who testified regarding project need; Daniel Peaco, President of La Capra Associates, who testified regarding project need; Peter A. Valberg, Ph.D., who provided testimony regarding electric and magnetic fields and public health; Christopher M. Bryan, P.E., owner of CBX Energy Engineering, who provided testimony regarding electrical engineering and transmission

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[10] (...continued)
Supplemental Ruling re: Petitions to Intervene and Petitions to Participate, January 17, 2003; Second Supplemental Ruling on Petitions to Intervene and Participate, February 7, 2003.

[11] Cape Wind's membership interests are owned by EMI, which is a Massachusetts limited liability corporation.

interconnection issues; and David P. Estey, P.E., Principal Electrical Engineer at E/PRO Engineering and Environmental Consulting, who provided testimony regarding the measurement and calculation of electric and magnetic fields.

NSTAR submitted the direct testimony of two witnesses: Charles P. Salamone, Director of System Planning for the electric subsidiaries of NSTAR, who testified regarding design, cost and reliability of the transmission project, and Robert J. Connors, Lead Engineer in the Transmission Engineering Department for the electric subsidiaries of NSTAR, who provided testimony regarding the evaluation of the NSTAR ROW. On September 8, 2003, Cape Wind filed written rebuttal testimony of six witnesses. Four of the Company's witnesses, Craig Olmsted, Charles Natale, Stephen Wood, and Douglas Smith, had previously submitted direct testimony on the Company's behalf. Two additional witnesses testified for the first time: Paul Kerlinger, Ph.D., Principal at Curry & Kerlinger, who provided testimony regarding potential avian impacts of the wind farm, and Peter H. Guldberg, President of Tech Environmental, Inc., who testified regarding potential noise impacts of the wind farm.

ii. Intervenors

On June 20, 2003, the Alliance, Save Popponesset Bay, and Mass Audubon each submitted prefiled direct testimony. The Alliance filed the direct testimony of five witnesses: Jeffrey D. Byron, an independent energy consultant, doing business as Byron Consulting Group, who testified regarding reliability need and economic need for the proposed wind farm; Michael L. Morrison, Ph.D. who testified regarding the potential impacts of wind-generated power on birds and bird habitat; Mark Weissman, Member, the Massachusetts Marine Fisheries Commission, who provided testimony regarding potential impacts on fisheries; Erich Bender, Sc.D., an acoustical engineer who provided testimony regarding acoustical impacts of the proposed wind farm; and Richard S. LeGore, Ph.D., President of Mote Environmental Services, Inc., and Senior Scientist at Mote Marine Laboratory, who provided testimony regarding potential benthic impacts.

Save Popponesset Bay filed the testimony of Peter J. Williams, P.E., Project Manager for Vine Associates, Inc., who provided testimony regarding coastal processes and coastal

engineering.

Mass Audubon filed the testimony of Stanley M. Humphries, Senior Project Manager at Ocean and Coastal Consultants, Inc., who provided testimony regarding coastal zone geology; Andrea L. Jones, Director of Mass Audubon's Coastal Waterbird Program, who provided testimony regarding rare and endangered coastal shorebirds; and Robert N. Buchsbaum, Ph.D., Southeast Regional Conservation Scientist for Mass Audubon, who testified regarding potential impacts of cable installation on subtidal habitats near Mass Audubon properties in Lewis Bay and Popponesset Bay.

b. Adjudicatory Hearing and Evidentiary Record

The Siting Board held twenty-one days of evidentiary hearings, beginning on July 29, 2003, and concluding on October 21, 2003.[12] The parties' witnesses under oath adopted their prefiled written direct testimony, provided certain limited direct testimony, and were subject to cross-examination by the Company, certain intervenors, and Siting Board staff.[13] Approximately 930 exhibits were entered into the evidentiary record. On November 25, 2003, initial briefs were filed by the Company, the Alliance, Mass Audubon ("Audubon Brief") and Save Popponesset Bay ("SPB Brief"), including responses to briefing questions posed by the Siting Board staff. On December 9, 2003, the Company, the Alliance, and Mass Audubon filed reply briefs. The evidentiary record was closed on December 18, 2003.[14]

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[12] On May 5, 2003, the Alliance moved to suspend the proceeding, and filed a similar motion at the conclusion of the adjudicatory hearing. The Presiding Officer denied both motions. See Ruling on Motion to Suspend Procedural Schedule, June 6, 2003; see Summary Ruling on Motion to Suspend the Briefing Schedule, October 30, 2003.

[13] On June 25, 2003, Cape Wind filed a motion to strike portions of the prefiled direct testimony filed by the Alliance. In a ruling issued on July 22, 2003, the Presiding Officer denied Cape Wind's motion, finding that the disputed testimony was potentially relevant to one of the findings the Siting Board would be required to make in its final decision, relative to a claim raised by Cape Wind itself. See Ruling on Petitioner's Motion to Strike, July 22, 2003.

[14] On March 16, 2004, after conclusion of the adjudicatory hearing, the Presiding Officer (continued...)

On July 2, 2004, the Siting Board staff issued a Tentative Decision approving the transmission project. The parties and limited participants were given 60 days, until August 31, 2004, to review and comment on the Tentative Decision. Thereafter, the Siting Board met on November 30, 2004, to consider the Tentative Decision.

On November 8, 2004, the U.S. Army Corps of Engineers issued a Draft Environmental Impact Statement/Draft Environmental Impact Report/Development of Regional Impact for the combined transmission and wind farm projects ("DEIR"). On November 24, 2004, the Alliance filed a motion to reopen hearings to allow the DEIR and any written comments on the DEIR into the evidentiary record. On November 29, 2004, Cape Wind filed its opposition to the Alliance's motion.

At the November 30, 2004, Siting Board meeting, the Siting Board directed the parties to submit written briefs on the issue of reopening and directed the presiding officer to rule on the motion. Cape Wind and the Alliance each filed an initial brief on December 30, 2004, and a reply brief on January 13, 2005.

In a ruling issued on March 21, 2005, the Alliance's motion to reopen was denied. Cape Wind Associates, LLC and Commonwealth Electric Company d/b/a NSTAR Electric, EFSB 02-2 / D.T.E. 02-53, Ruling on Motion to Reopen Adjudicatory Hearing (March 21, 2005).

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[14] (...continued)
issued a Sequencing Ruling recognizing that, pursuant to the Massachusetts Environmental Policy Act ("MEPA") the Siting Board cannot issue a decision in the Section 72 docket until the Massachusetts Executive Office of Environmental Affairs ("EOEA") has completed its review of the proposed transmission project, and that, as of the date of this decision, EOEA has not yet completed that review. The Sequencing Ruling confirms, however, that a final decision in the EFSB docket may be issued at this time, pursuant to the Siting Board's statutory exemption from MEPA, set forth in G.L. c. 164, § I. See Ruling Re Sequencing of Decisions, March 16, 2004, at 2-4. The Siting Board will issue a decision in the Section 72 docket after the Secretary's Certificate on the FEIR has been issued. Pursuant to G.L. c. 30, § 61, that decision must incorporate "a finding describing the environmental impact, if any, of the project and a finding that all feasible measures have been taken to avoid or minimize said impact".

C. Jurisdiction and Scope of Review

1. Jurisdiction Pursuant to G.L. c. 164

The Company filed its petition to construct the proposed transmission project in accordance with G.L. c. 164, § 69H, which requires the Siting Board to implement the energy policies in its statute to provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost, and pursuant to G.L. c. 164, § 69J, which requires a project applicant to obtain Siting Board approval for the construction of proposed energy facilities before a construction permit may be issued by another state agency.

As a new electric transmission line with a design rating of 69 kV or greater and a length in excess of one mile, the Company's proposed project falls within the definition of "facility" set forth in G.L. c. 164, § 69G, which provides that a "facility" includes:

> a new electric transmission line having a design rating of 69 kV or more and which is one mile or more in length on a new transmission corridor.

In accordance with G.L. c. 164, § 69J, before approving a petition to construct facilities, the Siting Board requires an applicant to justify its proposal in three phases. First, the Siting Board requires the applicant to show that additional energy resources are needed (see Section II.A, below). Next, the Siting Board requires the applicant to establish that, on balance, its proposed project is superior to alternative approaches in terms of cost, environmental impact, reliability, and ability to address the identified need (see Section II.B, below). Finally, the Siting Board requires the applicant to show that it has considered a reasonable range of practical facility siting alternatives and that the proposed site for the facility is superior to a noticed alternative site in terms of cost, environmental impact, and reliability of supply (see Sections III.A and III.C.5, below.)

2. The Ocean Sanctuaries Act

a. Alliance

In its initial brief, the Alliance asserts for the first time that the Ocean Sanctuaries Act, G.L. c. 132A et seq, requires the Siting Board to deny the Company's petition (Alliance Brief at 3). Although this assertion does not technically constitute a challenge to the Siting Board's

subject matter jurisdiction, we address the Alliance's argument here because it does purport to limit the Siting Board's authority to review marine-based projects, and to grant the Company's petition if the record supports such an outcome.

Section 18 of the Massachusetts Ocean Sanctuaries Act ("Ocean Sanctuaries Act" or "Act") provides, in relevant part, that Massachusetts agencies must issue permits "consistently with" the Act. G.L. c. 132A, § 18 ("Section 18"). The Alliance argues that approving the transmission project would violate the Siting Board's obligation under Section 18 to issue permits that are consistent with the Act because, the Alliance asserts, the project would be located within the Cape and Islands Ocean Sanctuary and transmission facilities of the type proposed by the Company are not permitted in that Ocean Sanctuary (Alliance Brief at 3-7, 18).[15,16]

b. Company

The Company agrees with the Alliance that a portion of the proposed transmission project would be located within the Cape and Islands Ocean Sanctuary (Company Reply Brief at 8-10). However, the Company asserts that the Ocean Sanctuaries Act expressly allows the construction of transmission facilities in the Cape and Islands Sanctuary (id.). G.L. c. 132A, §§ 15 and 16. In particular, the Company points to the language of Section 16 of the Act ("Section 16"), one portion of which provides that all "activities, uses and facilities associated with the generation, transmission and distribution of electrical power" may be located within the five designated Massachusetts ocean sanctuaries, except for the Cape Cod Ocean Sanctuary (Company Reply Brief at 9). The Company also points to language in Section 16 which provides that "the laying of cables approved by the [D]epartment of [T]elecommunications and [E]nergy"

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[15] The Alliance argues that both the wind farm project and the transmission project are precluded by the Act. However, the Company has not requested Siting Board approval to construct the wind farm. Arguments regarding the application of the Ocean Sanctuaries Act to the wind farm accordingly are not relevant to the Siting Board's review of the transmission project and will not be substantively addressed.

[16] In addition to Section 18, the Alliance cites to Sections 15 and 16 of the Ocean Sanctuaries Act.

may take place in any ocean sanctuary except for the Cape Cod Ocean Sanctuary (id.).

c. Analysis

Massachusetts has five ocean sanctuaries, the location and boundaries of which are identified in Section 13 of the Ocean Sanctuaries Act. G.L. c. 132A, § 13. A portion of the Company's proposed transmission project, whether along the primary or alternative route, will lie within the Cape and Islands Ocean Sanctuary.

Certain types of activities, such as offshore drilling and the construction of electric generating facilities, are prohibited in Massachusetts' ocean sanctuaries. G.L. c. 132A, § 15 ("Section 15"). However, this prohibition is not an absolute one; Section 15 expressly provides that the activities enumerated in that section are prohibited "[e]xcept as otherwise provided [in the Act]". Id. Consequently, in determining whether a particular activity is prohibited in an ocean sanctuary, one must review not only the list of prohibited activities set forth in Section 15, but the Act as a whole, to determine whether it contains an exemption or qualification applicable to the activity under consideration.

The Siting Board generally does not engage in interpretations of statutes other than its own enabling legislation, on the ground that such determinations generally are outside the scope of the Siting Board's expertise and lie more properly within the province of the courts. See Massachusetts Municipal Wholesale Electric Company, 12 DOMSB 18 (2001) ("MMWEC Decision"), Hearing Officer Ruling on Motion to Dismiss (March 16, 2000) (scope of applicant's statutory authority under its enabling legislation not appropriately determined in a proceeding before the Siting Board). In this case, however, the language of the statute in question is not ambiguous, and its interpretation is necessary if we are to address the claim by the Alliance that the Siting Board is required by the Ocean Sanctuaries Act to deny the proposed project.

Turning first to the list of prohibited activities set forth in Section 15 of the Act, there is only one category of activity that, if construed broadly, may be read to encompass the installation of transmission cables in the seabed of an ocean sanctuary: that of "the building of [a] structure on the seabed or under the subsoil." G.L. c. 132A, § 15.

We are uncertain whether the Legislature intended to define the term "structure" so broadly as to include buried electric transmission cables, and thus decline to make a finding on this issue. Fortunately, however, we do not need to make such a finding, because even if the proposed cables were deemed to constitute "structures" within the meaning of the Ocean Sanctuaries Act, the laying of such cables is an activity that is expressly permitted in certain ocean sanctuaries, including the Cape and Islands Ocean Sanctuary, under Section 16 of the Act.

The counterpart to Section 15 of the Act and its list of prohibited activities is Section 16, which identifies categories of activities that are allowable in ocean sanctuaries. Section 16 provides, inter alia, that

> Nothing in this act is intended to prohibit the following activities: In all ocean sanctuaries except the Cape Cod Ocean Sanctuary the planning, construction, reconstruction, operation, and maintenance of industrial liquid coolant discharge and intake systems and all other activities, uses and facilities associated with the generation, transmission, and distribution of electrical power . . .; [and] the laying of cables approved by the department of telecommunications and energy . . ..

G.L. c. 132A, § 16 (emphasis added).

The express language of Section 16 is unambiguous. We conclude that the Company's proposed transmission project fits within two of the categories of permissible activity set forth in this section: as facilities associated with the transmission of electrical power, and as cables which, if installed, will necessarily have been approved by the Department under G.L. c. 164, § 72.[17] Thus, even assuming the applicability of Section 15, the proposed transmission project constitutes a clearly permissible activity under Section 16 and may be sited

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[17] G.L. c. 164, § 72 requires Massachusetts electric companies such as NSTAR to obtain Department approval for the construction of new electric transmission lines like the transmission lines proposed by the Companies. The Department will approve such construction if it finds that a proposed line is necessary, will serve the public convenience, and is consistent with the public interest. Without such approval, construction of the lines cannot occur. See, e.g., Boston Edison Company v. Town of Sudbury, 356 Mass. 406 (1969). Thus, even if approved by the Siting Board, construction of the Companies' proposed transmission line cannot occur unless the construction also is approved by the Department under Section 72. The Companies filed a Section 72 petition, which is docketed as D.T.E. 02-53.

within the Cape and Islands Ocean Sanctuary without violation of the Massachusetts Ocean Sanctuaries Act. Siting Board approval of the proposed transmission project accordingly would be consistent with the Act.

II. ANALYSIS OF THE PROPOSED PROJECT

A. Need Analysis

1. Standard of Review

a. Background

In accordance with G.L. c. 164, § 69H, the Siting Board is charged with the responsibility for implementing energy policies to provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. In carrying out this statutory mandate with respect to proposals to construct electrical transmission facilities in the Commonwealth, the Siting Board is required to evaluate whether there is a need for additional transmission resources.[18]

Both Cape Wind and the Alliance have argued that the Siting Board should review the need for the proposed project using as guidance the standards applied in Turners Falls Limited Partnership, 18 DOMSC 141, at 154-155 (1988) ("Turners Falls Decision") and in Massachusetts Electric Company/New England Power Company, 18 DOMSC 383, at 394-395 (1989) ("MECo/NEPCo Decision"). In Turners Falls, the Siting Board reviewed a proposal to construct a 1.2-mile, 115 kV transmission line designed to interconnect a 20 megawatt ("MW") coal-fired

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[18] The Siting Board's review of proposed transmission facilities is conducted pursuant to G.L. c. 164, § 69J. This section states, in part, that "[n]o applicant shall commence construction of a facility at a site unless . . . in the case of an electric or gas company which is required to file a long-range forecast pursuant to section sixty-nine I, that facility is consistent with the most recently approved long-range forecast for that company." The Siting Board notes that, pursuant to the Department's Order in D.T.E. 98-84A, Massachusetts electric companies are now exempt from the requirements of G.L. c. 164, § 69I. Because NSTAR is no longer required to file a long-range forecast pursuant to G.L. c. 164, § 69I, and Cape Wind has never been subject to this requirement, the Siting Board need not consider whether the proposed transmission facilities are consistent with a recently-approved long range forecast.

power plant,[19] and required the proponent to show: (1) that there was a need within New England for the power generated by the non-jurisdictional generating facility; and (2) that the facility would provide benefits to Massachusetts. Turners Falls Decision, 18 DOMSC 141, at 144, 153-155. The Siting Board rejected the possibility of determining need for the transmission line based solely on whether a physical connection was needed to connect the power plant to the grid, noting that "[a]ddressing the need issue here so narrowly would be inconsistent with our analysis of other utility and non-utility facilities, as well as with our statutory mandate". Id. at 154, n.10.

In MECo/NEPCo, the Siting Board reviewed a proposal to construct a 3.2-mile, 69 kV transmission line intended to interconnect a 40 MW gas- and oil-fired power plant.[20] MECo/NEPCo, 18 DOMSC at 386. The Siting Board, adapting its analysis in Turners Falls, required the proponent to show: (1) that power from the non-jurisdictional cogeneration plant was needed on either economic efficiency or reliability grounds, and (2) that the existing transmission system was inadequate to support this new power source and that additional energy resources were necessary to accommodate the new power source. Id. at 395. The Siting Board again stated that limiting the need review to an analysis of the need for a physical interconnection "would be inconsistent with our need analysis for other facilities, as well as with our statutory mandate." Id.

The parties' proposal in this proceeding to review the need for the proposed transmission lines under some variant of the standards used in Turners Falls and MECo/NEPCo initially appears reasonable, because these two cases represent the entire body of Siting Board precedent relating to the construction of jurisdictional transmission lines to interconnect non-jurisdictional power plants with the regional electric grid. However, since these two cases were decided, the Siting Board's statute has been amended in ways which undercut the stated rationale for the standards of review used in those cases.

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[19] The Siting Board lacked jurisdiction over the power plant because its capacity was less than 100 MW.

[20] Again, the Siting Board lacked jurisdiction over the power plant because its capacity was less than 100 MW.

First, the 1997 Electric Restructuring Act ("1997 Restructuring Act") amended the Siting Board's general mandate in G.L. c. 164, § 69H to reflect market-based principles. Prior to the enactment of the 1997 Restructuring Act, the Siting Board was charged with reviewing the need for all major energy facilities to be built in the Commonwealth. Pursuant to Section 69H, as amended in 1997, the Siting Board continues to review the need for proposed transmission and natural gas facilities, but may no longer review the need for proposed generation. Now, the Siting Board is required:

> . . . to provide a reliable energy supply for the commonwealth with a minimum impact on the environment at the lowest possible cost. To accomplish this, the [B]oard shall review the need for, cost of, and environmental impacts of transmission lines, natural gas pipelines, facilities for the manufacture and storage of gas, and oil facilities; provided, however, that the [B]oard shall review only the environmental impacts of generating facilities, *consistent with the commonwealth's policy of allowing market forces to determine the need for and cost of such facilities* (emphasis added).

Second, consistent with the change to G.L. c. 164, § 69H, the Restructuring Act added a new section, G.L. c. 164, § 69J¼, to the Siting Board statute. Section 69J¼ governs the review of proposed generating facilities, and explicitly states that "[n]othing in this chapter shall be construed as requiring the [B]oard to make findings regarding the need for, the cost of, or alternate sites for a generating facility . . ."; in addition, it explicitly prohibits the Siting Board from seeking data regarding the need for or cost of a proposed generating facility, except for certain narrowly-defined cost data. In March 1999, the Siting Board issued a request for comments on the standard of review to be used in future generating facility reviews; and, beginning with its decision in Sithe Mystic Development LLC, 9 DOMSB 101 (1999) ("Sithe Mystic Decision"), the Siting Board has applied a standard of review for generating facilities that excludes any review of project need.

Since the Siting Board no longer reviews the need for power to be generated by power plants, applying a Turners Falls-style analysis in this case would not be consistent with the Siting Board's practice and statutory mandate. Rather, it would be inconsistent both with current practice – the limited review of jurisdictional generating facilities now undertaken pursuant to G.L. c. 164, § 69J¼ – and with the Commonwealth policy, articulated in G.L. c. 164, § 69H, of

allowing market forces to determine the need for new generation.

b. Revised Standard of Review

Given the statutory changes that have taken place since Turners Falls (1988) and MECo/NEPCo (1989), the Siting Board finds that the application of a revised standard of review, one more consistent with the Siting Board's mandate as set forth in the 1997 Restructuring Act, is appropriate in this case. Further, in order to avoid any confusion about the standard to be applied in future cases, the Siting Board takes this opportunity to articulate a single standard of review for need to be applied in all cases where a transmission line is proposed to interconnect new or expanded generation. This new standard must be broad enough to encompass both transmission lines serving generators subject to the Siting Board's jurisdiction, and transmission lines serving generators that are too small to be subject to our jurisdiction, generators that are located in another state, or generators that are located in federal territory.

In a recent review of a transmission line designed to interconnect a generating facility also subject to its jurisdiction, the Siting Board found a need for the line based on: (1) the Siting Board's earlier approval of the power plant to be served by the transmission line,[21] and (2) a showing by the proponent that "some form of electrical interconnection is required to provide the regional transmission system with the additional energy provided by" that power plant. Cambridge Electric Light Company, 12 DOMSB 305, at 318 (2001) ("CELCo Decision"). Taken together, the two findings in CELCo establish that a transmission line, with its attendant costs and potential construction and permanent impacts, is not built unnecessarily. While the Siting Board's approval of a jurisdictional generating facility does not encompass the question of whether the power plant is "needed," it does provide reasonable assurance that the generating project is environmentally sound and buildable at the chosen site. The finding regarding the need for electrical interconnection provides assurance that new transmission facilities will be built

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[21] The Siting Board noted that, pursuant to G.L. c.164, § 69J¼, the Siting Board's approval of a jurisdictional power plant demonstrated that the plant "would contribute to a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost". CELCo Decision, 12 DOMSB 305, at 318.

only when existing transmission facilities are inadequate to the task of supporting the new generation. The Siting Board regards these two factors as critical elements in the analysis of the need for any transmission line intended to interconnect a power plant with the regional electric grid. Therefore, the Siting Board will require an applicant seeking to construct a transmission line to interconnect a new or expanded generating facility to show: (1) that the existing transmission system is inadequate to interconnect the new or expanded generator, and (2) that the new or expanded generator is likely to be available to contribute to the regional energy supply. If the new or expanded generator exists, or is under construction, the availability showing will be deemed to have been made.[22] If the generator is planned, and is subject to the Siting Board's jurisdiction, that showing may be made by obtaining the Siting Board's approval of the generating facility. If the generator is planned, and not subject to the Siting Board's jurisdiction, the showing may be made on a case-by-case basis based on indicators of project progress (e.g., progress in permitting or in obtaining project financing).

In the sections below, the Siting Board reviews the need for the proposed transmission lines pursuant to the standard of review set forth above. However, we are mindful that parties before an administrative agency such as the Siting Board have a "right to expect and obtain reasoned consistency" in our decisions, and we recognize the uncertainties inherent in setting forth a new standard of review during the course of an adjudication, even where the new standard is prompted by statutory changes. Boston Gas Company v. Department of Public Utilities, 367 Mass. 92, 104 (1975). Therefore, in Appendix A, the Siting Board provides an analysis of the need for the transmission lines using the Turners Falls/MECo/ NEPCo precedent.

2. Description of the Existing Transmission System

The Company stated that, without the proposed transmission line, there would be no means by which to deliver energy from the proposed wind farm to potential customers in Massachusetts (Exh. CW-1, at 2-30). The Company stated that the 345 kV transmission system

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[22] The generators served by the Turners Falls and MECo/NEPCo transmission lines each were under construction at the time those cases were filed. Turners Falls Decision, 18 DOMSC 141, at 144; MECo/NEPCo Decision, 18 DOMSC 383, at 387.

on Cape Cod consists of: (1) two 345 kV lines connecting NSTAR's Canal Station switchyard to off-Cape locations, with capacities of 1261 mega-volt-amperes ("MVA") and 2169 MVA (Exhs. EFSB-3(1), Att.; EFSB-3(2), Att; EFSB-RR-57); and (2) a ring bus at Canal Switchyard, which is connected via transformers both to the Canal Electric power plant in Sandwich and to two 115 kV transmission lines that are part of the Cape Cod 115 kV transmission system (Exhs. EFSB-3(1), Att.; EFSB-3(2), Att.; Tr. 1, at 23-25).

The Company indicated that 115 kV transmission on the south (Nantucket Sound) side of Cape Cod extends from the Falmouth Bulk Substation in the west to the Harwich Bulk Substation in the east (Exhs. EFSB-3(1), Att.; EFSB-3(2), Att.). Existing substations and switching stations on Cape Cod also include the Mashpee Substation, the Barnstable Switching Station, the Hyannis Junction Substation, and the new Oak Street Substation in West Barnstable (Exhs. EFSB-3(1), Att.; EFSB-3(2), Att.; Tr. 1, at 29). Among these stations, Barnstable Switching Station is centrally located on the Cape and has six connections to 115 kV transmission lines (Exh. EFSB-3(2)). Transmission lines connecting at Barnstable Switching Station are listed in Table 1, below:

Table 1. Existing Interconnections to Barnstable Switching Station

Line No.	Termini*		Voltage	Capacity
120	Canal	Barnstable	115 kV	398 MVA
122	Bourne	Barnstable	115 kV	398 MVA
115	Falmouth	Barnstable	115 kV	227 MVA
118	Harwich Tap	Barnstable	115 kV	227 MVA
119	Harwich Tap	Barnstable	115 kV	227 MVA
124	Hyannis	Barnstable	115 kV	227 MVA

Sources: Exhs. EFSB-3(1), Att.; EFSB-3(2), Att; EFSB-RR-57; EFSB-RR-69

* Although some of these lines bifurcate to multiple termini, this table lists only two termini per line.

NSTAR does not expect additional transmission capacity to be needed on the Cape Cod system for at least ten years, following the addition of one transformer in 2003 (Tr. 3, at 386).

The Company indicated that an existing 46 kV transmission cable, operated by National Grid, extends from Lothrop Avenue Station in Harwich under Nantucket Sound to Nantucket

Island, passing approximately four miles east of Horseshoe Shoal (Exhs. EFSB-1, Att.; EFSB-3(1), Att.; Tr. 1, at 25-26). The Nantucket cable has a capacity of 35.8 MVA (Exh. EFSB-RR-57). In addition, four 23 kV transmission cables to Martha's Vineyard are located at the west end of Nantucket Sound; these cables have capacities of 8.5 MVA, 18.2 MVA, 20 MVA, and 22.8 MVA, respectively (Exhs. EFSB-3(1), Att.; EFSB-RR-57). There are no transmission cables traversing the Horseshoe Shoal area in Nantucket Sound (Exhs. EFSB-1, Att.; EFSB-3(1), Att.).

3. Project Permitting and Status

Cape Wind proposes to build its wind farm in Horseshoe Shoal, an area of Nantucket Sound located in federal, rather than Massachusetts, waters (Exh. CW-1, at 1-1 and 1-2). Consequently, the wind farm does not fall under the Siting Board's jurisdiction. Because it is built in navigable waters, it will require a Section 10 permit[23] from the United States Army Corps of Engineers ("ACOE"), which is the lead agency for the environmental review of the entire wind farm project, including the proposed transmission lines, under the National Environmental Policy Act ("NEPA") (Exhs. EFSB-4; EFSB-G-7). Pursuant to NEPA, a draft and final Environmental Impact Statement (respectively, "DEIS" and "FEIS") are required for the project (Exh. APNS-N-2).

In addition, Cape Wind has filed an Expanded Environmental Notification Form ("ENF") initiating review of the entire Cape Wind project, including the wind farm, under the Massachusetts Environmental Policy Act ("MEPA"); a draft and a final Environmental Impact Report ("DEIR" and "FEIR") also will be required for the project (Exhs. CW-2, at 6-2; EFSB-4). The scope of the MEPA review of the wind farm includes alternative generating technologies and locations for the wind farm, avian impacts, fisheries impacts, visual impacts, noise, rare species, marine archeological resources, navigation, and decommissioning and environmental monitoring programs (Exh. CW-2, at 4-1 to 4-9, 7-1 to 7-47).

In an addition to the EIR/EIS requirements, the wind farm will undergo a Federal

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[23] The Section 10 permit is issued by the ACOE pursuant to Section 10 of the Rivers and Harbors Act of 1899, 33 USC §§ 401 et seq.

Consistency Review conducted by the Massachusetts Office of Coastal Zone Management ("CZM") and review by the Cape Cod Commission ("CCC") as a Development of Regional Impact ("DRI") (Exh. EFSB-4). The NEPA, MEPA, and CCC reviews have been coordinated, and a joint EIS/EIR/DRI will be prepared for the wind farm and transmission line (Exhs. EFSB-4; EFSB-9). A draft EIS/EIR/DRI has not yet been issued.

As of March 2003, Cape Wind stated that it had not sought financing for the project (Exh. APNS-N-32).

4. Analysis

Pursuant to the standard of review set forth in Section II.A.1, above, the Siting Board requires an applicant seeking to construct a transmission line to interconnect a new or expanded generating facility to show: (1) that the existing transmission system is inadequate to interconnect the new or expanded generator, and (2) that the new or expanded generator is likely to be available to contribute to the regional energy supply.

With respect to the first element of the standard of review, the record indicates that Cape Wind is proposing to build its wind farm in Horseshoe Shoal, several miles distant from the nearest transmission cable. In addition, the record indicates that the total capacity of all existing transmission cables in Nantucket Sound would be insufficient to transmit the output of the proposed wind farm, even if they could be totally dedicated to that purpose. The Siting Board therefore finds that the existing transmission system is inadequate to interconnect the proposed wind farm.

As the wind farm is not yet under construction, and is not subject to the Siting Board's jurisdiction, we consider its availability based on its progress in permitting. The record indicates that, although scoping documents for the joint EIS/EIR/DRI process were issued in early 2002, the ACOE (which is the lead agency for the joint review) has not yet issued a Draft Environmental Impact Statement. Thus, environmental permitting for the wind farm is in its early stages, and the Siting Board cannot yet find that the wind farm will be available to contribute to the regional energy supply. Given the complexity of the federal, state and local permitting process for this project, the Siting Board concludes that acquisition of all permits

required for Cape Wind to begin installation of wind farm equipment in Nantucket Sound is necessary before the Siting Board could make such a finding.[24] Accordingly, the Siting Board finds that, to establish that the wind farm is likely to be available to contribute to the regional energy supply, Cape Wind shall submit to the Siting Board copies of all permits required for Cape Wind to begin installation of wind farm equipment in Nantucket Sound. The Siting Board finds that, at such time as Cape Wind complies with this condition, Cape Wind will have demonstrated that there is a need for additional transmission resources to interconnect the wind farm with the regional transmission grid. Cape Wind and NSTAR may not commence construction of the proposed transmission project until they have complied with this condition.

B. Comparison of the Proposed Project and Alternative Approaches

1. Standard of Review

G.L. c. 164, § 69H requires the Siting Board to evaluate proposed projects in terms of their consistency with providing a reliable energy supply to the Commonwealth with a minimum impact on the environment at the lowest possible cost. In addition, G.L. c. 164, § 69J requires a project proponent to present "alternatives to planned action" which may include: (a) other methods of generating, manufacturing, or storing electricity or natural gas; (b) other sources of electrical power or natural gas; and (c) no additional electric power or natural gas.[25]

In implementing its statutory mandate, the Siting Board requires a petitioner to show that, on balance, its proposed project is superior to alternative approaches in terms of cost, environmental impact, and ability to meet the identified need. CELCo Decision, 12 DOMSB 305, at 321; Boston Edison Company, 6 DOMSB 208, at 252 (1997) ("1997 BECo Decision"); Boston Edison Company, 13 DOMSC 63, at 67-68, 73-74 (1985). In addition, the Siting Board

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[24] Moreover, in light of the expansive scope of the MEPA and ACOE reviews of the wind farm, acquisition of these approvals also would provide reasonable assurance that the wind farm would be constructed and operated with a minimum impact on the environment.

[25] G.L. c. 164, § 69J also requires a petitioner to provide a description of "other site locations." The Siting Board reviews the Company's primary route, as well as other possible routes, in Section III.A, below.

requires a petitioner to consider reliability of supply as part of its showing that the proposed project is superior to alternative project approaches. 1997 BECo Decision, 6 DOMSB 208, at 262-263; Commonwealth Electric Company, 5 DOMSB 273, at 300 (1997) ("ComElec Decision"); Massachusetts Electric Company, 18 DOMSC 383, at 404-405 (1989).

2. Identification of Project Approaches for Analysis

The Company considered four approaches for the interconnection of the wind farm (Exh. CW-1, at 3-2 to 3-4). These four approaches include connecting the wind farm: (1) to NSTAR's 115 kV Barnstable Switching Station; (2) to NSTAR's 115 kV Harwich Substation; (3) to NSTAR's 115 kV Pine Street Substation in New Bedford; and (4) to a new 115 kV substation on Martha's Vineyard, then proceeding on to the mainland.[26, 27]

The Company used the following criteria to identify possible approaches to interconnecting the wind farm to the grid: (1) proximity of the electric power system to the wind farm; (2) ability of the electric power system to accept the wind farm's full output; (3) suitability of voltage levels for delivery of the output; and (4) availability of multiple transmission lines at the tie-in point (Exh. CW-1, at 3-1). Cape Wind stated that it considered only approaches that would provide firm capacity for the full output of the wind farm, and excluded approaches that might require curtailing output during a full load (Tr. 1, at 58). The Company stated that Cape Cod is served by a number of 115 kV lines, which generally range in capacity from 200 MVA to

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[26] The Company also considered a no-build alternative. The Company determined that this approach would prevent the wind farm from being interconnected to the regional transmission grid, and would preclude operation of the wind farm (Exh. CW-1, at 3-5). Therefore, this approach was not considered further (id.).

[27] At the request of the Siting Board, the Company also analyzed an interconnection at the Mashpee Substation (Exh. EFSB-PA-11). The Company stated that existing transmission lines out of the Mashpee substation could not accommodate the 420 MW of power generated by the wind farm (id.). The Company explained that the Mashpee Substation supports two 115 kV transmission lines – one that extends west to the Hatchville Substation and one that extends northeast to the Barnstable Switching Station – each of which has a short-term emergency rating of 291 MVA (id.; Exh. EFSB-1). Because neither line is capable of carrying the full output of the wind farm, the loss of either line would result in the overload of the remaining line (Exh. EFSB-PA-11).

over 400 MVA, but noted that only two of these lines – Lines 120 and 122, which extend west from the Barnstable Switching Station – could accommodate power flows in excess of 400 MVA (id. at 31, 35). The Company stated that approaches which allowed transmission at higher voltages, with lower line losses, were preferred due to their greater ability to deliver large blocks of power more efficiently (Exh. CW-1, at 3-1).

a. The Barnstable Interconnect

The Company's preferred approach ("Barnstable Interconnect") would interconnect the wind farm with the grid at NSTAR's 115 kV Barnstable Switching Station via an approximately 18- to 24-mile transmission line, 9 to 12 miles of which would be submarine cable (Exhs. CW-1, at 3-2; EFSB-RR-84). The Barnstable Switching Station is located south of Route 6 off Mary Dunn Road in Barnstable (Exh. CW-1, at 3-2). Six 115 kV lines emanate from the Barnstable Switching Station, including three that run to the west (Lines 115, 120, and 122), two that run to the east (Lines 118 and 119), and one that runs to the south (Line 124) (Exh. EFSB-3, at Figs. 3-1 and 3-2). The distance from landfall to the Barnstable Switching Station ranges from approximately 5.9 miles (for the New Hampshire Avenue landfall in Yarmouth), to approximately 14.2 miles (for the Mashpee Town Landing landfall) (Exh. CW-1, at 1-4 and 1-13). If the alternative route were used, a new riser station would need to be constructed in the NSTAR ROW in Mashpee, to connect the proposed transmission lines to the existing NSTAR 115 kV line and to the new overhead transmission lines (id. at 1-13 to 1-14). The Company indicated that the capital cost of the Barnstable Interconnect would be $79.5 million (Exh. EFSB-PA-2, Table 3-1).[28]

b. Harwich Alternative

The Harwich Alternative would interconnect the wind farm with the grid at NSTAR's 115 kV Harwich Substation, located south of Route 6 off Great Western Road and Lothrop Avenue in Harwich, via an approximately 21-mile transmission line, 17 miles of which would be

[28] The cost estimate of the Barnstable Interconnect is based on 11 miles of submarine cable (Exh. EFSB-PA-2, Table 3-1).

submarine cable (Exh. CW-1, at 3-3). The Harwich Substation is connected to two 115 kV transmission lines (Lines 118 and 119) that run generally from the Harwich Substation to the Harwich Tap and then to the Barnstable Switching Station (id. at 3-3).[29] The Company noted that the transmission lines from the wind farm would be connected to Lines 118 and 119 at the Harwich Substation (Tr. 1, at 102). The Harwich Alternative would then require the construction of an additional 115 kV line extending 12.3 miles from the Harwich Substation to the Barnstable Switching Station (14 miles from landfall), necessitating an expansion of the Harwich Substation (Exhs. CW-1, at 3-3; EFSB-PA-10). The Company indicated that the capital cost of the Harwich Alternative would be $126.8 million (Exh. EFSB-PA-2).[30]

c. New Bedford Alternative

The New Bedford Alternative would interconnect the wind farm with the grid at NSTAR's Pine Street Substation in New Bedford via an approximately 32-mile submarine cable (Exh. CW-1, at 3-4). The cable would pass through Horseshoe Shoal in Nantucket Sound, Vineyard Sound, Buzzards Bay, and New Bedford Harbor before making landfall at New Bedford and proceeding several hundred feet overland to the Pine Street Substation (id. at 3-3 to 3-4; Tr. 1, at 106). The Company noted that the Pine Street Substation is connected to the grid through three transmission lines – two that are capable of carrying 60 MVA each and one that is capable of carrying 130 MVA– for a total existing transmission capacity of 250 MVA (Tr. 1, at 49). The Company therefore concluded that use of the New Bedford Alternative would require construction of another line to transmit the wind farm's maximum output; it would also

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[29] The Lothrop Avenue Low Voltage Substation is located adjacent to the Harwich Substation, and the 23kV Nantucket Cable runs from this low voltage substation to Nantucket (Tr. 1, at 102). The Company explained that although there are plans for a second cable to Nantucket, Nantucket's load is appropriate for low-voltage service and attempting to upgrade the system for use by both the Nantucket Cable Project and the wind farm would add substantial cost and complexity without providing any cost benefits (id. at 72-73,75).

[30] The Company estimated that the cost of the Harwich Alternative would be $102.5 million if the on-land cable were installed overhead instead of underground (Exh. EFSB-PA-21).

necessitate an expansion of the Pine Street Substation (Exh. EFSB-PA-27; Tr. 1, at 54, 104).[31] The Company indicated that the capital cost of the New Bedford Alternative would be $129.2 million (Exh. EFSB-PA-2).

The Company initially proposed using a 150 kV direct current ("DC") transmission cable for the New Bedford Alternative, rather than the alternating current ("AC") cable proposed for the other alternatives, due to the length of the submarine cable (Exh. CW-1, at 3-3 to 3-4). However, the Company later concluded that the cost and line loses associated with the use of DC would be greater than for AC, that the DC technology was new and unproven, and that AC was appropriate for cable lengths of less than 50 to 100 miles (Tr. 1, at 46-47). In addition, the Company noted that the use of DC technology would require the installation of converter stations at both the ESP and the Pine Street Substation (Exh. CW-1, at 3-3 to 3-4). The Company indicated that converter stations have large space requirements and high losses, and that the installed cost of the converter stations would be $124 million (Exh. EFSB-PA-1). The cost of the New Bedford Alternative with DC cable would be $292.4 million as opposed to $129.2 million with AC cable (Exh. CW-1, at Table 3-1). The Company therefore indicated that it would use AC technology for the New Bedford Alternative (Exh. EFSB-PA-2).

d. Martha's Vineyard Alternative

The Martha's Vineyard Alternative would connect the wind farm first to Martha's Vineyard to serve load on the Island, and then to a substation on the mainland. A 13.5-mile 115 kV submarine cable would run from the wind farm to a new 115 kV substation on Martha's Vineyard (Exh. CW-1, at 3-4).[32] The Company stated that the most recently recorded summer peak load on Martha's Vineyard was 42.3 MW (August 2002) (Exh. EFSB-PA-8). From

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[31] With the wind farm at the maximum output of 420 MW, the Company noted that even adjusting the output to subtract out up to 70 MW of output to the New Bedford area load served from the Pine Street Substation, transmission capacity of at least 350 MW would be required on lines connecting the Pine Street Substation to the rest of the grid to carry the remaining output from the wind farm (Tr. 1, at 51).

[32] The highest voltage level currently serving Martha's Vineyard is 23 kV (Exh. EFSB-3, Fig. 3-1).

Martha's Vineyard, a new 115 kV line would extend either to the Mashpee Substation (a distance of 14 miles), or to the Falmouth Substation (a distance of approximately 5 miles) (Exh. CW-1, at 3-4). The Company indicated that the Mashpee tie-in would be preferable (id.).

The Company estimated that the capital cost of the Martha's Vineyard Alternative would exceed that of the Barnstable Interconnect by $109 million, for a total cost of $188.5 million (id.).[33] The Company indicated that it eliminated this alternative from further consideration due to these substantial additional costs (id.).[34]

e. Analysis

The Company has identified four approaches to meeting the identified need, each of which could provide reliable service for the proposed wind farm. The Siting Board agrees with the Company's conclusion that the Martha's Vineyard Alternative does not warrant further consideration due to the magnitude of increased cost over the Barnstable Interconnect without any offsetting benefits.[35] The Martha's Vineyard Alternative would involve increased lengths of

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[33] In making this estimate, the Company assumed that the Martha's Vineyard Alternative would make landfall in Mashpee and would follow the Mashpee route for the Barnstable Interconnect to the Mashpee Substation and then on to the Barnstable Switching Station (Exh. CW-1, at 3-4). The additional cost includes the cost of 27.5 miles of submarine cable from the ESP to Martha's Vineyard and then to landfall at Mashpee at $3.7 million per mile, and $7.2 million for the new facilities on Martha's Vineyard (id.).

[34] The Company noted that it also considered an interconnection via Nantucket, but rejected it for the same reasons that it rejected the Martha's Vineyard Alternative (Exh. CW-1, at 3-4). A Nantucket alternative would require construction of new 115 kV facilities on the Island and a longer submarine cable than that required for the Martha's Vineyard Alternative (id.).

[35] The Siting Board notes the $109 million cost differential is overstated, as the Company failed to subtract out the submarine cable costs of the Barnstable Interconnect when making its calculation. A more accurate incremental cost estimate would be $68 million (based on subtracting the cost of 11 miles of marine lines for the Barnstable Interconnect at $3.7 million per mile). Therefore, the recalculated cost of the Martha's Vineyard Alternative would be approximately $147.5 million, versus the original estimate of $188.5 million. However, this cost is still significantly greater than the $79.5 million cost of the Barnstable Interconnect, the $127 million cost of the Harwich Alternative, and the

(continued...)

the marine route and the associated impacts of such construction, with potentially the same land route as the Barnstable Interconnect.

The Harwich and New Bedford Alternatives are somewhat less costly than the Martha's Vineyard Alternative, although each would cost approximately $50 million more than the Barnstable Interconnect. The Harwich Alternative provides an alternative interconnection point on Cape Cod, while ultimately transmitting most of the wind farm output via the Barnstable Switching Station. The New Bedford Alternative connects to the regional transmission system at a point off Cape Cod, and thus presents a different set of advantages and disadvantages. The Siting Board finds that the Barnstable Interconnect, the Harwich Alternative, and the New Bedford Alternative each would meet the identified need and provide potential tradeoffs between reliability, environmental impacts and cost worthy of further analysis. Therefore, in the following sections, the Siting Board compares the three approaches with respect to reliability, environmental impacts, and cost.

3. Reliability

The Company stated that, while each of the project approaches could provide a reliable interconnection with the regional transmission grid, the best interconnection point would be the Barnstable Switching Station, which is the major bulk substation on Cape Cod, and is connected to the grid by six separate transmission lines (Exhs. CW-1, at 3-5; EFSB-RR-57). The Company explained that interconnecting at a point served by multiple transmission lines would ensure that the loss of one of those lines would not force the curtailment of the wind farm's output (Exh. EFSB-PA-5). The Company also asserted that only the Barnstable Switching Station could accept the wind farm's full output and transport it to the transmission grid without substantial transmission upgrades elsewhere on the system (Tr. 1, at 53). The Company explained that the Barnstable Switching Station already has a ring bus; consequently, the work required for interconnection would involve only the extension of that ring bus to accommodate the cables from the wind farm, which would limit the construction to inside the fence line and would not

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[35] (...continued)
$129.2 million cost of the New Bedford Alternative.

require expansion of the existing substation (id. at 110-111).[36] The Company acknowledged that a system impact study has not yet been conducted, and that it consequently does not have the benefit of system impact study analyses simulating the effect of wind farm operations on the system (id. at 79).

The Company stated that interconnecting at the Harwich Substation would be a less reliable approach, since the new capacity generated by the wind project would be "connected at a greater distance from the core of the Cape Cod transmission system" (Exh. CW-1, at 3-5). Interconnecting at the New Bedford Substation also was deemed less reliable due to the greater length and complexity of the associated submarine cable (id.).

The record shows that the Barnstable Switching Station is the major bulk substation on Cape Cod, with six 115 kV transmission lines available to carry energy to various parts of Cape Cod. Interconnection at this location provides high reliability in that energy from the wind farm can be reliably delivered to the grid even if one of the lines emanating from the Barnstable Switching Station is out of service. Both the Barnstable Interconnect and the Harwich Alternative provide added transmission capacity ultimately reaching the Barnstable Switching Station; however, the Company argues that the Barnstable Interconnect provides a more direct connection to this substation, since the Harwich Alternative first interconnects at the Harwich Substation. The Siting Board agrees that, all other considerations being equal, a direct connection at the Barnstable Switching Station provides greater reliability than an indirect connection through another, smaller substation 12.3 miles distant from the Barnstable Switching Station. However, this reliability advantage would be diminished if for any reason the Company selected the alternative route for the Barnstable Interconnect, which includes an intermediate connection at the Mashpee Substation, and 14.2 miles of upgraded transmission lines, 12.3 miles of which are on new overhead lines, before reaching the Barnstable Switching Station.

The record suggests that the length of the New Bedford marine line – 32 miles, as opposed to 9 to 12 miles for the Barnstable Interconnect and 17 miles for the Harwich

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[36] The Company explained that interconnecting at the Harwich, Mashpee, or Falmouth Substations would require either the construction of a new substation or the expansion of an existing substation's footprint (Tr. 1, at 111).

Alternative – may make the New Bedford Alternative less reliable than interconnection at the Barnstable Switching Station. Further, at the point of interconnection to the grid, the number and capacity of the existing interconnecting lines is significantly lower under the New Bedford Alternative than the Barnstable Interconnect. The record shows that with the Barnstable Interconnect, the wind farm's maximum output is well matched to the transmission capacity at the Barnstable Switching Station. In contrast, with the New Bedford Alternative, the wind farm's output would be six times the existing peak load supplied from the interconnection point, and the excess output could not be fully transferred to other load areas via the available interconnection lines.

Accordingly, the Siting Board finds that the Barnstable Interconnect is slightly preferable to the Harwich Alternative and preferable to the New Bedford Alternative with respect to reliability.

4. Environmental Impacts

The Company asserted that the environmental impacts associated with the Barnstable Interconnect would consist predominantly of temporary impacts associated with the construction of the marine and underground facilities (Exh. CW-1, at 3-6). The Company stated that these temporary impacts could be mitigated through the design of the facilities and through optimization of the route (id.). Asserting that the marine-based construction impacts were essentially equivalent, the Company argued that the only differences would be associated with the lengths of the routes, and concluded that construction of a longer submarine cable might cause greater impacts than construction of a shorter cable (Tr. 1, at 89).[37] The Company concluded that the Barnstable Interconnect would have fewer temporary impacts since it is the shortest project alternative (Exh. CW-1, at 3-7).

The Company also assessed construction impacts on traffic and navigation associated with the three project approaches. With respect to traffic impacts, the Company noted that the

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[37] However, the Company also noted that each of the submarine cable routes has its own set of particular environmental constraints or opportunities, and that the New Bedford route is quite different than any of the other project approaches (Tr. 1, at 109).

land portion of the Harwich Alternative is routed through a slightly less dense residential and commercial area, and that the traffic volumes are lighter than along the land portion of the Barnstable Interconnect (id; Tr. 1, at 97). With respect to navigational impacts, the Company noted that the likely route through Vineyard Sound, Buzzards Bay, and New Bedford Harbor is complicated by a number of factors, including the presence of surface bedrock, limited channel work space, and heavy commercial marine traffic (Tr. 1, at 90-92). In addition, the Company noted that construction of the New Bedford Alternative would be complicated by federal navigation channels and a hurricane barrier located in New Bedford Harbor (id. at 91). The Company asserted that, of the three approaches under consideration, the Harwich Alternative would have the fewest impacts on navigation (id. at 90).

The Company noted differences in the permanent land use impacts of the three project approaches. It noted that, depending on the route selected, the Barnstable Interconnect could have some permanent land use impacts resulting from the construction of the Mashpee riser station structures and overhead lines within the existing NSTAR ROWs (id. at 3-6). The Company stated that the impacts of the Harwich Alternative would include permanent impacts associated with the expansion of the Harwich Substation to accommodate the new underground transmission lines (Exhs. CW-1, at 3-7; EFSB-PA-9). The Company explained that the Harwich Substation site is constrained due to the number of existing facilities, including two transformers and distribution equipment (Tr. 1, at 103). The Company indicated that the site is bordered by Lothrop Avenue to the east, by wetlands to the west, open land to the south, and the ROW to the north (Exh. EFSB-PA-9; Tr. 1, at 98, 108, 109). The Company also noted that additional ROW might need to be acquired and cleared to accommodate the Harwich Alternative, since the existing ROW already is cleared to its full width (Exh. EFSB-PA-9; Tr. 1, at 98). The Company noted that Lothrop Avenue is a low-lying road, subject to flooding, that passes through the Parkers River Area of Critical Environmental Concern ("ACEC") (Tr. 1, at 101).

The Company explained that upgrades to the Pine Street Substation with the New Bedford Alternative would consist of additional interconnection work and bus work (Tr. 1, at 104). The Company stated that the Pine Street Substation is located at an industrial waterfront facility, surrounded by urban waterfront, industrial, and commercial uses (id. at 105). Further,

although the Pine Street Substation is fairly compact, there appears to be potential for expansion on the site (id.). The Company estimated that the distance from the New Bedford landfall to the Pine Street Substation is several hundred feet, giving the New Bedford Alternative the shortest and easiest on-land route of the project alternatives (id. at 106).

The Company provided a detailed analysis of magnetic field impacts for the Barnstable Interconnect, but did not measure existing magnetic fields or predict future magnetic fields for the Harwich Alternative and the New Bedford Alternative (Exh. EFSB-PA-12). The Company posited that since the same type of submarine cable would be used for all project approaches, the magnetic fields along the marine portions of the Harwich and New Bedford Alternatives would be similar to those for the Barnstable Interconnect (id.). The Company indicated that on-land electromagnetic field ("EMF") of the Barnstable Interconnect would be limited by the underground design, but they acknowledged that it is not possible, given the existing data, to predict with any accuracy the combined fields associated with the new and existing on-land facilities (id.).

The record indicates that use of the Harwich Alternative or the New Bedford Alternative would require the construction of transmission upgrades at existing substations, and that this construction could result in permanent land use impacts. The Barnstable Interconnect, if constructed along the primary route, would not require substation expansion. If the alternative route for the Barnstable Interconnect were used, some construction would be required at the Mashpee Substation. However, this work would be less extensive and have fewer impacts than the work required for the Harwich Alternative, due to space constraints at the Harwich Substation site, and the presence of wetlands to the west. In addition, the existing ROW in the immediate vicinity of the Harwich Alternative has been cleared to its full width; therefore, additional ROW may need to be acquired and cleared if the Harwich Alternative were used.

The New Bedford Alternative appears to have fewer permanent impacts than the Harwich Alternative; however, it has potential temporary impacts on navigation due to construction of the route through New Bedford Harbor. Construction in New Bedford Harbor may be complicated by bedrock, limited work space, and the hurricane barrier. Further, the marine portion of the New Bedford route is approximately three times the length of the Barnstable Interconnect and

twice that of the Harwich Interconnect.

Accordingly, the Siting Board finds that the Barnstable Interconnect would be preferable to both the Harwich Alternative and the New Bedford Alternative with respect to environmental impacts.

5. Cost

The Company estimated that the total capital cost of the transmission project would be $79.5 million if the Barnstable Interconnect is used, $126.8 million if the Harwich Alternative is used, $102.5 million if an overhead version of the Harwich Alternative is used, and $129.2 million if the AC version of the New Bedford Alternative is used (Exh. EFSB-PA-2).

The record demonstrates that the capital cost of the Barnstable Interconnect would be $47.3 million less than the Harwich Alternative, $23 million less than an overhead version of the Harwich Alternative, and $49.7 million less than the AC version of the New Bedford Alternative. Accordingly, the Siting Board finds that the Barnstable Interconnect would be preferable to the Harwich Alternative and the New Bedford Alternative with respect to cost.

6. Conclusions: Weighing Need, Reliability, Environmental Impacts, and Cost

The Siting Board has found that the Barnstable Interconnect, the Harwich Alternative, and the New Bedford Alternative each would meet the identified need. The Siting Board also has found that the Barnstable Interconnect would be slightly preferable to the Harwich Alternative and preferable to the New Bedford Alternative with respect to reliability, and that the Barnstable Interconnect would be preferable to the Harwich Alternative and the New Bedford Alternative with respect to environmental impacts and cost. Accordingly, the Siting Board finds that the Barnstable Interconnect would be preferable to both the Harwich Alternative and the New Bedford Alternative with respect to providing a reliable energy supply for the Commonwealth, with a minimum impact on the environment at the lowest possible cost.

III. ANALYSIS OF THE PRIMARY AND ALTERNATIVE ROUTES

The Siting Board has a statutory mandate to implement the policies of G.L. c. 164, §§ 69J-69Q to provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. G.L. c. 164, §§ 69H and 69J. Further, G.L. c. 164, § 69J requires the Siting Board to review alternatives to planned projects, including "other site locations." In implementing this statutory mandate, the Siting Board requires a petitioner to demonstrate that it examined a reasonable range of practical siting alternatives, and that its proposed facilities are sited at locations that minimize costs and environmental impacts while ensuring supply reliability. CELCo Decision, 12 DOMSB 305, at 326; MMWEC Decision, 12 DOMSB 18, at 89; New England Power Company, 21 DOMSC 325, at 376 (1991).

A. Site Selection

1. Standard of Review

G.L. c. 164, § 69J provides that a petition to construct a proposed facility must include "a description of alternatives to [the applicant's] planned action" including "other site locations." In past reviews of alternative site locations identified by an applicant, the Siting Board has required the applicant to demonstrate that it examined a reasonable range of practical siting alternatives. CELCo Decision, 12 DOMSB 305, at 326; MMWEC Decision, 12 DOMSB 18, at 119; New England Power Company, 7 DOMSB 333, at 374 (1998) ("1998 NEPCo Decision"). In order to determine whether an applicant has considered a reasonable range of practical alternatives, the Siting Board has required the applicant to meet a two-pronged test. First, the applicant must establish that it developed and applied a reasonable set of criteria for identifying and evaluating alternative sites in a manner which ensures that it has not overlooked or eliminated any sites which, on balance, are clearly superior to the proposed site. Second, the applicant must establish that it identified at least two noticed sites or routes with some measure of geographic diversity. CELCo Decision, 12 DOMSB 305, at 326; MMWEC Decision, 12 DOMSB 18, at 119; 1998 NEPCo Decision, 7 DOMSB 333, at 374.

2. Site Selection Process

a. Description

The Company indicated that its site selection process consisted of two parts – the identification of potential routes connecting the ESP to the Barnstable Switching Station, and the screening and ranking of the identified routes (Exh. CW-1, at 4-2 to 4-3; Tr. 2, at 188). Cape Wind explained that it identified several potential interconnection points through the use of U.S. Geological Survey maps, aerial photography, and consultation with NSTAR; then, potential landfall locations were identified along the southern shore of Cape Cod using the same methods (Exh. EFSB-SS-2). The Company then conducted site visits to screen the potential landfall locations and assessed the viability of the routes (id.).

The Company stated that it used two categories of "siting criteria" – land use criteria and environmental protection criteria – to identify potential routes for the transmission line (Exh. CW-1, at 4-2). With respect to land use, the Company sought to: (1) use landfall locations in close proximity to the Barnstable Switching Station; (2) use interconnection locations with transmission at 115 kV in order to minimize transmission upgrades; (3) maximize use of underground construction for the land portion of the route; (4) use previously developed and disturbed land; (5) use developed waterfront and near shore areas for the transmission cable landfall; (6) use existing ROWs with available workspace; (7) minimize bends or turns in the ROW; and (8) use roadways, sidewalks, and shoulder areas to maintain vehicle and pedestrian travel access (id. at 4-2 to 4-3). With respect to environmental protection, the Company sought to: (1) select a direct route between the ESP and the landfall; (2) avoid or minimize surface or subsurface disturbance of terrestrial, wetland and aquatic resources; (3) maximize use of existing developed land and waterfront areas and avoid encroachment on undeveloped areas; (4) minimize impacts to regional land-based and waterborne commerce and transportation networks; (5) avoid or minimize impacts to aquatic resources, water quality, seabed conditions and benthic habitat; and (6) minimize the number of marine transmission line trenches and the width of the trenches (id. at 4-3).

Based on these criteria, the Company identified six potential routes for the transmission lines, as follows: (1) an approximately 17-mile route making landfall at New Hampshire Avenue

in Yarmouth, continuing along Yarmouth streets and along an NSTAR ROW in Barnstable ("New Hampshire Avenue Route" or "Alternative 1"); (2) an approximately 24-mile route making landfall at the Mashpee Road Town Landing, via Popponesset Bay, continuing along Mashpee streets and along the NSTAR ROW ("Mashpee Town Landing Route" or "Alternative 2"); (3) an approximately 23.25-mile route making landfall at Bryants Cove in Mashpee, via Popponesset Bay, continuing along a cart path and along the NSTAR ROW ("Bryants Cove Route" or "Alternative 3"); (4) an approximately 21-mile route making landfall at Main Street in Cotuit, continuing along Main Street and along the NSTAR ROW ("Cotuit Route" or "Alternative 4"); (5) an approximately 17.5-mile route making landfall at Whale Road/Point Gammon in Yarmouth continuing along Yarmouth streets and along the NSTAR ROW ("Point Gammon Route" or "Alternative 5"); and (6) an approximately 14.5-mile route making landfall at Lewis Bay Road in Hyannis Harbor continuing along Hyannis streets and the Barnstable Airport to the NSTAR ROW and the Barnstable Switching Station ("Hyannis Harbor Route" or "Alternative 6") (Exh. CW-1, at 4-4 to 4-21 and Table 4-1).

The Company stated that it considered, but did not include, routes that would make landfall in an approximately 10-mile long coastal area lying between the Lewis Bay area, where Alternatives 1, 5, and 6 make landfall, and the Popponesset Bay/Cotuit Bay area, where Alternatives 2, 3, and 4 make landfall (Exh. EFSB-SS-23).[38] The Company explained that this in-between area lacked commercially available property for a landfall, and would necessitate use of on-land routing extending toward the Barnstable Switching Station that was likely to present construction difficulties due to congested roadways and utilities (id.).

The Company also considered but rejected routes that would come ashore in the Popponesset Bay/Cotuit Bay area but that, instead of using a lengthy overhead alignment along the NSTAR ROW, would follow an underground alignment along area roadways extending all the way to the terminus at the Barnstable Switching Station, or extending most of that distance before joining and following the NSTAR ROW at a point near the terminus (id.). The Company explained that it sought routes which minimized roadway construction, citing traffic, utility

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[38] The coastal area includes Sea View Avenue in Wianno, Craigville Beach, Coville Beach and Keyes Beach (Exh. EFSB-SS-23).

congestion and cost, and added that it deemed the primary route to be clearly superior to other possible routes, beyond the identified alternatives, that would predominantly use roadway alignments (id.; Tr. 2, at 239-240). The Company further stated that it favored overhead construction where possible, based on differences in electrical line losses, environmental impacts and cost (Exh. EFSB-SS-23).

The Company stated that it evaluated the six route alternatives using 26 screening criteria, including cost, reliability, 11 installation and maintenance ("I&M") complexity criteria, and 13 environmental and land use criteria (Exh. CW-1, at 4-21). The Company explained that it started with the same unit price per foot to calculate the cost of each route alternative, but then factored in cost differences due to specific installation and design difficulties, including the number of horizontal directional drills ("HDD"), state highway crossings or railroad crossings, and installation in areas with congested underground utilities (id. at 4-28; Tr. 2, at 247).

The Company stated that the only factor used to assess differences in reliability between the route alternatives was the extent of overhead versus underground construction (wherein an underground line was considered to have a small reliability advantage (Exh. EFSB-SS-18; Tr. 2, at 229). The Company noted that routes which interconnect to the Barnstable Switching Station from the east would use underground lines for their full length, and thus were considered more reliable than those which interconnected from the west (Exh. EFSB-SS-18). The Company stated that the marine route segments all were deemed to be equally reliable because the length of the circuits, installation techniques, burial depths and materials used would be similar (Tr. 2, at 231).

The Company categorized eight of the I&M criteria as land and three as marine (Exh. CW-1, Tables 4-1, 4-2, and 4-3). The I&M criteria for the land portions of the routes included: (1) underground utility congestion; (2) intersection crossings; (3) traffic; (4) street width; (5) transmission line length; (6) number of manholes/splicing vaults; (7) railroad crossings; and (8) road access during construction (id. at 4-21 to 4-24, Table 4-3). The I&M criteria for marine portions of the routes included: (1) marine transmission line distance; (2) marine HDD; and (3) navigational impacts (id.).

Finally, the Company categorized twelve of the environmental criteria as land and one as

marine (id. at Tables 4-1, 4-2, 4-3). The environmental criteria for the land portions of the routes included: (1) wetlands; (2) terrestrial rare and endangered species habitat; (3) tree and vegetation removal; (4) shade tree removal; (5) percentage of new ROW; (6) water supply and groundwater (Zone I); (7) water supply and groundwater (Zone II); (8) disruption to properties during construction;[39] (9) prehistoric and historic archeological sites; (10) historic districts; (11) community facilities; and (12) hazardous waste sites (id. at 4-25 to 4-28, Table 4-3). The Company identified three environmental criteria for the marine transmission cable – eelgrass, fish runs, and shellfish; however, of these, only eelgrass was carried forward to a quantitative analysis (id.. at 4-28).[40]

The Company stated that it evaluated and ranked the six alternative routes using the 26 screening criteria described above (id. at 4-30).[41] For each route, the Company assigned scores for each criterion on a scale of 0 to 5, where 5 was the most favorable (id.). Each of the criteria was assigned a weight of 1, 2, or 3, with very important criteria given a weight of 3, moderately important criteria given a weight of 2, and minor criteria given a weight of 1 (id. at 4-31; Tr. 2, at 214).[42] The scores were multiplied by the relevant weights and totaled to develop an overall weighted score for each route (Exh. CW-1, at 4-31). This scoring is shown in Table 2, below.

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[39] The Company indicated that the property disruption criteria reflected traffic and property access concerns resulting from construction along streets (Exh. EFSB-SS-19).

[40] The Company asserted that fish runs and shellfish were present along all of the routes, and that impacts could be addressed by construction techniques (Exh. CW-1, at 4-28). The Company concluded that impacts to fish runs and shellfish would be essentially equivalent along all routes, and therefore did not carry the fish run and shellfish criteria forward to the quantitative stage of the analysis (id. at 4-28, Tables 4-1, 4-2, 4-3).

[41] The Company assessed the land and marine portions of each route separately (Exh. CW-1, at 4-30).

[42] The total weights of all of the 26 criteria equaled 52 (based on a 1, 2, or 3 weight assigned to each criterion) (Exh. CW-1, at Table 4-3). Of the total weight of 52, the land installation criteria accounted for 16, the upland environmental/land use criteria accounted for 22, the marine installation criteria accounted for 9, the marine environmental/land use criterion accounted for 2, the cost criterion accounted for 2, and the reliability criterion accounted for 1 (id.).

Table 2. Site Selection Scoring

Criteria Category	Total Weighting	New Hampshire Avenue	Mashpee Town Landing	Bryants Cove	Cotuit	Point Gammon	Hyannis Harbor
UPLAND CRITERIA							
Installation & Maint. Criteria	31%	45	43	53	39	39	35
Environ./ Land Use Criteria	42%	73	73	60	41	74	60
Subtotal	73%	118	118	113	80	113	95
SUBMARINE CRITERIA							
Installation & Maint. Criteria	17%	39	28.5*	24	42	36	30
Environ./ Land Use Criteria	4%	10	10	10	10	2	10
Subtotal	21%	49	38.5	34	52	38	40
COST	4%	2	10	8	6	0	4
RELIABILITY	2%	5	1	1	1	5	5
TOTAL	100%	174	165.5*	156	139	156	144

Sources: Exh. CW-1, at Table 4-3; Tr. 8, at 1059; Company Brief at 136-138.

* As originally presented, the score for submarine I&M was 30: during the course of the proceeding the raw score for marine HDD on the Mashpee Town Landing Route was revised from 3 to 2.5, which lowered the weighted score by 1.5; the submarine I&M score dropped from 30 to 28.5, and the total score decreased from 167 to 165.5 (id.).

In response to questions from staff and intervenors, the Company provided additional information about its approach to assessing marine impacts, noise impacts, visual impacts and cultural resource impacts as part of the site selection process. With respect to marine impacts, the Company explained that for Alternatives 2 and 3, impacts to the landfall barrier beach (Popponesset Spit) were reflected in its site screening analysis, specifically under the criteria of marine HDD, rare and endangered species, and wetlands (Tr. 2, at 296, 297, 332).[43] The

[43] For the two alternatives that pass under Popponesset Spit (Mashpee Town Landing and (continued...)

Company noted that the evaluation of rare and endangered species reflected the presence of plant or wildlife species and habitat on the NSTAR ROW as well as on Popponesset Spit (Exh. EFSB-SS-3A). The Company stated that while wetlands along the marine portion were considered, they were determined to be the same along all six routes within the three mile length of coastal wetlands (Tr. 8, at 1063). Therefore, only the land portions were included in the scoring of routes for wetlands issues (id.).[44]

The Company asserted that, although noise was not used as a siting or screening criterion, and was not explicitly discussed as part of another criterion, it was nonetheless subsumed in the actual rankings and analysis (Tr. 8, at 1060). The Company asserted that the HDD criterion served as a marker for community disturbance and disruption of endangered species caused by HDDs, and the scoring for each route thus incorporated such impacts (id. at 1060).[45]

The Company stated that it did not include visual impacts as a separate screening

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[43] (...continued)
Bryants Cove), Tables 4-1 and 4-3 of the Petition provide the following detail for the wetlands criteria: they were described as "no direct impact – buffer zone" (score of 3), and "temporary impact – intermittent stream" (score of 1), respectively (Exh. CW-1, at Tables 4-1, 4-3). The rare and endangered plant and animal species habitat criteria were described as "present – direct impact" (score of 1) for both routes (id.).

[44] The record indicated that within the NSTAR ROW, Alternatives 2, 3, and 4 cross 15, 14, and 13 jurisdictional wetlands respectively (Exh. CW-1, at 4-11, 4-13, 4-16, 5-69). However, while Popponesset Spit was not included as a jurisdictional wetland area in the site scoring, the Company indicated that the wetlands associated with Popponesset Spit were considered an upland wetland area (Tr. 8, at 1013, 1064). The record indicates that all of the routes received an unweighted score of three (i.e., no direct impact) for wetlands, with the exception of Alternative 3 which received an unweighted score of one (i.e., temporary impact), due to the crossing of an intermittent stream (Exh. CW-1, at Tables 4-1, 4-3).

[45] The Company stated that it did not specifically consider the potential impact of noise from an HDD on nesting and breeding habits of the piping plover (or any other species) in its site selection process, but rather assumed that the impact of noise from HDDs was the same for all route alternatives under all conditions (Tr. 8, at 1038-1040). The Company stated that it did consider whether there were sensitive receptors that could be affected by the noise from HDDs; however, it concluded that the receptors and noise level would be the same for all routes (id. at 1040).

criterion because transmission lines installed underground would have no visual impact, and overhead transmission lines would be limited to the NSTAR ROW where 115 kV structures already exist (Exh. EFSB-SS-20; Tr. 2, at 206-207). The Company argued that visual impacts were reflected in both the tree/vegetation removal criterion and the shade tree removal criterion,[46] since the visual impacts of transmission lines result mainly from the clearing of vegetation for new overhead lines (Tr. 8, at 1064-1065). The Company stated that the north side of the NSTAR ROW was not previously cleared by NSTAR, and therefore currently is wooded for much of the 8-mile distance from the Mashpee Substation to Shootflying Hill Road in Barnstable (Exh. EFSB-L-27; Tr. 2, at 203-204; Tr. 6, at 729). The Company noted that use of this length of ROW would require clearing an additional 55-60 feet width of the ROW and thereby would increase the visibility of transmission lines from some of the nearby residential areas (Exh. EFSB-L-27; Tr. 2, at 203-204; Tr. 6, at 729).

The Company noted that it based its evaluation of the potential impacts on historic resources only on that portion of each route between the landfall and the point at which it joined the NSTAR ROW (Exh. EFSB-SS-19; Tr. 2, at 195). The Company stated that NSTAR's existing ROWs have been disturbed by existing transmission facilities and on-going maintenance, and that the potential for impacts on historic resources therefore was assumed to be generally equivalent for those segments of each route that occurred on the ROW (Exh. EFSB-SS-19).

Based on the results of the route screening analysis, the Company selected the New Hampshire Avenue Route, which had the highest weighted score, as its primary route, and the

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[46] The Company indicated that these criteria each received a weight of 3 (Exh. CW-1, at Table 4-3). Unweighted scores for tree/vegetation removal were: one for Alternative 3, based on clearing in the NSTAR ROW and in an undeveloped area between the route landfall and the NSTAR ROW; three for Alternatives 2 and 4, in each case based on clearing in the NSTAR ROW; and five for Alternatives 1, 5 and 6, which each require little or no ROW clearing (id. at 4-12, Tables 4.1, 4.3). Unweighted scores for shade tree removal focused on in-street construction and ranged from one for Alternative 4, where a route segment along Main Street in Cotuit is very narrow and within a historic district, to five for all the other alternatives where the Company expected no impact (id. at 4-16, Table 4-1).

Mashpee Town Landing Route, which received the second highest weighted score, as its alternative route (Exh. CW-1, at 4-31). The Company asserted that the New Hampshire Avenue Route scored well on both land and marine installation criteria and was superior to all other routes for environmental criteria (id.).[47] It stated that the Mashpee Town Landing Route scored well on land installation criteria, scored second highest on environmental criteria, and had the lowest estimated cost of the six routes; however, it scored on the lower end for marine installation criteria, due to necessary work under and within Popponesset Bay (id.).

b. Positions of the Parties

Two intervenors – Mass Audubon and Save Popponesset Bay – argued that the Company's site selection process understates the environmental impacts associated with construction in and through the Popponesset Bay area, and that the record would not justify the approval of the Company's noticed alternative route, the Mashpee Town Landing Route. The intervenors' arguments and the Company's response are summarized below.

i. Mass Audubon

Mass Audubon stated that it participated in this proceeding to protect the environmental interests affected by the alternative route through Popponesset Beach and Popponesset Bay (Audubon Brief at 1). It argued that the Company's analysis does not justify approval of this route, and notes that because the primary route is clearly superior, there should be no need to use the alternative route (id.). However, Mass Audubon argued that, if the Siting Board were to approve the alternative route, it should impose a condition requiring Cape Wind to "negotiate with the Massachusetts Audubon Society a mutually acceptable easement for construction, placement, and use of the proposed transmission line beneath Popponesset Spit" (id. at 28).

Mass Audubon noted that the Siting Board's standard of review requires an applicant to establish "that it developed and applied a reasonable set of criteria for identifying and evaluating

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[47] However, Table 4-3 of the Petition, and Table 2, above, show that the New Hampshire Avenue and the Mashpee Town Landing Routes were scored equally for environmental criteria (Exh. CW-1, at Table 4-3).

alternative sites . . .” (citing CELCo, 12 DOMSB 305, at 327). Mass Audubon asserted that route selection standards should capture all environmental, cost and reliability features of the various alternatives, based upon a reasonable evaluation of available and relevant information (Audubon Brief at 14).

Mass Audubon further asserted that the Company’s consideration of environmental impacts in the site selection process was unreasonable and incomplete (id. at 14). Mass Audubon argued that, out of a total of 26 site selection criteria, only four applied to the installation of the submarine cable, and there was only one environmental criterion for the marine portion of the cable (id.; Tr. 2, at 218-219). Mass Audubon noted that for projects with far fewer marine impacts, companies have in the past used criteria based upon wetland/saltmarsh crossings, shellfish bed/tideland crossings, crossings of ACECs, and use of preferred waterway techniques (Audubon Brief at 15 citing 1998 NEPCo Decision, 7 DOMSB 333, at 374). Mass Audubon asserted that Cape Wind inappropriately limited the number of marine criteria based on its belief that the routes were essentially equivalent at the screening level for these criteria (id.). Mass Audubon noted that the Company used numerous marine criteria to distinguish between the primary and alternative routes when comparing noticed routes; it argued that these criteria cannot therefore rationally be said to be essentially equivalent (id.).

Mass Audubon stated the following factors associated with the marine portion of the route either were not included, or were insufficiently addressed, at the screening stage of the site selection process: (1) impacts on rare and endangered marine species and habitat; (2) impacts on finfish resources and habitat; (3) benthic and shellfish impacts; (4) impacts on wetland resources; (5) presence of underwater archeological resources; (6) differences in sediment characteristics; (7) number of HDD operations, in terms of both cost and the potential marine impacts; and (8) project cost (id. at 17-26).

Specifically, Mass Audubon argued that Cape Wind included rare and endangered plant and animal species and habitats as a criterion for the land portion of the route, but not the marine portion (Audubon Brief at 17). Therefore, Mass Audubon asserted, serious impacts on birds, and the associated impact on the project’s construction schedule at Popponesset Bay, were not considered in site selection (id. at 18). Mass Audubon stated that the site selection criteria do not

account for the differences in impacts on anadromous fish runs, with respect to either the number of fish runs or the presence of physical constraints upon the fishes' ability to avoid impacts (id. at 10). Mass Audubon pointed out that Popponesset Bay has two mapped anadromous fish runs that coincide with the noticed Alternative Route (Exhs. CP-1, at 5-19; EFSB-W-3(B); Audubon Brief at 9). Mass Audubon noted that sediment characteristics were not reflected in the site selection criteria, in terms of either sediment metal concentrations or grain size (Audubon Brief at 11, 12). Mass Audubon explained that sediment characteristics can affect suspension times associated with sediment displacement during marine construction, and that longer suspension times result in greater impacts upon shellfish and other benthic organisms (id. at 12 -13; Exh. EFSB-RR-43). Mass Audubon pointed to Cape Wind's data indicating that the Popponesset Bay routes have twice the benthic abundance as one or more of the alternatives and have a recreational shellfish area and two privately licensed shellfish grants, and argued that impacts to shellfishing areas would be more difficult to avoid in Popponesset Bay than along other routes (Audubon Brief at 22).

Further, Mass Audubon stated that Cape Wind did not include Popponesset Spit as a jurisdictional wetland resource (barrier beach), nor did it identify the Popponesset Bay alternatives as involving an additional coastal resource, the barrier beach (id. at 22). Mass Audubon asserted that the Company failed to account for the added marine impacts of multiple HDD operations, for the additional construction time needed for work in Popponesset Bay, or for the cost of potential seasonal restrictions on construction (id. at 25). Finally, Mass Audubon asserted that, because the cost of Alternatives 2, 3, and 4 are within 1.2% of each other, the three routes should have been scored as essentially equivalent in cost (id. at 26).

ii. Save Popponesset Bay

Save Popponesset Bay asserted that Cape Wind did not consider the status of Popponesset Spit as a barrier beach in the site selection process (SPB Brief at 2). Save Popponesset Bay argued that the Company incorrectly estimated the true costs of installing the cable along Alternative Routes 2 and 3 by ignoring the slower rates of installation within Popponesset Bay, the cost of mitigating adverse impacts, and the costs resulting from potential

time of year restrictions (id. at 6). Save Popponesset Bay noted that Popponesset Bay is a designated shellfish growing area, and that the costs of shellfish mitigation work for Alternatives 2 and 3 were not included in the analysis (id.). Save Popponesset Bay pointed out that the Company has not done any subsurface testing on Popponesset Spit to determine whether HDD will work as described (id. at 12). Save Popponesset Bay also stated that Cape Wind did not consider the possible effects of open trenching across Popponesset Spit, which the Company reserved the right to carry out as a last resort (id. at 2, 12).

iii. Company Response

Cape Wind argued that its site selection process meets the Siting Board's standard of review, in that: (1) the Company developed and applied a reasonable set of criteria to identify and evaluate potential routes for the transmission project; (2) the process ensured that Cape Wind did not overlook or eliminate any routes that are clearly superior to the primary route; and (3) Cape Wind noticed two routes that are geographically diverse (Company Reply Brief at 48). The Company suggested that Mass Audubon is arguing that the same level of information should be required for all routes considered in the route selection process; it contends that such a requirement would be impractical, unworkable, and at odds with the practices required by the Siting Board (id. at 49).

The Company argued that the Mass Audubon and Save Popponesset Bay complaints "lie with the reasonable exercise of discretion and judgment by Cape Wind's experts" in the selection of the noticed alternative route (id. at 50-51). The Company defended certain rankings challenged by Mass Audubon or Save Popponesset Bay, arguing, for example, that it was appropriate to consider Lewis Bay and Popponesset Bay as essentially similar with regard to metals in sediments, since the level of metals in both bays were below the ranges in which adverse biological impacts are observed (id.). The Company argued that the appropriate question is not whether other parties agree with its rankings, but whether its experts exercised reasonable judgment in ranking the routes (id. at 52).

The Company also disputed Mass Audubon and Save Popponesset Bay arguments regarding descriptions of its site selection process, suggesting that these parties confused:

(1) the siting criteria, used to identify the six routes; (2) the screening criteria, used to evaluate the six routes and select the primary and alternative routes; and (3) the process of comparing the impacts of the primary and noticed alternative routes (id. at 52). The Company stated that it used 14 siting criteria, of which seven focused on considerations for the submarine cable route and landfall, and 26 screening criteria, of which six involved specific marine considerations (Company Reply Brief at 54). The Company therefore concluded that, overall, it applied 13 marine-based criteria in its route selection process, not just four as stated by Mass Audubon (id.).

c. Analysis

To identify route options for further evaluation, the Company first identified an area that would encompass all viable routing options given the limitations imposed by the location of the ESP and the Barnstable Switching Station. The Company used 14 site identification criteria, which it referred to as siting criteria, to identify six potential routes within this area. It then used 26 screening criteria, including installation, environmental, cost and reliability factors, to evaluate these six routing alternatives. The Company weighted the importance of each criterion as low, medium and high, and for each of the identified alternatives, multiplied the unweighted assigned scores for the 26 criteria by the weights to produce weighted scores. The Company used the weighted scores to balance the environmental impacts, technical issues, costs and reliability of the six routing alternatives.

In past decisions, the Siting Board has found various types of criteria to be appropriate for identifying and evaluating route options for transmission lines and related facilities. These types of criteria include natural resource issues, land use issues, community impact issues, cost and reliability. CELCo Decision, 12 DOMSB 305, at 331; 1998 NEPCo Decision, 7 DOMSB 333, at 381; New England Power Company, 4 DOMSB 109, at 167 (1995) ("1995 NEPCo Decision"). The Siting Board also has found the specific design of scoring and weighting methods for chosen criteria to be an important part of an appropriate site selection process, and in some cases has identified the appropriate allocation of weights among the broad categories of environmental

concerns, cost and reliability.[48] CELCo Decision, 12 DOMSB 305, at 331; 1997 BECo Decision, 6 DOMSB 208, at 285; Boston Edison Company, 19 DOMSC 1, at 38-42 (1989).

Here, the Company developed 14 siting criteria, which it used to identify potential routes, and 26 screening criteria, which it used to evaluate the routing options. These criteria generally encompass the types of criteria that the Siting Board previously has found to be acceptable. The Company also developed a quantitative system for ranking routes based on compilation of weighted scores across all criteria; this is a type of evaluation approach the Siting Board previously has found to be acceptable.

However, questions have been raised about whether certain categories of environmental criteria, including marine impacts from underwater cable installation and visual impacts of overhead construction, were under-represented in the Company's site selection process. As a related matter, the Company also has been asked about the merits of other possible routes, which might have been preferred if marine and visual impacts had been given greater weight. The Siting Board addresses these questions below.

As an initial matter, the Siting Board notes that it requires applicants to analyze the primary route in greater detail than the alternative route, and to analyze both the primary and alternative routes in far greater detail than the routes which are discarded as a result of the site selection process. Thus, a disparity in the level of detail available in the record on the different routes does not indicate a flaw in the site selection process. However, the site selection analysis must be detailed enough to capture any significant differences between the route options, and the criteria used to evaluate the various route options must be carefully selected and weighted to ensure that an unintended bias does not lead the applicant to overlook or eliminate superior routes.

Mass Audubon and Save Popponesset Bay argue that the 26 screening criteria did not sufficiently address the environmental impacts associated with the marine portion of the routes;

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[48] For example, the CELCo Decision, 12 DOMSB 305, at 331, the Company used weighted scores to balance the community/environmental impacts, technical issues and costs, and the Siting Board stated that the allocation of approximately half of the overall weight to community/ environmental and half to technical/cost was reasonable.

they therefore conclude that the development of the screening criteria was unreasonable and incomplete. They assert that the following specific areas should have been included or addressed in more depth: rare and endangered marine species and habitat; finfish resources and habitat; benthic and shellfish habitat; wetland resources; archeological resources; sediment characteristics; costs and impacts of multiple HDD operations; and costs. The Company counters that the routes were deemed to be essentially equivalent for certain of these criteria, and that other criteria were appropriately analyzed. In addition, it notes that a total of 13 marine-related criteria were used in the Company's analysis, when both the siting and screening criteria are taken into account.

Regarding the Company's argument that a total of 13 marine-related criteria were applied, the Siting Board notes that it is not appropriate to point to a combination of the siting and screening criteria, as they each address one iteration of the siting process, and therefore should be assessed separately. Mass Audubon and Save Popponesset Bay have not challenged the Company's choice of siting criteria; instead, their critique focuses on the screening criteria used to evaluate, score and rank the six routes. In its quantitative screening analysis, the Company used four marine-based criteria – marine transmission line length, number of marine HDDs, navigational impacts, and eelgrass – which together accounted for 21% of the total weight for screening criteria.[49] The Company asserted that it qualitatively considered two other marine-based criteria – fish runs and shellfish – but did not incorporate them into the quantitative analysis, as it considered the impacts to be equivalent along all routes. The Siting Board notes that the inclusion of these two criteria in the quantitative analysis would have increased the weight given to marine criteria, but not altered the Company-generated ranking of the six routes, given the Company's qualitative opinion of the two criteria. The Siting Board urges future applicants to include all important criteria in any quantitative ranking of potential routes, in order to eliminate confusion about the decision-making process.

The record indicates that the Company considered, in greater or lesser detail, six marine-

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[49] The total weight of all the screening criteria is 52, of which the discrete marine transmission criteria account for 21%, compared to 73% for land-based criteria, 4% for cost, and 2% for reliability.

related criteria in ranking the six routes, although only four were formally quantified. Of these four, only one (eelgrass) was classified as "environmental," although two others – HDD and navigational impacts – represent environmental criteria for which project impacts appeared significant and necessary mitigation potentially costly. However, even assuming that the Company were correct in treating the impacts of fish runs and shellfish as equivalent along all routes, the Company's analysis appears to be missing certain criteria that would help distinguish the level of environmental impacts and construction difficulties associated with the different landfalls. Specifically, the review of endangered species appears to have been limited to species along the land portion of the route, leading the Company to overlook impacts to the piping plover; and there was no recognition of the status of Popponesset Spit as a barrier beach. In short, the Company's screening criteria addressed the costs and impacts of on-land construction in greater detail than the costs and impacts of construction under water or at the landfall; this disparity may have led the Company to overlook screening-level differences between routes using the Lewis Bay and Popponesset Bay landfalls.

With respect to visual impacts, the record shows that three routes, including the Mashpee Town Landing Alternative, would require extensive tree clearing along an approximately eight-mile segment of the NSTAR ROW through a largely built-up area, significantly increasing the visibility of existing and any new transmission lines that occupy the ROW. The Company maintained that the overhead segment of each route would be located where there are existing overhead transmission facilities, and that the tree/vegetation removal criterion was a suitable proxy for visual impacts along the NSTAR ROW. Given that the visual impacts of overhead construction would be a long-term issue affecting half or more of the on-land portion of the three routes, it is unclear that the issue was adequately represented by one criterion[50] encompassing a range of issues of which visual impacts was one, and which accounted for only 1 of 13 environmental and 26 total criteria, in the screening analysis. Further, by relying on tree removal as the sole indicator of visual impacts along the NSTAR ROW, the Company failed to take into account other factors relating to visual impact sensitivity, such as the residential density of

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[50] As indicated in n.45, above, the shade tree criterion was applied to the in-street portion of the route, not the NSTAR ROW.

affected areas, potential visibility from different directions, and potential visibility of the new substation facilities. In recent Siting Board cases concerning transmission lines with overhead construction options, two companies included visual impacts specifically, and several companies included residential density and other visual sensitivity indicators, as discrete environmental/land use criteria for selecting routes. ANP Blackstone Energy Company, 8 DOMSB 1, at 216-217 (1999) ("ANP Blackstone"); 1997 BECo Decision, 6 DOMSB at 208, 278; New England Power Company, 5 DOMSB 1, at 44-47 (1996); 1995 NEPCo Decision, 4 DOMSB 109, at 163-166.

Overall, the record indicates that the Company's choice of screening criteria may not have captured fully (1) the screening-level differences between the costs and impacts of the Lewis Bay and Popponesset Bay landfalls, and (2) the potential visual impacts associated with overhead lines. The Siting Board notes that the Company's primary route uses the lower-impact Lewis Bay landfall, and has no overhead component. The parties do not claim, and the record does not indicate, that the Company erred in selecting the primary route as the first choice among its identified routes. Similarly, the Company's consideration of additional possible routes identified by staff provided no indication that the Company may have overlooked a route that would be superior to the primary route. Accordingly, the Siting Board finds that the Company has developed and applied a reasonable set of criteria for identifying and evaluating alternative routes in a manner which ensures that it has not overlooked or eliminated any routes which are clearly superior to the proposed project.

However, the Siting Board notes that the issues raised about the Company's site selection process were significant to the Company's ranking of the Mashpee Town Landing Route, which resulted in its selection as the noticed alternative route. The identified shortcomings in the site selection process call into question the merit of the alternative route as a fallback to the primary route. The Siting Board notes that, if the Company were to abandon its primary route and seek approval of the alternative route, it might have difficulty demonstrating that it had not overlooked a clearly superior route without significant further analysis.

3. Geographic Diversity

The Company stated that its site selection process resulted in a spectrum of alternative routes that reflects an appropriate degree of geographical diversity (Exh. CW-1, at 4-32). The Company stated that the primary and alternative routes are geographically diverse, noting that the primary route makes landfall in Yarmouth and traverses Barnstable, while the alternative route makes landfall nearly 10 miles away in Mashpee (Company Reply Brief at 48).

The Company considered six geographically diverse transmission line routes to connect the wind farm with the Barnstable Switching Station. Consequently, the Siting Board finds that the Company has identified a range of practical route alternatives with some measure of geographic diversity.

4. Conclusions on the Site Selection Process

The Siting Board has found that the Company has developed and applied a reasonable set of criteria for identifying and evaluating alternative routes in a manner which ensures that it has not overlooked or eliminated any routes which are clearly superior to the proposed project. In addition, the Siting Board has found that the Company has identified a range of practical transmission line routes with some measure of geographic diversity. Consequently, the Siting Board finds that the Company has demonstrated that it examined a reasonable range of practical siting alternatives.

B. Description of the Primary and Alternative Routes

The proposed project along the primary route would be an approximately 18.1-mile transmission line connecting at one end to the ESP of the wind farm and at the other end to the Barnstable Switching Station, located off Mary Dunn Road (Exhs. CW-1, at 1-1; EFSB-RR-84). The primary route would begin in Nantucket Sound, in the area of Horseshoe Shoal, pass to the west of underwater ledges known as Bishop and Clerks, proceed northerly across WSW Ledge, turn northeast at a point west of Great Island, follow near the east edge of the Hyannis ship channel past the Egg Island sandbar, then turn east-northeast across Lewis Bay to a landfall at New Hampshire Avenue in Yarmouth (Exhs. CW-1, at 1-11; EFSB-5(b)).

At the landfall, the primary route would connect with a 115 kV transmission line at an underground transition vault located on New Hampshire Avenue approximately 10 feet south of Shore Road; from there it would proceed in a single underground in-street ductbank for approximately 4 miles to the existing NSTAR ROW at Willow Street in Yarmouth (Exhs. CW-1, at 1-4; CO-3; EFSB-RR-14; Tr. 6, at 755).[51] The in-street route would follow New Hampshire Avenue northward, merging with Berry Avenue, continuing across Route 28 and north on Higgins Crowell Road (Exh. CW-1, at 1-12). The route then would continue north on Willow Street, passing under Route 6, to an intersection with the existing NSTAR 115 kV line north of Summer Street (id.). The route would then proceed underground along NSTAR's ROW, at a depth of 32 inches for approximately 1.9 miles to the Barnstable Switching Station, crossing again under Route 6 (id. at 1-10 and 1-12).[52]

The alternative route would run approximately 24.2 miles from the ESP to the Barnstable Switching Station, with an intermediate connection point at NSTAR's Mashpee Substation (Exh. CW-1, at 1-12 to 1-13). The alternative route would begin in Horseshoe Shoal, traveling in Nantucket Sound to Popponesset Spit at the entrance of Popponesset Bay (id. at 1-12, 4-8). The alternative route would cross under Popponesset Spit via an approximately 1000-foot HDD to avoid impacts to the barrier beach (id. at 4-8; Exh. MA-32). The alternative route would then continue through Popponesset Bay to a landfall at the Mashpee Town Landing (Exh. CW-1, at 1-13).

The Company stated that the alternative route would make landfall via a second HDD, connect with a 115 kV transmission line in an underground transition vault, and then proceed in a single underground in-street ductbank for approximately 1.9 miles to the existing NSTAR ROW off Orchard Road (id. at 1-4). From the transition vault, the alternative route would follow Mashpee Neck Road north to Orchard Road, then turn onto a proposed street located off Orchard Road and follow it to NSTAR's Mashpee Substation, a 115 kV substation located on an

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[51] The ductbank would be approximately 5 feet, 8 inches wide by 2 feet deep and would be buried approximately 64 inches in-street (Exh. CW-1, at 1-10).

[52] The 1.9-mile portion of the NSTAR ROW begins in Yarmouth and enters Barnstable approximately 1,000 feet in from Willow Road (Exh. EFSB-2, Att. 2-e).

NSTAR-owned 10.6-acre parcel at the intersection of Orchard Road and Route 28 (id. at 4-10). At the Mashpee Substation, a new riser station would be built in an approximately 50 by 100 foot area within the site (id.).[53] The alternative route would then travel easterly for 12.3 miles overhead along the NSTAR ROW from the Mashpee Substation to the Barnstable Switching Station, crossing numerous roads including Main Street, Route 28, Route 149, Osterville-West Barnstable Road, Old Stage Road, Shootflying Hill Road, Route 132 and Phinney's Lane, and would terminate at the Barnstable Switching Station off Mary Dunn Road (id.; Exh. EFSB-L-28).

C. Environmental Impacts, Cost and Reliability of the Proposed and Alternative Facilities

1. Standard of Review

In implementing its statutory mandate to ensure a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost, the Siting Board requires a petitioner to show that its proposed facility is sited at a location that minimizes costs and environmental impacts while ensuring a reliable energy supply. To determine whether such a showing is made, the Siting Board requires a petitioner to demonstrate that the proposed site for the facility is superior to the noticed alternatives on the basis of balancing cost, environmental impact, and reliability of supply. CELCo Decision, 12 DOMSB 305, at 334; MMWEC Decision, 12 DOMSB 1, at 127; 1997 BECo Decision, 6 DOMSB 208, at 287.

An assessment of all impacts of a proposed facility is necessary to determine whether an appropriate balance is achieved both among conflicting environmental concerns as well as among environmental impacts, cost, and reliability. A facility which achieves that appropriate balance thereby meets the Siting Board's statutory requirement to minimize environmental impacts at the lowest possible cost. CELCo Decision, 12 DOMSB 305, at 335; MMWEC Decision, 12 DOMSB 1, at 128; 1997 BECo Decision, 6 DOMSB 208, at 287.

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[53] The riser station would include a new ring bus, consisting of five new circuit breakers, providing connections to NSTAR's existing Line 115 (Exh. CW-1, at 1-13 and 1-14).

The Siting Board recognizes that an evaluation of the environmental, cost and reliability trade-offs associated with a particular proposal must be clearly described and consistently applied from one case to the next. Therefore, in order to determine if a petitioner has achieved the proper balance among various environmental impacts and among environmental impacts, cost and reliability, the Siting Board must first determine if the petitioner has provided sufficient information regarding environmental impacts and potential mitigation measures to enable the Siting Board to make such a determination. The Siting Board then can determine whether environmental impacts would be minimized. Similarly, the Siting Board must find that the petitioner has provided sufficient cost and reliability information in order to determine if the appropriate balance among environmental impacts, cost, and reliability would be achieved. CELCo Decision, 12 DOMSB 305, at 336; MMWEC Decision, 12 DOMSB 1, at 128; Commonwealth Electric Company, 5 DOMSB 273, at 337 (1997) ("ComElec Decision").

Accordingly, in the sections below, the Siting Board examines the environmental impacts, reliability, and cost of the proposed facilities along Cape Wind's and NSTAR's primary and alternative routes to determine: (1) whether environmental impacts would be minimized; and (2) whether an appropriate balance would be achieved among conflicting environmental impacts as well as among environmental impacts, cost and reliability. In this examination, the Siting Board compares the primary and alternative routes to determine which is superior with respect to providing a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost.

2. Environmental Impacts

a. Marine Construction Impacts

In this section, the Siting Board reviews the environmental impacts associated with installing the proposed underwater transmission lines seaward of the seawall at New Hampshire Avenue, for the primary route, and seaward of the landfall in Mashpee, for the alternative route.

i. Construction Techniques

The Company stated that it would use jet-plowing as the primary means of installation for the submarine transmission cables (Exh. EFSB-C-3). The Company described jet-plowing as the installation and burial of submarine cables using a jet plow blade mounted on two skids that can serve as pontoons by adjustment of their buoyancy (id.; Tr. 7, at 940). The jet plow has no propulsion of its own, but is towed along the seabed by a cable-laying barge, generally within 50 feet of the designated centerline (Exh. EFSB-C-3; Tr. 7, at 913-914). In deeper water, the cable-laying barge progresses forward by winching itself toward anchors placed ahead of it by anchor-handling tugs (Exh. MA-10; Tr. 7, at 943-944). The Company stated that the blade of the jet plow is fitted with nozzles that release a total of 2500 to 9000 gallons of seawater per minute at velocities of 143 to 235 feet per second (Exh. EFSB-RR-41). As the jet plow is towed along the seabed, the blade cuts a continuous trench by fluidizing the sediments in the trench to a predetermined depth (Exh. EFSB-C-3; Tr. 7, at 936-937). The Company stated that there are no indications of shallow bedrock beneath the seafloor sediments, and that the entire route is suitable for jet-plowing (Exhs. EFSB-W-11; CW-CJN/SBW-2-R at 13; Tr. 8, at 1066-76).[54] The Company indicated that, as the trench is formed by the jet plow, cable is fed from a turntable on the barge and settles into the trench under its own weight (Exh. EFSB-C-3). Depth of burial is controlled by the depth of the jetting blade (Exh. MA-6). The Company stated that the sediment temporarily suspended by the pressurized seawater then resettles, burying the cable to depth (id.; Exh. EFSB-RR-44).

The Company indicated that near the shore, it would use anchors and spuds to station the cable-laying barge and would use either a smaller jet plow or the same jet plow tended by a smaller barge to carry the hydraulic pumps (Exh. MA-10; Tr. 7, at 943-944, 952). The Company stated that the construction equipment would be diesel powered and that it expected no refueling of vessels within the job site (Exhs. MA-40; MA-42; Tr. 2, at 318). The Company stated that the tugboats that would be used are standard for the region (Exh. MA-42).

The Company explained that the jet-plowing process would be conducted twice, to create

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[54] The Company stated that the existing cable from Harwich to Nantucket was installed by jet plow to the same depth as the proposed transmission line (Exh. EFSB-W-11).

two trenches, one for each cable circuit (Exh. MA-6). The Company stated that the cables would be buried at a depth of 6 to 8 feet below the seabed, and that the two trenches would be spaced approximately 20 feet apart (Exhs. CW-1, at 1-8, Fig. 7; MA-4).

The Company stated that it would use hand jet-plowing and direct trenching to install cable in inshore areas of the primary route (Tr. 7, at 882-884). Direct trenching would be used for the first 40 feet from the seawall, and hand-jetting would be used the next 50 feet (Exhs. EFSB-RR-38; EFSB-RR-39). Hand jets fluidize sediments to allow the cable to descend to a depth within the seabottom, like ordinary jet-plowing, but the jets are hand carried (Tr. 7, at 951). Also on the primary route, the Company stated that installation of the cables at the landfall would require the excavation of an area at the foot of the existing seawall, construction of a temporary cofferdam, and replacement of the seawall (Exh. CW-CO-3; Tr. 17, at 2218-19).

On the alternative route, the Company specified the use of HDDs at two locations – at the landfall, and underneath Popponesset Spit. The Company indicated that at each HDD location there would be four separate holes drilled from the entrance point, each involving boring a pilot hole, reaming out the pilot hole, pulling 12-inch diameter plastic conduit back through the borehole, and then pulling transmission cable through the conduit (Exh. CW-1, at 1-8; Tr. 2, at 775; Tr. 7, at 866-869). Before the conduit is installed, the hole would be maintained by keeping it pressurized with bentonite (Tr. 7, at 869). The Company explained it would excavate a pit at the exit point, prior to boring the HDDs, in order to receive the borehole beneath the seabottom, and to transition to jet-plowing (Exh. CW-1, at 1-8).

The Company stated that the HDD under Popponesset Spit would consist of four 1000-foot long boreholes extending approximately 60 feet below the mean low water elevation (Exh. EFSB-C-2(B), Att.; Tr. 20, at 2742). The Company stated that the Popponesset Spit boreholes would be staged from barges positioned in sub-tidal areas off the spit, with the entrance point approximately 300 feet into Nantucket Sound and the exit point approximately 300 feet into Popponesset Bay (Exhs. EFSB-C-1; EFSB-W-16; SPB-3; MA-28; Tr. 2, at 261; Tr. 7, at 860; Tr. 8, at 1026). A 45-foot by 63-foot area around the entrance point would be isolated by a cofferdam (Exh. EFSB-RR-37). The Company stated that if the Popponesset Spit HDDs were to prove unsuccessful, another site on the spit would be tried (Exh. EFSB-C-5). The

Company stated that it would consider jacking or open-cut trenching as a last resort (id.; Tr. 9, at 1244).[55] However, the Company indicated this was unlikely, asserting that the sand and clays underlaying Popponesset Spit are conducive to successful drilling (Exh. MA-54).

The Company stated that, inside Popponesset Bay, it would use floats and shallow draft boats to position the cables prior to jet-plowing, and indicated that the cable-laying barge would not enter Popponesset Bay (Exh. CW-CJN/SBW-2-R at 38; Tr. 9, at 1171). The Company stated that it would also bore an approximately 500-foot long HDD from the entrance point at an upland location at the Mashpee Town Landing landfall to an exit point out on the subtidal area of Popponesset Bay (Exhs. CW-1, at 1-13; EFSB-W-18).

The Company stated that the transitions on the alternative route between jet-plowing and HDDs would be located approximately 300 feet south of Popponesset Spit, 300 feet north of Popponesset Spit, and 500 feet off the landfall location in Mashpee; no transition vaults or other permanent structure would remain, other than the cables themselves (Exhs. CW-1, at 1-13; MA-28). The Company stated that a splice of the cable might be necessary on the alternative route because the length of cable that can be pulled through the HDD conduit may be limited (id.).

The Company stated it would prefer to install the submarine cables April through November to avoid safety concerns associated with unfavorable winter sea and weather conditions (Exhs. EFSB-C-1; EFSB-C-7; EFSB-W-7; CW-CJN/SBW-2-R at 13; EFSB-RR-47). The Company stated that jet plowing would take approximately two to four weeks for each circuit; with an additional two weeks for preparatory work, marine work on the primary route would extend up to ten weeks (Tr. 21, at 2871-76). The Company stated that HDD operations would take two to four weeks, extending marine work on the alternative route to as much as 14 weeks (id.).[56] For both the primary and alternative routes, there would be an additional four

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[55] The Company stated that if jacking or open-cut trenching were used at Popponesset Spit, the Company would restore the spit to its pre-existing condition (Exhs. EFSB-C-5; CW-1, at 1-8).

[56] The Company provided a variety of estimates for the duration of marine construction. At (continued...)

weeks of land-based work in and around the transition vault (id.).

ii. Direct Impacts (Sand and Sediment Disturbance)

(a) Primary Route

The Company stated that jet plowing along the primary route would begin at a point approximately 40 feet seaward of the New Hampshire Avenue landfall and continue seaward through Lewis Bay to the wind farm's ESP, for a distance of approximately 12.2 miles (Exhs. MA-6; CW-CJN/SBW-2-R at 20; EFSB-RR-38; EFSB-RR-84). The Company stated that the seabed along the primary route, including Lewis Bay up to the New Hampshire Avenue landfall, consists predominantly of sand-sized sediment (Tr. 6, at 780). The Company asserted that jet-plowing is a standard method of cable installation where environmental impacts are of concern (Exh. CW-CJN/SBW-2-R at 24; Tr. 7, at 876).

The Company indicated that the surface area directly disturbed by the jet plow as it moves along the seabed is approximately 12 square feet for each foot of cable laid (Exh. EFSB-RR-44). The Company calculated that jet-plowing along the primary route would disturb up to 18 acres of seabed sediment, that the pontoons supporting the jet plow would disturb an additional 18 acres, and that anchoring, positioning and movement of the cable installation barge would disturb approximately 4 acres (Exhs. EFSB-SS-22-S at 5-41; CW-CJN/SBW-2-R at 21). The Company estimated that direct disturbance of seabed sediment would thus encompass up to 40 acres (Exh. EFSB-SS-22-S at 5-42). In addition, the Company estimated that 59 cubic yards of material would be excavated in connection with replacement of the seawall, and 44 cubic yards would be disturbed by hand-jetting (Exh. EFSB-RR-39).

The Company indicated that the trench created by the jet plow would be trapezoidal in cross-section, narrowing from a width of 4 to 6 feet at the seabottom to a width of 2 feet at a depth of 8 feet (Exhs. MA-6; EFSB-RR-44). The Company asserted that using a jet plow is a

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[56] (...continued)
one extreme, the Company stated that construction from the landfall to the ESP would take two to four weeks (Tr. 9, at 1175). For the alternative route, the Company stated at one time that each HDD would take four to six weeks and that they would be done sequentially (Tr. 10, at 1328).

mitigation measure, arguing that jet-plowing disturbs sediment less than mechanical or hydraulic dredging followed by laying of cable and backfilling a trench (Exh. MA-45; Tr. 5, at 788). The Company asserted that the fluidized sediments would remain largely in the trench (Exh. MA-6). The Company indicated that approximately 70% of the suspended sediment would remain within the trenches and that approximately 30% would be distributed vertically in the water column (Exh. EFSB-RR-43(a), Att.). The Company indicated that this would constitute approximately 0.36 cubic yards of suspended sediment injected into the water column for each foot of jet-plowing (Exh. MA-6). The sediment would remain suspended for a period ranging from a few minutes to 48 hours (Exhs. EFSB-SS-22-S at 5-40; EFSB-W-10; EFSB-RR-43(a), Att.).

The Company modeled lateral dispersion of sandy sediments for a scenario of a 0.4-knot current running 45 degrees off the alignment of a jet-plowed trench (Exh. EFSB-RR-43(a), Att.). The Company's modeling showed sediment deposition exceeding 2 centimeters ("cm") would be limited to areas within 30 feet of the jet plow, and deposition exceeding 1 millimeter ("mm") would be limited to areas within 150 feet (id.). The modeling indicates that the maximum concentration of suspended sediment in the water above sandy seabed such as in Lewis Bay would be approximately 120 milligrams per liter ("mg/L"), directly above the trenches, and would be less than 10 mg/L at 1500 feet from the trench (id.).

The Company indicated by comparison that commercial fishing nets may extend as wide as 200 feet, leading to extensive seafloor disturbance and injection of sediment into the water column; the Company asserted that fishing impacts are significant because the activity is recurring (Exh. EFSB-RR-44, at 3, 4; EFSB-RR-44(a), Att). The Company also indicated that waves and currents may typically create near-bottom suspended sediment concentrations of 70 mg/L, and indicated further that suspended sediment concentrations of up to 2500 mg/L in the near-bottom waters of the project area have been reported (Exhs. EFSB-RR-44, at 4; EFSB-SS-22-S at 5-40).[57]

The Company stated that it performed bulk sediment chemical analyses on samples collected in Nantucket Sound and Lewis Bay (Exh. EFSB-W-14). The Company stated that the

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[57] The Company stated that some of the route goes through fields of migratory sand waves 3 to 5 feet high (Tr. 7, at 931-935).

concentrations of the detected constituents are below federally recognized marine sediment benchmarks of the potential for biological effects (id.).[58] Therefore, the Company asserted that biological effects from metals in sediments would not be likely on the primary route (Exh. CW-CJN/SBW-2-R at 41).

The Company stated that construction of the proposed project along the primary route would result in temporary alterations to areas subject to protection under the Massachusetts Wetlands Protection Act, the Barnstable Wetlands Protection Ordinance, and the Yarmouth Wetlands Protection By-Laws and Regulations (Exh. YAR-7). The Company noted that the primary route traverses Land Under the Ocean, a jurisdictional coastal wetland resource area (Exh. CW-1, at 5-30 to 5-31). Overall, the Company indicated that temporary impacts to Land Under the Ocean would affect between 4.2 and 6.1 acres (Exh. EFSB-W-19).

Another category of jurisdictional wetland is Coastal Beach, which extends from the mean low water line landward to the coastal bank line or seaward edge of existing manmade structures (Exh. EFSB-SS-22-S, Att. at 5-50 to 5-51). The Company noted that here, the Coastal Beach is the gently sloping, sandy area extending from the mean low water mark to the concrete seawall that comprises Coastal Bank at the New Hampshire Avenue landfall (id. at 5-51). The Company indicated that the landfall at New Hampshire Avenue does not have some of the sensitive features of other coastal locations (Tr. 6, at 778). The Yarmouth Wetlands Protection Regulations prohibit new structures within 50 feet of Coastal Bank or Coastal Beach (Exh. EFSB-W-28). However, the Company stated that the proposed transmission line and vaults most likely do not qualify as structures under the local definition because they are components of a linear project that cannot avoid the resource areas and the 50-foot wetland

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[58] The single shallow sediment sample from Lewis Bay, VC01-L1-S1 (from zero to five feet below the surface) had reported concentrations of 3.4 milligrams arsenic per kilogram (mg/kg) (compared to a NOAA Effects Range Low ("ERL") of 8.2 mg/kg), 0.16 mg/kg cadmium (compared to an ERL of 1.2 mg/kg), 5.5 mg/kg chromium (compared to an ERL of 81 mg/kg), 2.7 mg/kg copper (compared to an ERL of 34 mg/kg), 2.3 mg/kg lead (compared to an ERL of 46.7 mg/kg), 3.7 mg/kg nickel (compared to an ERL of 20.9), 11 mg/kg vanadium (no ERL), and 8.8 mg/kg zinc (compared to an ERL of 150 mg/kg) (Exh. EFSB-22-S at Fig. 5-16, Table 5-13). This sample had 6250 mg/kg of organic carbon (id.).

buffer setback (id.). The Company indicated that the issue would be more fully explored in the submission of the Notice of Intent to the Yarmouth Conservation Commission (id.).[59]

The Company stated that the proposed construction through certain coastal waterways and tidelands along part of the primary route would require a license under Chapter 91[60] (Exh. EFSB-RR-58, Att.; Tr. 11, at 1580-83). As part of the Chapter 91 licensing process, the Massachusetts Department of Environmental Protection ("MDEP") must determine whether the project is "water-dependent," consistent with its policy regarding infrastructure crossings in 310 CMR § 9.02 (Exh. EFSB-RR-58, Att.). The Company provided correspondence from MDEP indicating that, in this case: (1) a variance will be required for the project under 310 CMR § 9.21, including a determination by MDEP that the project is in the public interest; and (2) the public interest requirement could be satisfied by a finding by the Siting Board that the infrastructure project is needed (id.). MDEP further stated that Cape Wind would need to meet the requirements of 310 CMR § 9.55, including requirements related to alternatives, and noted that such issues would be addressed through the MEPA review process (id.).

The Company stated that its proposed construction in certain coastal waters and lands known as the coastal zone, along the primary route, would require a consistency review under the CZM program[61] (Exh. CW-1, at 1-14 to 1-16). The Company asserted that the proposed transmission lines would be a "coastally dependent" use of the coastal zone, as defined for CZM program purposes, and would be consistent with other applicable CZM policies relating to work in the coastal zone (id. at 1-14 to 1-16, 5-3 to 5-6). The Company explained that the transmission line project would be coastally dependent because it would deliver energy to, from, or within the coastal zone (id. at 1-16). The Company further stated that the proposed marine

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[59] Cape Wind stated that it anticipated that the Notice of Intent would be filed with the Yarmouth and Barnstable Conservation Commissions in the fourth quarter of 2003 (Exh. EFSB-L-20; Tr. 6, at 708). As of this date, the Siting Board has not received the Notice of Intent, nor by association, the subsequent Order of Conditions (Exh. EFSB-RR-33).

[60] See G.L. c. 91, §§ 1-63; 310 CMR § 9.00 et seq.

[61] G.L. c. 21A, § 4A; 301 CMR §§ 20.00 et seq.; 21.00 et seq.

construction of the transmission lines would be consistent with CZM policies relevant to any disturbance of sand and sediment from such construction, including Habitat Policy #1 and Coastal Hazard Policies #1 and #2 (id. at 5-3, 5-6).[62]

Cape Wind stated that the Secretary of Environmental Affairs, in his Certificate on the Company's ENF, has required the Company to develop a comprehensive environmental monitoring program ("CEMP") for the project area (the area including both the wind farm and the transmission lines) (Exh. EFSB-C-19, and Att). The Company provided a preliminary draft of its CEMP (Exh. EFSB-C-19, Att.).[63] The Company indicated that it developed the preliminary CEMP in consultation with cooperating agencies participating in the Army Corps/MEPA review process, and stated that specific elements of the CEMP, such as monitoring methods, locations, frequency, and duration would be finalized at a later time, based on comments received in response to the DEIS/DEIR/DRI for the combined projects (id. at 1).

Cape Wind stated that, once completed, the CEMP would include surveys of both pre-construction and post-construction conditions in the project area and, in some cases, conditions would be monitored during construction (id.).[64] Cape Wind stated that consistent methods and locations would be used for pre-construction and post-construction monitoring, to allow for comparison of pre- and post-construction conditions (id. at 6). The Company stated that the

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62 See 301 CMR § 20.06; 301 CMR § 21.98: Policy Appendix.

63 The preliminary CEMP is dated April 25, 2003.

64 Cape Wind stated that some pre-construction field monitoring and/or literature review regarding resource conditions has already been conducted (Exh. EFSB-C-19, Att. at 1). The Company stated that pre-construction assessments of seabed conditions, sediment quality, noise, benthic invertebrates, sea turtles, marine mammals, submerged aquatic vegetation, shellfish and fisheries, birds, and upland state-listed rare species have been conducted or will be conducted prior to construction (id. at 1-6). The Company further noted that it has installed a Scientific Measurement Devices Station ("SMDS") in the center of Nantucket Sound (id. at 1). Cape Wind stated that the SMDS contains instrumentation that continuously monitors pre-construction meteorological and oceanographic conditions in Nantucket Sound, including wind, waves, wind and wave correlation, currents, air and water temperature, and sea level variations (id. at 1, 2). The Company stated that the SMDS will remain in place for a minimum of five years (id. at 2).

conditions to be included in pre-construction and post-construction monitoring include: seabed conditions, noise, submerged aquatic vegetation, birds, protected marine species, and upland state-listed rare species (id. at 6-8). The Company stated that the type and scope of environmental monitoring to be conducted during construction would depend, in part, on the final route selected, the type of construction methods and equipment to be used, and the construction schedule for the combined projects (id. at 4).

(b) Alternative Route

(i) Company

The Company stated that the alternative route is approximately 10 miles in length from the proposed Mashpee Town Landing landfall to the wind farm ESP (Exh. CW-1, at 1-12). The Company stated that the majority of the cable along the alternative route would be installed by jet-plowing (id. at Fig. 4-3).

The Company asserted that the stability of Popponesset Spit would not be adversely affected because the HDD would be deep below the spit and would not disturb the shoreline or intertidal area (Exhs. MA-33; CW-CJN/SBW-2-R at 29). The Company predicted that the cable would not be exposed, based on its belief that the configuration of Popponesset Spit has been stable for the last 150 years (Tr. 2, at 295).

The Company stated that the seabed in Popponesset Bay along the alternative route consists predominantly of fine-grained, silty sediment (Exh. CW-2, at Fig. 7.2, Table 7.3; Tr. 9, at 1286-1287). The Company modeled lateral sediment dispersion under conditions of a 0.3-knot current running 5 degrees off parallel to the jet-plowed trench (Exh. EFSB-RR-43(a), Att.). The Company's modeling indicated that sediment deposition exceeding 2 cm would be limited to areas within 35 feet of the jet plow in Popponesset Bay and deposition exceeding 1 mm would be limited to areas within 200 feet (id.). The modeling indicates that the maximum concentration of suspended sediment in Popponesset Bay would be approximately 5500 mg/L directly above the trenches (id.). The Company stated that the sediments in Popponesset Bay have a higher organic content and lower dissolved oxygen than sediments on the primary route; consequently, sediment disturbance may be more likely to reduce oxygen levels in surface water

along the alternative route than along the primary route (Exh. EFSB-RR-42; Tr. 8, at 1100-1111).

The Company stated that it performed bulk sediment chemical analyses on samples collected in Popponesset Bay (Exh. EFSB-W-31). The Company stated that the concentrations of the detected constituents are below levels federally recognized as marine sediment benchmarks of the potential for biological effects (id.).[65] Therefore, the Company asserted that metals in sediments on the Popponesset Bay route would likely cause no adverse biological effects (Exh. CW-CJN/SBW-2-R at 41). The Company stated that the alternative route likely has higher sulfide concentrations in sediments than the primary route, and that this might negatively affect organisms should the sediments be disturbed (Tr. 11, at 1574-1575, 1578).

The Company noted that the following jurisdictional coastal wetland resource areas occur at the Mashpee Town Landing landfall and in Popponesset Bay: Land Under the Ocean, Barrier Beach, Coastal Beach, Coastal Dune, and Salt Marsh (Exh. CW-1, at 5-33 to 5-34). The Company asserted that use of HDD at the Mashpee landfall would allow it to avoid impacts to Coastal Beach and Coastal Bank resource areas (id. at 1-12 to 1-13; Tr. 6, at 810-811).

The Company stated that boring beneath Popponesset Spit would avoid any direct impacts to the spit, its shoreline, or the intertidal area and would avoid impacts to wildlife that may nest there (Exhs. EFSB-C-(B), Att; MA-28; MA-32; MA-33). However, construction would likely include digging out HDD receiving pits and stabilizing the pits with cofferdams (Exh. CW-CJN/SBW-2-R at 43).

(ii) Intervenors

Mr. Mark Weissman, a witness for the Alliance, indicated that jet-plowing may cause more turbidity than mechanical plowing in locations of very fine-grained material (Tr. 12,

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[65] Among the two shallow sediment samples from Popponesset Bay, VC01-PB1-S1 and VC01-PB2-S2 (both zero to five feet), the higher reported concentrations were 7.0 mg/kg arsenic (compared to an ERL of 8.2 mg/kg), 0.76 mg/kg cadmium (compared to an ERL of 1.2 mg/kg), 26 mg/kg chromium (compared to an ERL of 81 mg/kg), 11 mg/kg copper (compared to an ERL of 34 mg/kg), 9.5 mg/kg lead (compared to an ERL of 46.7 mg/kg), 17 mg/kg nickel (compared to an ERL of 20.9), 43 mg/kg vanadium (no ERL), and 44 mg/kg zinc (compared to an ERL of 150 mg/kg) (Exh. EFSB-22-S at Fig. 5-16, Table 5-13). These samples had 27,300 and 21,500 mg/kg of organic carbon (id.).

at 1700).

Mr. Stanley M. Humphries, a witness for Mass Audubon, stated that Popponesset Spit, especially its northern end, has historically moved landward and that it is typically expected that barrier beaches will continue to move landward (Tr. 13, at 1773, 1805). However, he indicated that an HDD would have little to no effect on the stability of the spit (id. at 1782). Mr. Humphries recommended that open-cut trenching be considered only as a last resort (id. at 1813).

Mr. Peter J. Williams, P.E., a witness for Save Popponesset Bay, raised questions about the impact of jet-plowing within Popponesset Bay. Mr. Williams stated that Popponesset Spit is a "dynamic and complex barrier island system" and, as such, it is susceptible to breaching by storm surge and waves during severe storms (Exh. SPB-PJW at 7). He stated that a breach at the location of the submarine cable crossing could damage the cable and would require the removal and re-installation of the cable, likely causing significant construction impacts to Popponesset Spit and Popponesset Bay (id.). He provided information generated in 1993 by the Army Corps of Engineers stating that Popponesset Spit has been breached several times in the last 200 years, and asserting that a breach was likely to occur in connection with a storm event within the next 10 years, and possibly within the next 2 to 5 years (id.; Exh. SPB-PJW, Bulk Att.). Mr. Williams stated that information on how the cable alignment will be designed to avoid future barrier island breaches and potential impacts of a cable removal and re-installation should be provided (Exh. SPB-PJW at 7).

The Company responded that the most likely breach location on Popponesset Spit is one-half mile from the alternative route, but that if there were a breach directly over the cables, it would not affect the cables which would be installed deep below the spit (Exh. CW-CJN/SBW-2-R at 32).

Mr. Williams noted that the concentration of metals in bottom sediments is typically two to three times higher in Popponesset Bay than in Lewis Bay, and argued that re-suspension of these sediments has a greater potential for adverse impacts on fish and shellfish than resuspension of sediments in Lewis Bay (Exh. SPB-PJW at 4-5).

(c) Analysis

Jet-plowing would be the predominant construction method for the marine portion of the primary route. Near the landfall at New Hampshire Avenue, construction methods would include hand jetting and direct excavation. Construction along the primary route would require removing and replacing the existing concrete seawall at the end of New Hampshire Avenue. Marine construction impacts, from jet-plowing and direct excavation, would be reviewed by the Yarmouth and Barnstable Conservation Commissions under state and municipal wetlands protection programs, by MDEP under the Chapter 91 program and the Section 401 Water Quality Certification Program,[66] and by the CZM program office.

The record indicates that jet-plowing would inject 0.36 cubic yards of sediment into the water column for each foot of cable installation. With two circuits extending 12.2 miles each, the project would inject approximately 46,800 cubic yards of sediment into the water column.[67] However, jet-plowing has an advantage over alternative methods such as dredging, in that the sediment is disturbed only once in the installation process. The proceeding has not revealed that any other cable embedment technique would have fewer environmental impacts in sandy-bottom open-water areas than jet-plowing. Also, the record shows that the amount of sediment entrainment would be roughly comparable to some commercial fishing and natural processes except that project construction would be of limited duration. The Company has indicated that pre-construction and post-construction monitoring of seabed conditions will be conducted.

Consequently, the Siting Board finds that jet-plowing would minimize the extent of sediment disturbance for deep installation of the submarine cable. Overall, the Siting Board finds that impacts associated with disturbance of marine sediments along the primary route would be minimized.

The record shows that use of jet plowing to install the offshore portion of the proposed

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66 A Section 401 Water Quality Certification is required under the federal Clean Water Act [33 USC §§ 1341 et seq.] for certain activities in wetlands and waters. MDEP implements the Section 401 Water Quality Certification Program in Massachusetts. See 33 USC 1341 et seq.; G.L. c. 21, §§ 26-53; 314 CMR §§ 9.00, 4.00.

67 Hand-jetting near shore would not add appreciably to the estimate of 46,800 cubic yards.

submarine cables would have similar impacts on the seabed along the primary and alternative routes. However, in the near-shore area, the sediment data indicate that Popponesset Bay sediments are finer-grained than sediments in Lewis Bay, and that the Popponesset Bay sediments contain a higher proportion of organic material. The record shows that the finer-grained sediments of Popponesset Bay would be more widely dispersed by jet-plowing than sandier sediments of Lewis Bay. The Siting Board notes that the finer-grained material from Popponesset Bay would likely remain suspended in the water column for a longer period of time as well. The record shows that high concentrations of organic materials in Popponesset Bay sediments could reduce the oxygen content of the water column, if entrained into the waters of the Bay. The Siting Board recognizes that some organisms are sensitive to high turbidity and/or low oxygen levels. Therefore, the risk that disturbing the sediments with a jet plow could adversely affect organisms is higher in Popponesset Bay than in Lewis Bay.

The record shows that sediment disturbed by jet plowing along the alternative route would have higher concentrations of metals. However, it is not clear that the higher measured concentrations in Popponesset Bay reflect anything but finer-grained material in the sample, and it has not been demonstrated that these sediment constituents would pose a risk to marine life.

Use of the alternative route poses a greater risk of adversely affecting water quality. Because there would be three underwater pits excavated for the ends of HDDs on the alternative route, the alternative route would require excavation of a greater volume of seabed sediment than would the preferred route; also, there is an opportunity for leakage of bentonite from drilling operations on the alternative route. In addition, the Company did not wholly resolve what would happen in the event that Popponesset Spit migrated away from the location of deep burial by HDD. Accordingly, the Siting Board finds that the primary route would be preferable to the alternative route with respect to disturbance of sediments.

iii. Eelgrass and Other Submerged Aquatic Vegetation

(a) Company

The Company stated that eelgrass (*Zostera marina*) is the only submerged aquatic vegetation found in colonies in the vicinity of the primary or alternative routes (Tr. 9,

at 1134-35).[68] Specifically, the Company asserted that the seabed along the primary route is not conducive to kelp beds, and that it did not observe any kelp beds during its field investigations (Exh. CW-CJN/SBW-2-R at 26). The Company indicated that MDEP has mapped no eelgrass along the alternative route (Exh. MA-44; Exh. EFSB-5(a)).

The Company indicated that in July 2003 it observed a small area of eelgrass adjacent to the Egg Island sandbar in Lewis Bay, approximately 70 feet away from the preferred route at its closest point (Exh. EFSB-W-21-S and Att). The Company stated that this area would not be directly affected by cable installation work, and that indirect impacts would be avoided by maintaining an appropriate distance between construction activities and mapped eelgrass beds (Exhs. EFSB-W-21; EFSB-W-21-S).

The Company stated that it will not anchor vessels or perform cable installation work in areas where eelgrass beds are located (Exh. EFSB-RR-83). The Company asserted that the location of eelgrass beds near the Egg Island sandbar is relatively stable (Tr. 20, at 2790-2791). Nonetheless, the Company stated that a survey dive would be done to confirm the limits of eelgrass beds prior to the commencement of cable installation in the same calendar year preceding construction, and that divers also would be used to confirm correct placement of work vessel anchors (Tr. 21, at 2850-2857). The Company also stated that, if the project were to disturb eelgrass during construction, the Company would replant the eelgrass (Exh. EFSB-RR-83; Tr. 21, at 2841-2845).

The Company stated that the proposed transmission lines would be consistent with CZM policies relevant to eelgrass, including Habitat Policy #1 (Exh. CW-1, at 5-3, 5-6). The Company also stated that its CEMP would include pre-construction and post-construction monitoring of submerged aquatic vegetation such as eelgrass (Exh EFSB-C-19, att.).

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[68] Massachusetts Wetland Protection Act regulations include restrictions on adversely affecting marine fisheries habitat by destruction of eelgrass beds. 310 CMR § 10.25(6).

(b) Intervenors

Robert N. Buchsbaum, Ph.D., a witness for Mass Audubon, stated that eelgrass is potentially sensitive not only to direct construction impacts, but also to dragging of anchor chains, boat wakes, and siltation (Tr. 17, at 2204-2205, 2213). He stated that eelgrass performs a number of valuable ecological functions, including stabilizing coastal sediment and providing protective habitat for juvenile fish and shellfish, and he asserted that it is therefore critical that the proposed submarine cables avoid negative impacts on eelgrass (Exh. MA-RNB, Att. B at 3; Tr. 17, at 2228). Dr. Buchsbaum testified that eelgrass has declined in recent years in a number of bays and estuaries along the south side of the Cape, due to nutrient enrichment of the shallow waters from on-land development (Exh. MA-RNB, Att. B at 3). He stated that eelgrass is protected under federal regulations as a "special aquatic site" and that, as a result, dredging projects that affect eelgrass usually are required to carry out mitigation (id.).

Dr. Buchsbaum testified that an eelgrass study conducted by MDEP in 1995 identified no eelgrass beds in the locations of either the primary or alternative submarine cable routes (id.). He stated that there appears to have been eelgrass near the Egg Island sandbar, based on a 2001 orthophoto provided by the Company (and designated as Exhibit MA-3), but he indicated that eelgrass near the proposed route is limited to a relatively small patch (id.). Dr. Buchsbaum testified that it is not unusual for eelgrass to vary in extent or even to disappear from an area and to recolonize at a later date (id.; Tr. 17, at 2210-2211). Dr. Buchsbaum stated that one element that may affect the distribution of eelgrass is excess sedimentation, and that, based on sediment modeling provided by the Company, the depth of sedimentation on top of eelgrass growing closest to the jet-plow trench would approximate the depth of sedimentation to which eelgrass may be sensitive (Tr. 17, at 2213-2215). He stated that the Company should be required to examine and present information from available historical aerial photographs to determine whether eelgrass was once more abundant along the two proposed routes (Exh. MA-RNB, Att. B at 3). He stated that mapping is best done in late July, when eelgrass beds reach their maximum extent, and indicated that he would consider any map outdated after three years, at which point re-mapping would be needed (Tr. 17, at 2250-2251, 2229-2230).

Dr. Buchsbaum stated that the Company also should determine whether any seaweed

communities, such as kelp forests, exist along the primary and alternative routes (Exh. MA-RNB, Att. B at 4). He stated that these communities serve a nursery function similar to that of eelgrass, and are particularly valuable to juvenile lobsters (id.). He stated that these areas could be affected either directly by the jet plow or indirectly by the sediment plume created by the jet plow (id.).

Dr. Buchsbaum recommended that the Company be required to monitor the area along the path of the jet plow, both before and after its use, to evaluate impacts on subtidal habitat (id.). He recommended that the Company be required to commit to remediation of habitat that is disturbed and does not recover within a certain time period (id.).

(c) Analysis

The record indicates that the primary route would come in close proximity to a small bed of eelgrass located near Egg Island in Lewis Bay. The record shows that eelgrass may be sensitive to direct and indirect impacts of jet-plowing and that eelgrass performs valuable ecological functions. The Company has stated that it intends to avoid impacts to eelgrass beds by conducting a survey dive prior to the commencement of cable installation, and by using divers to confirm correct placement of work vessel anchors. In addition, the Company will perform pre- and post-construction monitoring of seabed impacts, and will replace any eelgrass that is lost. Together, these measures should be adequate to minimize impacts on eelgrass. However, the record indicates that, while eelgrass beds reach their maximum extent in July, eelgrass is able to re-colonize seabed areas over longer time periods, so the July 2003 MDEP eelgrass survey may become less accurate over time. Accordingly, the Siting Board directs the Company to aerially photograph the entrance to Lewis Bay in the month of July immediately prior to jet-plowing, under conditions conducive to documenting the extent of eelgrass beds, to use the photographs in finalizing the exact location of jet-plowing, and to provide such photographs to the Siting Board. The Siting Board finds that, with compliance with this eelgrass documentation condition, eelgrass impacts of the proposed transmission lines along the primary route would be minimized.

The record shows that, while eelgrass recently has been mapped in close proximity to the primary route, no eelgrass has been identified near the alternative route. Consequently, the Siting

Board finds that the alternative route is preferable to the primary route with respect to eelgrass impacts.

iv. Shellfish

(a) Primary Route

(i) Company

The Company provided information showing that the majority of the waters in Lewis Bay have been designated by the Massachusetts Division of Marine Fisheries ("MDMF") as approved shellfish growing areas (Exhs. EFSB-W-2, at 2; EFSB-W-1(d)).[69] The Company stated that Yarmouth's shellfish constable has indicated that Lewis Bay contains quahogs, soft-shell clams, sea scallops, and a limited number of eastern oysters (Exh. EFSB-W-2, at 2).

The Company indicated that approximately 500 feet of the preferred route crosses through a designated recreational shellfish growing area in Lewis Bay which extends from Colonial Acres, near the mouth of Mill Creek, southeasterly along the Yarmouth shore of Lewis Bay to the Englewood breakwater ("Englewood recreational shellfishing area") (Exhs. CW-1, at 5-26, EFSB-W-1(b), Att.; EFSB-W-2; EFSB-W-24). According to the Company, Yarmouth's shellfish constable considers the Englewood recreational shellfishing area to be an important quahog growing area (Exh. EFSB-W-2). The Town of Yarmouth stocks the area with seed shellfish and with shellfish from contaminated areas around Fall River and New Bedford (Exhs. CW-1, at 5-27; EFSB-W-1(b), Att.; EFSB-W-2; EFSB-W-24, at 3). The Englewood recreational shellfishing area is conditionally open for recreational shellfishing only, and only on Sundays; the Company indicated that the area is normally closed for a year every other year after shellfish

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69 The Company stated that *approved* shellfish areas are open for harvest of shellfish for direct human consumption, that conditionally approved areas are open for harvest of shellfish for human consumption during particular periods of time, typically based on water quality and shellfish availability, and that prohibited shellfish areas are closed for harvest of shellfish, most commonly due to contamination concerns (Exh. EFSB-W-24, at 2).

from contaminated areas are stocked (Exhs. EFSB-W-2; EFSB-W-24, at 3).[70]

The Company stated that deeper waters of Nantucket Sound support sea clams and whelk, both of which are harvested commercially (Tr. 7, at 910; Tr. 9, at 1161).[71] The Company asserted that marine organisms in offshore areas traversed by the route are already adapted to a mobile seabed and to high suspended sediment concentrations associated with tidal currents, wind waves in shallow waters, and ocean swells (Exhs. CW-CJN/SBW-2-R at 12; EFSB-RR-44, at 3, 5). The Company indicated that clams can tolerate sediment deposition of at least 5 mm; higher deposition would be limited to areas within 100 feet of jet-plowing (Exh. EFSB-RR-44, at 2). Additional mortality is expected within the trench, where there would be significant shear forces from water injection (id.). The Company stated that quahogs would tend to settle deeper below the seabed in the fluidized trench due to their size and weight (Tr. 9, at 1160).

The Company stated that it has reached an agreement with the Town of Yarmouth with respect to shellfish resource area mitigation (Exh. EFSB-RR-53). The Company stated that any affected shellfish beds would be replaced by re-seeding the affected portion of the recreational shellfishing area with two shellfish per square foot, rather than by a relay or transport program (Tr. 7, at 919). According to the Company, the Yarmouth Shellfish Constable has recommended that submarine cable installation not occur on Sundays in Lewis Bay during the recreational shellfish harvesting season (primarily summer) to avoid interference with recreational shellfishing (Exh. EFSB-W-24).

The Company stated that the proposed transmission lines would be consistent with CZM policies relevant to shellfish, including Habitat Policy # 1 (Exh. CW-1, at 5-3, 5-6). The Company indicated in its preliminary CEMP that it has conducted pre-construction monitoring of shellfish resources, and that it does not intend to perform any additional pre-construction

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[70] The Company also indicated that there are several privately-operated shellfish aquaculture grant or lease sites from the Town of Yarmouth along the southeast shores of Lewis Bay; however, these are not within the pathway of the proposed transmission line (Exhs. CW-1, at 5-27; EFSB-W-1(c), Att.; EFSB-W-2).

[71] The Company stated that Nantucket Sound does not support a major lobster fishery (Tr. 7, at 851).

monitoring; the CEMP does not provide for shellfish monitoring during construction or post-construction (Exh. EFSB-C-19, Att.).

(ii) Intervenors

Dr. Buchsbaum, a witness for Mass Audubon, stated that jet plowing would cause a temporary disturbance of marine organisms within the footprint of the trenches (Exh. MA-RNB, Att. B at 1). He stated that the disruption could consist of direct removal by the jet plow or smothering by the sediment plume created by the plow (id. at 1-2). Dr. Buchsbaum identified sea clams, whelk, lady crabs, horseshoe crabs, and sand shrimps as subtidal organisms that could be displaced during project construction (id. at 2). Dr. Buchsbaum testified that the Company has not provided sufficient information regarding potential shellfish and benthic impacts, and that additional analyses are needed to properly evaluate, avoid, minimize, and mitigate such impacts (id. at 1).

Richard S. LeGore, Ph.D., a witness for the Alliance, stated that changing the mixture of grain size would change the biological community in the area that is jet-plowed (Tr. 17, at 2157). Dr. LeGore also expressed concern about turbidity and lowered oxygen levels caused by jet plowing having an adverse effect on shellfish spawn survival (id. at 2177). Dr. LeGore stated that the Company's benthic surveys used partial samples, lacked replicates, and were not coordinated with sediment profiles of adequate precision; he asserted that the Company's data and analysis are inadequate to properly assess the project's potential benthic impacts (id. at 2157-2161).

(b) Alternative Route

(i) Company

The Company indicated that MDMF has designated waters in Popponesset Bay seaward of Gooseberry Island as an approved shellfish growing area (Exhs. EFSB-W-1(g), Att.; EFSB-W-24). The Company stated that Popponesset Bay contains quahogs, soft-shell clams, and ribbed mussels, and that it has been seeded with scallops (Exh. CW-1, at 5-28). Seed shellfish are grown in trays away from the alternative route by the Town of Mashpee, prior to

being planted elsewhere in Popponesset Bay (Exh. EFSB-W-24, at 3). The Company stated that the Town maintains designated recreational shellfish growing areas for use by town residents, which the town has seeded with quahogs (Exhs. CW-1, at 5-28; EFSB-W-2, at 3). The Company indicated that one of the two such areas in Popponesset Bay is the Thatch Island recreational shellfishing area, located on the west side of Popponesset Spit; this area lies within the path of the alternative route but would be avoided by the use of HDD (Exhs. CW-1, at 5-28; EFSB-W-1(e), Att.; EFSB-W-2, at 3; EFSB-W-24, at 4).

The Company stated that, in addition to the Town shellfishing areas, two private shellfish grants are located in Town of Mashpee waters (Exhs. CW-1, at 5-28; EFSB-W-1(f), Att.; EFSB-W-2, at 3). The Company stated that one grant is located near Little Thatch Island, and is within the path of the alternative route (Exhs. CW-1, at 5-28; EFSB-W-2, at 3). The Company stated that the second grant is located near Gooseberry Island, immediately adjacent to the alternative route in Popponesset Bay (Exhs. CW-1, at 5-28; EFSB-W-1(f), Att.; EFSB-W-2, at 3).

The Company stated that offshore portions of the primary and alternative submarine cable routes have similar shellfish resources and are equal with respect to impacts to offshore shellfish resources (Exh. CW-1, at 5-29). However, the Company stated that turbidity impacts on shellfish would be more pronounced in Popponesset Bay than in Lewis Bay due to the finer grain size of the sediments in Popponesset Bay (Tr. 9, at 1138).

The Company stated that if the alternative route is selected, it would work with the Town of Mashpee to identify the location and extent of expected shellfish disturbance and would develop a plan acceptable to the Town to avoid and minimize impacts, including moving and re-seeding of affected shellfish (Exhs. EFSB-W-24; EFSB-SS-22-S, Att. at 5-58).

(ii) Intervenors

Mr. Williams, a witness for Save Popponesset Bay, stated that due to the shallow depth of Popponesset Bay (1 to 2 feet), the small mean tide range (2.3 feet) and the large draft (24 feet) of the work boats to be used for submarine cable installation, the proposed project would likely have a significant impact on shellfish resources in Popponesset Bay (Exh. SPB-PJW at 2-3).

(c) Analysis

The record shows that the primary route would pass through a significant amount of approved or conditionally approved shellfish growing area, including approximately 500 feet of recreational shellfish area in Yarmouth. No privately managed shellfish grants in Lewis Bay would be directly affected.

Jet plow operations would create high shear forces from nozzle water velocities above 140 feet per second, and would cause deep burial of heavier shellfish; thus, the project would likely destroy much of the benthic life, including shellfish, within the trapezoidal trough fluidized by the jet plow. The sediments may be restratified in the trough, but the area would be available for recolonization by other species after construction. The record indicates that some sediments from the trench would be entrained in the water column, then settle outside the trench. The record suggests that shellfish and other benthic life outside the trench are likely adapted to the shifting sands along the unstable seabed found on much of the primary route, although quahogs within 100 feet of the jet plow could be adversely affected by burial in excess sediment. Some additional impacts to shellfish would be expected from dragging the jet plow pontoons over the bottom and from anchor drag. The record suggests that the sediment entrainment and anchor drag effects of project construction would be comparable to effects of dragging fishing nets along the seabed.

The Company's CEMP does not provide for additional pre-construction monitoring of shellfish resources, and does not provide for post-construction monitoring (Exh. EFSB-C-19, att). However, Cape Wind has conducted certain pre-construction shellfish surveys and it has entered into an agreement with the Town of Yarmouth regarding mitigation for impacts to shellfish resources. Consequently, the Siting Board finds that shellfish impacts of the proposed transmission lines along the primary route would be minimized.

The alternative route traverses approved shellfish growing areas in Popponesset Bay, including a recreational shellfish area on the landward side of Popponesset Spit, and passes a private shellfish grant near Thatch Island. The alternative route also would be located directly adjacent to the private shellfish grant near Gooseberry Island.

The record indicates that disturbance of the fine sediments in Popponesset Bay on the

alternative route may adversely affect shellfish along the route and in adjacent areas, whereas the primary route is characterized more by sandier sediments, the disturbance of which would not affect as large an area of shellfish habitat. However, the record contains little information on the relative abundance, extent, or importance of the various types of shellfish found in Lewis Bay and in Popponesset Bay. Therefore, while the alternative route poses a greater chance of asphyxiating clams by stirring up sediments with the jet plow, as discussed in Section II.C.2.a.ii, above, it is not possible to rank the potential benthic impacts of the primary and alternative routes. Consequently, the Siting Board finds that the primary and alternative routes would be comparable with respect to shellfish impacts.

v. Fish

(a) Primary Route

(i) Company

The Company indicated that the proposed transmission lines lie within an area of Nantucket Sound that is designated as Essential Fish Habitat ("EFH"), pursuant to the federal Magnuson-Stevens Fishery Conservation and Management Act,[72] for 18 species of finfish and invertebrate species, including Atlantic cod (*Gadus morhua*), scup (*Stenotomus chrysops*), black sea bass (*Centropistus striata*), Atlantic mackerel (*Scomber scombrus*), fluke (summer flounder; *Paralichthys dentatus*), winter flounder (*Pleuronectes americanus*), long-finned squid (*Loligo pealei*), and sea clam (*Spisula solidissima*) (Exh. CW-2, at 7-16 and Table 7.6).[73] The Company identified six dominant species of commercially harvested fish and invertebrate species in Nantucket Sound: long-finned squid, Atlantic mackerel, scup, black sea bass, fluke, and channeled whelk (*Busycon canaliculatum*) (id. at 7-31, 7-35). The Company identified bluefish (*Pomatomus saltatrix*) and striped bass (*Morone saxatilis*) as the dominant recreationally fished

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[72] 16 USC §§ 1801 et seq.

[73] EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growing to maturity (Exh. APNS-MW at 5; see also, 18 USC § 1802 (10)). A full listing of EFH species is provided in Section V.E.4.b, below.

species (id. at 7-35 and Table 7.12).[74] The Company stated that both Lewis Bay and Popponesset Bay provide important winter flounder habitat and serve as important nursery grounds for several finfish species (Exh. CW-1, at 5-19).

The Company stated that project construction is not expected to cause significant impacts to fish, including EFH species, because adult and juvenile fish are mobile in the water column and are adapted to avoid disturbance, and because the principal method to be used for submarine cable installation (jet plowing) was specifically selected for its ability to minimize disturbance to sediment and other marine habitat (Exhs. CW-2, at 7-19; EFSB-SS-22-S2, Att., App. 5-I, at 24-31). The Company acknowledged that larval and egg life stages of fish may be more affected by marine construction than juvenile or adult fish due to their lower mobility (Exh. CW-2, at 7-19). The Company stated that the existing level of ambient underwater noise in Nantucket Sound is relatively high due to commercial and recreational boat traffic, and that, because jet plowing would produce similar noise levels, noise from cable installation would not be expected to adversely affect fish (Exh. EFSB-W-12).

The Company stated that a mapped anadromous fish run in Mill Creek empties into Lewis Bay; this fish run is used primarily by migrating river herring such as alewife, with spring migration typically occurring between March 15 and June 15 (Exhs. CW-1, at 5-19; EFSB-W-3A; EFSB-W-25; Tr. 7, at 852). The Company characterized Lewis Bay as a relatively large bay, with a fairly broad reach of water at the entrance to the fish run, which would allow migrating adult fish to successfully avoid cable installation activities (Exh. CW-1, at 5-19). The Company stated that potential impacts to anadromous fish from submarine cable installation would result from direct or indirect sediment disturbance, and would be localized, temporary and short-term (Exh. EFSB-W-25). The Company stated that spawning of anadromous fish would occur well upriver, so spawning adults and eggs should be unaffected by jet plowing (id. at 2).

The Company stated that it would coordinate with appropriate state and federal agencies on measures to prevent or mitigate any fisheries impacts, including the imposition of seasonal

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[74] The record does not indicate that any of the species identified by the Company as occurring in Nantucket Sound within the project area is a state-listed or federally-listed protected species. See 321 CMR § 10.61(4); 50 CFR § 17.11.

restrictions prohibiting marine construction during certain times of the year, such as the spring migration period (Exhs. EFSB-G-9; EFSB-W-25). However, the preliminary CEMP states that no further pre-construction assessment of fish and fisheries resources is planned, and the CEMP does not provide for construction monitoring or post-construction monitoring of fish and fisheries (Exh. EFSB-C-19, Att.).

(ii) Intervenors

Dr. Buchsbaum, a witness for Mass Audubon, stated that dredging projects in Massachusetts are often restricted to periods when winter flounder are not spawning, and that the Company's marine construction methods and schedule should be carefully defined to avoid winter flounder spawning (Exh. MA-RNB, Att. B at 2). Dr. Buchsbaum stated that the Company should consult with MDMF and comply with any seasonal construction restrictions requested by MDMF to avoid fish spawning and migration periods (id. at 3). Mr. Weissman, witness for the Alliance, stated that construction activities, particularly jet plowing, would raise a large amount of sediment and the resultant turbidity of the water would suffocate benthic fauna and juvenile fish; interfere with feeding and spawning; destroy eggs; and disperse juvenile and adult fish and invertebrates, thereby reducing the number of fish that would survive to maturity (Exh. APNS-MW at 18; Tr. 12, at 1686-1688). Mr. Weissman stated that, overall, some loss of fisheries production would occur, but that recovery time is unknown, as are long-term effects (Exh. APNS-MW at 18). In conclusion, Mr. Weissman stated that the impact of the wind farm project and the transmission project on fisheries must be viewed as unknown, since some impacts may be detrimental, some may be beneficial, many are unknown, and some, given the complexity of the ecosystem, may be unknowable (id.). He stated that, in his opinion, additional studies of existing fish populations, habitat, and potential mitigation measures should be conducted (id. at 22-24).

(b) Alternative Route

The Company indicated that the alternative route in Popponesset Bay contains two mapped anadromous fish runs: one in the Landing River and one in Shoestring Bay, both of

which empty into Popponesset Bay (Exhs. CW-1, at 5-19; EFSB-W-3B; EFSB-W-25). The Company stated that river herring are the predominant species of anadromous fish using the Popponesset Bay fish runs, and that migration typically occurs between March 15 and June 15 (Exh. EFSB-W-25; Tr. 7, at 852). The Company characterized Popponesset Bay as a narrow, linear and fairly restricted bay, which may make it more difficult for fish to avoid cable installation activities (Exh. CW-1, at 5-19).[75] The Company stated that if it were to use the alternative route, it would conduct no jet plow activity in Popponesset Bay between April 1 and May 15, to prevent or minimize potential impacts to anadromous fish (Exh. CW-5).

(c) Analysis

The record indicates that the primary route would be located within or close to EFH for 18 fish species. The Company has selected jet plowing as its principal marine construction method in order to minimize disturbance to bottom sediment and other habitat. Construction impacts to adult and juvenile fish likely would be minimal, since fish are able to swim to avoid construction activities; however, some impacts may be expected to fish larvae and eggs.

The record shows that an anadromous fish run used primarily by migrating river herring empties into Lewis Bay, and that the spring migration typically occurs between March 15 and June 15. The Company has not proposed specific seasonal restrictions for work in Lewis Bay, arguing that the broad reach of water at the entrance to the fish run should allow migrating adult fish to avoid cable installation activities. However, the Company has agreed to consult with relevant state and local agencies to develop measures (including seasonal restrictions, if necessary) to prevent or mitigate fisheries impacts. Accordingly, the Siting Board finds that impacts of the proposed transmission lines on fisheries along the primary route would be minimized.

The record does not indicate any significant difference in fisheries impacts along the marine segments of the primary and alternative routes. The marine portion of the alternative route is approximately two miles shorter, and thus may be slightly preferable with respect to the

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[75] The Company stated that the entrance to Popponesset Bay is 300 feet wide (Exh. CW-1, at 5-49).

potential for fisheries impacts. However, as discussed in Section II.C.2.a.ii, above, the sediment in Popponesset Bay is finer-grained and has a higher concentration of organic materials than the sediment in Lewis Bay; as a result, it would likely remain suspended in the water column longer than the sandier sediment of Lewis Bay, and it may cause a drop of oxygen content in the water, due to the greater presence of organic materials.

The record shows that Popponesset Bay has two anadromous fish runs, and that the entrance to Popponesset Bay is more constricted than the entrance to Lewis Bay. Thus, if project construction were to occur in Popponesset Bay during seasonal fish migration, impacts on fish and fisheries likely would be greater along the alternative route than along the primary route. However, the Company has agreed not to conduct jet plowing in Popponesset Bay between April 1 and May 15, a period which covers approximately six weeks of the twelve-week (March 15 to June 15) fish-migration period identified by the Company. In summary, Popponesset Bay has two mapped fish runs and is more naturally constrained than Lewis Bay, and its sediments are likely to have greater impacts on fish when the sediments are disturbed during jet plowing. The slightly shorter length of the alternative route and the Company's proposed 6-week seasonal restriction do not outweigh these elements. Accordingly, the Siting Board finds that the primary route is preferable to the alternative route with respect to impacts on fish.

vi. Protected Marine Species

(a) Description

The Company stated that rare whale, seal, and turtle species may occur in Nantucket Sound (Exhs. CW-2, at 7-26; EFSB-SS-22-S2, Bulk Att., App. 5-G, 5-H). The Company identified the humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), and northern right whale (*Eubalaena glacialis*) as potential users of Nantucket Sound (Exh. CW-2, at 7-29). Each of these is a state-listed endangered species under the Massachusetts Endangered Species Act,[76] and a federally-listed endangered species under the Federal

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[76] See G.L. c. 131A et seq.; 310 CMR § 10.61(4).

Endangered Species Act.[77] However, the Company's environmental consultants stated that, historically and at present, Nantucket Sound is not an important area for whales (id. at 7-27; Exh. EFSB-SS-22-S2, Bulk Att., App.5-H, at 10-11).[78]

The Company stated that MDFW has identified the gray seal (*Halichoerus grypus*) as a species of special concern (Exh. CW-2, at 7-27).[79] According to the Company's environmental consultants, the western North Atlantic population of gray seals is centered on Sable Island, Nova Scotia, but ranges from Labrador to New England (Exh. EFSB-SS-22-S2, Bulk Att., App. 5-G at 1). The Company stated that the southernmost breeding colony of gray seals is on Monomoy and Muskeget Islands, located 10.5 nautical miles and 7.0 nautical miles, respectively, from the proposed wind farm site (Exh. EFSB-SS-22-S2 Bulk Att., App.5-G at 1, 3). It stated that gray seal pupping occurs on land or ice from late December through mid-February (Exh. EFSB-SS-22-S Bulk Att., App. 5-G at 1). The Company provided information that the principal known cause of human-induced gray seal mortality in U.S. waters is by drowning in gill nets, and that few if any are listed as killed in the course of marine construction work (Exh. EFSB-SS-22-S2 Bulk Att., App. 5-G at 4).[80]

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77 See 16 USC §§ 1531-1534; 50 CFR § 17.11.

78 Single humpback whales were observed in Nantucket Sound in 1757 and in 1825 (Exh. EFSB-SS-22-S2 Bulk Att., App. 5-H at 10-11). Since 1697, a small number of finback whales has been observed; since 1854, a small number of northern right whales has been observed (id. at 19, 26).

79 The Massachusetts NHESP is responsible for the inventory of rare animal and plant species in the Commonwealth, and for maintaining records of rare species locations. 321 CMR § 10.02. The gray seal does not appear on the most recent list of Massachusetts rare species issued by NHESP. See 321 CMR § 10.61(4) (rev. August 1, 2003).

80 The ENF also discusses harbor seals (*Phoca vitulina concolor*), although it does not identify the harbor seal as a rare species. The ENF states that harbor seals generally are present in Nantucket Sound only in the winter months (Exh. CW-2, at 7-27). The Company stated that no pupping areas have been identified in southern New England (Exh. EFSB-SS-22-S2 Bulk Att., App. 5-G at 5). The U.S. Fish & Wildlife Service ("USFWS") has identified Muskeget and Tuckernuck Islands as favorite haul-out spots for the harbor seal population; these islands are all located at least 8.5 miles from the

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The Company stated that any seals present in the project area during construction would be capable of moving away from localized turbidity and vessel traffic (Exh. EFSB-SS-22-S2 Bulk Att., App. 5-G at 5). The Company reported on findings that seals habituate to most anthropogenic noises and activities, including pile driving during construction of the Näsrevet wind farm in Sweden (Exh. EFSB-SS-22-S2 Bulk Att., App. 5-G at 7). The Company asserted that seals can easily avoid slow moving vessels, such as the tugs and barges that would be used on the project (Exh. EFSB-SS-22-S2 Bulk Att., App.5-G at 5).

The Company identified loggerhead turtles (*Caretta caretta*), Kemp's ridley turtles (*Lepidochelys kempii*), and leatherback turtles (*Dermochelys coriacea*) as potential users of Nantucket Sound (Exh. CW-2, at 7-28). The loggerhead turtle is a State-listed threatened species, and both the Kemp's ridley turtle and the leatherback turtle are state-listed endangered species. 321 CMR § 10.61 (4). The Company stated that sea turtles are highly migratory, preferring more temperate waters than those of Nantucket Sound, and therefore would most likely be present in the Sound during summer (Exh. CW-2, at 7-28). The Company stated that leatherback turtles may be present in the fall as well, but that sightings of leatherback turtles in Nantucket Sound are extremely rare (id.). The Company asserted that sea turtles should be able to avoid slow moving vessels such as those that would be used for the project (Exh. EFSB-SS-22-S2 Bulk Att., App. 5-H at 47). The Company's CEMP states that certain pre-construction surveys have been conducted, but that no additional pre-construction monitoring of protected marine species is planned; the CEMP does, however, provide for the monitoring of protected marine species during and after construction (Exh. EFSB-C-19, Att.).

(b) Analysis

The Company has produced evidence indicating the potential presence in Nantucket Sound of several species of protected marine mammals and sea turtles. However, there is no

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[80] (...continued)
project area (Exhs. CW-2, at 7-27; EFSB-SS-22-S Att., App. 5-G at 5). According to USFWS, some strandings of harbor seals in southern New England have been attributed to vessel strikes (Exh. EFSB-SS-22-S Att., App. 5-G at 5).

evidence to suggest that these species are more likely to be found in the project area, or along the path of the proposed submarine cables, than in other areas of Nantucket Sound. There also is no evidence to suggest that protected marine species would be more likely to occur along the primary route than along the alternative route.

The record indicates that a very small number of any rare whale or turtle species is likely to occur within Nantucket Sound. The gray seal breeding grounds are sufficiently distant from the proposed cable-laying to support a conclusion that project-related work will not affect existing gray seal populations. The harbor seal is not a listed rare species and there is no evidence in the record to support a conclusion that harbor seals are likely to be affected by construction of the proposed transmission lines. The Company has indicated its intention to monitor the presence of rare marine species during and after construction.

Consequently, the Siting Board finds that impacts of the proposed transmission lines on protected marine species along the primary route would be minimized. The Siting Board also finds that the primary and alternative routes would be comparable with respect to impacts on protected marine species.

vii. Protected Coastal Shorebirds

(a) Primary Route

(i) Company

The Company provided information from NHESP stating that four species of protected coastal shorebirds have been identified in the vicinity of the transmission project: the roseate tern (a state and federally-listed endangered species); the piping plover (a state-listed threatened species); and the least tern and common tern (state-listed species of concern) (Exhs. CW-2, at 7-22, 7-24; EFSB-RR-45-S, Att.; MA-12).[81] Cape Wind asserted that cable installation along the primary route would not have a direct impact on any protected species nesting sites along the

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[81] Pursuant to the regulations implementing the Massachusetts Endangered Species Act, an endangered species is a species of plant or animal in danger of extinction; a threatened species is one likely to become endangered within the foreseeable future; and a species of concern is one that has suffered a decline that could threaten the species if allowed to continue unchecked. See 10 CMR § 10.03.

route, due to: the distance of the identified nesting sites (on Great Island and Kalmus Beach) from the proposed construction; the location of the main navigational channel into Hyannis Harbor in between the identified nesting sites and the proposed marine construction; the short duration of the construction; and the similarity between the work boats that would be used during construction and the types of recreational and commercial boats traffic that travel through the area (Exh. CW-CJN/SBW-2-R at 35).

The Company provided maps indicating the location of its proposed work areas, and the distances between the proposed cable-laying activities and three identified areas of coastal bird habitat in Lewis Bay: Smith's Point (on Great Island), Kalmus Beach (in Barnstable), and the Egg Island sandbar (Exh. EFSB-RR-83, Bulk Att.). The record indicates that work vessels associated with installation of the proposed cables would come within approximately 1000 feet of the Smith's Point habitat area and within roughly 650 feet of the Kalmus Beach habitat area (id.). The maps show that construction work would occur in very close proximity to the western side of the Egg Island sandbar (id.).

Cape Wind maintained that marine construction activities along the primary route would be sufficiently far from protected bird nesting habitat that a seasonal work restriction may not be necessary (Exh. CW-CJN/SBW-2-R at 35). However, the Company proposed to avoid performing marine construction during shorebirds' "courting, breeding and nesting season" (Exh. MA-19). The Company asserted that mid-March through April is the period when piping plovers are courting and are most sensitive, and that, once their eggs have been laid, plovers would not be disturbed by the Company's proposed construction activities (Tr. 11, at 1548-1549). The Company indicated that it would consult with appropriate agencies regarding the need for seasonal restrictions (Exhs. CW-CJN/SBW-2-R at 35-36; MA-8). Cape Wind stated that its preliminary CEMP includes provisions for pre-construction and post-construction monitoring of state-listed rare species within the footprint of the on-land portion of the proposed cable route, but the CEMP does not include express provisions for pre-construction, construction, or post-construction monitoring of state- or federally-listed bird species along the marine portion

of the route (id.).[82]

(ii) Intervenors

Andrea Jones, Director of Mass Audubon's Coastal Shorebird Program, testified that several important nesting sites for protected coastal shorebirds are located at the entrance to Lewis Bay (Exhs. MA-ALJ, Att. B at 4; EFSB-RR-83, Bulk Att.). She stated that six pairs of piping plovers were recorded in 2002 at Great Island on Smith's Point and that seven pairs of piping plovers and four pairs of least terns were recorded in 2002 at Kalmus Beach Park (Exhs. MA-ALJ, Att. B at 4; EFSB-RR-62). She stated that Egg Island, which is located in Lewis Bay between Kalmus Beach Park and Great Island, is exposed during low tides and is frequently used by terns for rest between foraging forays (Exhs. MA-ALJ, Att. B at 4; RR-83, Bulk Att.).[83]

Ms. Jones testified that migratory shorebirds such as terns and plovers need to rest and feed in order to gain fat during spring and fall migration, and that beaches along the southern shore of Cape Cod provide essential shorebird habitat during such migration (Exh. MA-ALJ, Att. B at 3). She stated that disturbance to birds while resting and feeding (e.g., by humans, pets, or vehicles) causes the birds to expend stored energy required for successful migration (id.). She stated that even short disturbances, such as "flushing" birds (causing birds to fly), can cause them to expend energy unnecessarily (id.).

Ms. Jones testified that the spring courting, breeding and nesting season for piping plovers occurs between late March and late August (Exh. MA-ALJ, Att. B at 3). Ms. Jones stated that piping plovers begin arriving on Massachusetts beaches to nest in late March, and eggs may be laid as early as April 19 (id.). She stated that eggs are incubated for a minimum of

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[82] The preliminary CEMP provides for pre-construction and construction monitoring of "birds". However, when read in context, this category appears to reference surveys of avian species in Nantucket Sound generally, rather than the specialized monitoring of rare or endangered coastal shorebirds.

[83] Ms. Jones stated that piping plovers, common terns and least terns currently are nesting at Kalmus Beach Park, and that piping plovers and a pair of American oystercatchers are nesting at Great Island (Tr. 13, at 1826).

26 days, and that hatch dates occur between May 23 and July 26 (id.; Exh. EFSB-RR-61). She testified that fledge dates occur between June 16 and August 20, and that parents may continue to care for young in their nesting areas as late as August 30 (Exh. MA-ALJ, Att. B at 3). Ms. Jones testified that piping plovers typically begin their migratory movements in early-to-late August and leave Massachusetts by late August (id.). Ms. Jones stated that, depending on its level and frequency, noise could adversely affect plovers throughout the species' breeding season (Tr. 13, at 1835). She stated that disturbance in the form of human activity or noise could disrupt plover courting, and that noise or activity during incubation could cause nesting birds to become agitated and to abandon their eggs (id. at 1834). She stated that during the period when the chicks have hatched but not yet fledged, necessary communication between chicks and parents could be disrupted by noise (id. at 1834-1835). Ms. Jones did indicate, however, that if plovers have begun laying their eggs and are disturbed by a storm or by predation, they may re-nest (id. at 1823).

Ms. Jones stated that restrictions on public access to beaches with protected coastal shorebird nesting areas are common in Massachusetts during the nesting and breeding season (id. at 1829-1830). She stated that state guidelines provide for 50 yards of protective fencing surrounding piping plover nests to prevent humans and vehicles from approaching the nests (id.). She said that the primary purpose of the fencing is to protect the chicks, and that the initial 50-yard radius of the fencing often is expanded once the chicks have hatched (id.).

Ms. Jones testified that seasonal restrictions on the Company's proposed marine construction activities are necessary to protect endangered piping plover and tern populations known to breed and to stage migration in the project area (Exh. MA-ALJ, Att. B at 3). She testified that construction activities should be avoided from early May to mid-September when terns are present in Lewis Bay (id.).

(b) Alternative Route

(i) Company

The Company introduced evidence showing that two protected coastal shorebird species occur on Popponesset Spit: the piping plover and the least tern (Exhs. CW-1, at 5-14;

EFSB-L-21). The Company estimated that construction activities (HDD) could come within 300 feet of Popponesset Spit, that maximum HDD sound levels of 63 decibels on the A-weighted scale ("dBA") would occur at the spit from work performed at this distance, and that noise from existing boat traffic is in the range of 50 to 80 dBA (Exh. EFSB-RR-29; Tr. 11, at 1550-1551). The Company stated that HDD cable installation under Popponesset Spit would require approximately two to four weeks and would be conducted for 20 to 24 hours a day (Exhs. EFSB-C-1; CW-CJN/SBW-2-R at 35; EFSB-RR-30; Tr. 13, at 1849-1850).

In order to limit impacts to piping plovers, Cape Wind agreed it would not conduct HDD under Popponesset Spit between April 1[84] and June 30, unless field observations by the USFWS confirmed the absence of nesting piping plovers on Popponesset Spit, and confirmed that any piping plover eggs had already hatched (Exh. CW-5; Tr. 21, at 2830).[85] The Company also agreed to maintain a distance of at least 300 feet between piping plover habitat and any construction work (Exh. CW-5). The Company agreed that during installation of the transmission cables, any plovers present on the spit would be monitored, and that work would cease if it were determined that the plovers were being disturbed (id.).

(ii) Intervenors

Ms. Jones testified that piping plovers have nested regularly at Popponesset Spit in recent years (Exh. MA-ALJ, Att. B at 2). She testified that four pairs nested on the spit in 2000, and that three pairs nested there in 2001, 2002, and 2003 (id. at 3).

Ms. Jones testified that least terns maintained a small breeding colony on the spit during the 1990s, but that no terns have nested there in the past five years (id.). However, she stated that terns do use the spit and surrounding shoals at low tide during spring migration, summer feeding,

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[84] The record is unclear whether the Company has agreed to use April 1 or March 15 as the date to start its proposed HDD restriction (Exh. CW-5; Tr. 21, at 2838, 2893; Company Brief at 151).

[85] Earlier in the proceeding, Cape Wind had proposed to restrict marine construction along the alternative route to the period "outside the spring courting, breeding, and nesting season"; however, the Company had indicated that it was prepared to avoid only mid-March to mid-April (Exhs. MA-45; Tr. 11, at 1545-1546).

and fall pre-migratory staging (id.). Ms. Jones stated that approximately 200 terns are regularly counted on the landward side of the spit at low tide (id.). She stated that, in mid- through late May, approximately twenty percent of the terns observed are roseate terns, and the remainder are common terns and least terns (id.). She stated that terns (primarily common terns) are observed through the summer months, and that terns continue to be present in the fall until departure in mid-September (id.). Ms. Jones stated that the nesting season for terns ranges from mid-May, when egg-laying begins, to August, when fledging occurs (Tr. 13, at 1826-1827).

Ms. Jones testified that disturbance of Popponesset Spit and the adjacent intertidal zone should be prohibited during the piping plover breeding season (late March through late August) and during coastal fall migration (late summer through late October) (Exh. MA-ALJ, Att. B at 3). On brief, Mass Audubon argued that Cape Wind should agree not to perform HDD drilling or other activities near or under Popponesset Spit from March 15 to August 30 (Audubon Reply Brief at 2).

(c) Analysis

The record indicates that construction activities along the primary route would pass within approximately 1000 feet of Smith's Point (habitat for piping plover), within approximately 650 feet of Kalmus Beach (habitat for piping plover and least terns), and in close proximity to Egg Island, a sandbar exposed at low tide on which terns regularly rest.

Both Cape Wind and Mass Audubon agree that a seasonal work restriction along the primary route would be appropriate, although the lengths and timing of the work restrictions they have proposed differ significantly. Mass Audubon advocates a work restriction from early May to mid-September, a period encompassing the nesting and breeding seasons, as well as pre-migration staging, for rare terns.[86] Cape Wind has proposed a seasonal restriction for the

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[86] Mass Audubon proposed a somewhat different seasonal work restriction for the protection of piping plovers (from late March through late August (nesting and breeding) and continuing through late October (fall migration)) in the context of its testimony regarding the alternative route. The Siting Board recognizes that these recommendations may extend to work along the primary route, since the restriction is biologically based

(continued...)

protection of birds, and bird habitat, only from mid-March to mid-to-late April. The Company's preliminary CEMP provides for monitoring of protected marine mammals and upland rare species, but does not provide for monitoring of rare bird species known to exist near the marine portion of the proposed cable route. While acknowledging the preliminary nature of the CEMP, we are nonetheless concerned by this omission. However, Cape Wind has indicated that it would consult with appropriate agencies regarding the need for a seasonal work restriction to protect such species.

The existing record does not permit the Siting Board to determine which of the seasonal restrictions urged by the parties – if any – would adequately protect rare coastal shorebirds and balance the protection of these birds with other likely conditions on project construction, such as seasonal restrictions for the protection of anadromous fish and shellfish, and the Company's desire to avoid marine construction in the winter months for safety reasons. In addition, it is critical that any necessary seasonal restrictions be developed in consultation with those federal and state agencies that have particular expertise in the protection of rare species and of fisheries resources. Accordingly, the Siting Board directs the Company to work with the ACOE, NHESP, and MDMF, and with Mass Audubon, if Mass Audubon wishes to participate: (1) to determine whether seasonal restrictions, or some other protective measures, are appropriate to minimize potential impacts on protected coastal shorebirds and their habitat along the primary route and, if so, to develop appropriate seasonal restrictions and/or other protective measures; and (2) to determine whether protected coastal shorebirds should be included in the Company's comprehensive environmental monitoring plan and, if so, to develop an appropriate monitoring protocol. The Company shall file with the Siting Board, prior to the commencement of marine construction, documentation of the seasonal restrictions, any additional protective measures, and the monitoring protocol. With this mitigation, the Siting Board finds that impacts on protected coastal shorebird along the primary route would be minimized.

While construction activities along the primary route occur within 1000 feet of Smith's

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[86] (...continued)
(corresponding to the birds' nesting, breeding and migration cycles), not geographically based.

Point and within 650 feet of Kalmus Beach, the alternative route passes directly under Popponesset Spit, where piping plovers regularly nest. Additionally, the record shows that construction along the alternative route would require two HDDs, one of which would include entry and exit points within 300 feet of the spit. HDD work would be conducted up to 24 hours per day, for two to four weeks, and would produce substantial noise near the spit. Accordingly, the Siting Board finds that the primary route is preferable to the alternative route with respect to impacts on protected coastal shorebirds.

viii. Marine Archeology

(a) Description

The Company stated that no submerged prehistoric archeological sites have been reported in the area of the proposed transmission project (Exh. EFSB-SS-22-S2 Att. at 6). The Company stated that it has conducted a preliminary geophysical survey along the primary and alternative cable routes, the purpose of which was to identify potential underwater obstructions and cultural resources (Exh. CW-1, at 5-39). The Company stated that the geophysical survey included the use of side-scan sonar to evaluate seabed sediments and obstructions, and the use of magnetometers to identify ferrous objects (Exh. CW-2, at 7-37). The Company stated that the locations of detected anomalies were identified using the Global Positioning System ("GPS") (id.). The Company stated that the preliminary survey data would be reviewed by the project's marine archeologist to identify potential cultural resources, and that the results of that review would be submitted to the Massachusetts Board of Underwater Archeological Resources ("MBUAR") and the Massachusetts Historical Commission ("MHC") (Exh. CW-1, at 5-41).

The Company stated that the preliminary survey indicated no significant underwater features along the primary route (id.). The Company stated that one "sizeable" magnetic anomaly was detected, but that no shipwrecks were identified and that most of the features detected by sonar were likely geological features of the sea bottom, such as sand waves, glacial till, or patches of gravel (id.).

The Company stated that one charted shipwreck has been mapped near the alternative route (Exh. CW-1, at 5-44). The Company stated that the shipwreck is located approximately

3000 feet northeast of the alternative route, approximately one mile offshore of Cotuit Highlands (id. at 5-42). The preliminary survey also detected three large submerged magnetic anomalies in Popponesset Bay, between Popponesset Highlands and Meadow Point in Cotuit, which the Company stated "may represent an obstruction in a constrained area" (id. at 5-42 to 5-44).

The Company stated that, following selection of the submarine cable route, a more detailed underwater archeological survey will be developed in consultation with the Company's underwater archeology consultants, together with MBUAR, MHC and the ACOE (id. at 5-39). The Company stated that the archeological survey would be conducted under a permit issued by MBUAR (id.).[87]

(b) Analysis

Cape Wind has conducted a preliminary geophysical survey to identify potential underwater obstructions and cultural resources along the primary and alternative routes. This preliminary survey indicates the presence of one underwater anomaly, and no shipwrecks, in the vicinity of the primary route. Once the marine routing of the proposed transmission lines has been finalized, the Company will carry out a marine archeological survey in consultation with relevant federal and state agencies, under a permit issued by MBUAR. Accordingly, the Siting Board finds that impacts of the proposed transmission lines on marine archeological resources along the primary route would be minimized.

The Company's preliminary geophysical survey indicates the presence of a potentially significant underwater obstacle and a mapped shipwreck in the vicinity of the alternative route, as compared with one underwater anomaly, and no shipwrecks, in the vicinity of the primary route. Accordingly, the Siting Board finds that the primary route is slightly preferable to the alternative route with respect to impacts on marine archeological resources.

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[87] The MBUAR issues two types of permits: Reconnaissance Permits, to conduct non-destructive inspection and identification of underwater archeological resources, and Excavation Permits, to uncover or remove underwater archeological resources. See G.L. c. 6, §§ 179-189; G.L. c. 91, § 63; 312 CMR §§ 2.00 et seq.

ix. Navigation

(a) Primary Route

Installation of the submarine cables along the primary route will require work in Nantucket Sound and in Lewis Bay (Exh. CW-1, at 5-45). The Company stated that any impacts on recreational or commercial navigation associated with installation of the submarine cables in these areas would be temporary (because the cables would be buried at least six feet below the seabed once installed) and of limited duration (because cable installation will require only two to four weeks) (Exhs. CW-1, at 5-44, 5-45).[88] The Company stated that peak use of Nantucket Sound by recreational boaters is generally from April through October (id.).

The Company stated that there are two main shipping lanes in Nantucket Sound: the Main Channel, located south of Horseshoe Shoal, which, the Company stated, is used by most of the boats traveling through the Sound, and the North Channel, which runs along the north side of Nantucket Sound, north of Horseshoe Shoal, and which is used primarily by boats headed for the south shore of Cape Cod (id.). The Company's maps indicated that the primary route would travel within the North Channel for approximately 12,000 feet (Exhs. EFSB-T-7; EFSB-T(8), Att.). The Company stated that both the cable-laying barge and support boats would be in the North Channel for one to two days (Tr. 9, at 1167-1168). The Company stated that, in addition to the shipping channels, privately and federally maintained channels are located at the approaches to Centerville Harbor and Hyannis Harbor (Exh. EFSB-T-8(B), Att.). The Company stated that the Hyannis Harbor channel is the main navigational channel into Lewis Bay, and that no marine construction would take place within that channel (Tr. 9, at 1167).

The Company stated that approximately 91% of Horseshoe Shoal has charted water depths of 30 feet below mean lower low water ("MLLW") or less, which limits the types of

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88 The Company stated that, once the submarine cable is installed, it will be mapped and designated as a transmission line area on NOAA's National Ocean Service nautical chart for the area, and the designation will be published in the U.S. Coast Guard's Coastal Pilot and Local Notice to Mariners (Exh. CW-1, at 5-51). The Company stated that such transmission line designations do not restrict or preclude vessel traffic or general navigation in the areas where they are located (id.).

vessels that can operate in the area (Exhs. APNS-N-35, Bulk Att. at ii; EFSB-T-8(A), Att.).[89] The Company stated that the area between the Main Channel and the Cape Cod shoreline, including Horseshoe Shoal, is designated as an anchorage ground (Exh. CW-1, at 5-46).

The Company stated that passenger and freight ferries, including high-speed ferries, serving both Nantucket and Martha's Vineyard operate out of Hyannis Inner Harbor (id.). The Company provided maps indicating that, within Lewis Bay, the primary route would lie in close proximity to both ferry routes, and would cross the Nantucket route (Exh. EFSB-T-7). The Company asserted that the entrance to Lewis Bay is wide enough to allow access for its cable-laying vessel and indicated that no shallow shoals or obstructions are located there that would hinder ferry navigation (Exh. CW-1, at 5-48). The Company indicated that the work boats used for cable installation would be similar to typical fishing and recreational boats, and that the tug boats would be smaller and have lower horsepower than the ferries used in the vicinity (Exh. MA-42).

The Company indicated that the details of its marine construction would be closely coordinated with the Coast Guard and published in the Coastal Pilot, and that a Notice to Mariners would be posted as required, most likely on a daily basis (Exhs. SPB-15; CW-1, at 5-51). The Company stated that it would mitigate impacts to ferry travel by involving the Steamship Authority and private ferry operators in discussions, filing the Notice to Mariners with the Coast Guard, and maintaining radio communication during construction (Exh. EFSB-T-12). Further, all anchors and cables would be marked with construction buoys, as appropriate (id.).

(b) Alternative Route

(i) Company

Installation of the submarine cables will require work in Nantucket Sound and in Popponesset Bay (Exh. CW-1, at 44-45). Cape Wind stated that it considered all mapped

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89 The Company has prepared a Navigational Risk Assessment for the ACOE (Exh. APNS-N-35, Bulk Att.). The primary focus of the Navigational Risk Assessment is the 130 wind farm turbines, but the report contains information regarding the shallow depth of waters in the area of Horseshoe Shoal and the corresponding limitations on the size of boats able to navigate there (id. at 1-9).

navigation channels in Popponesset Bay when assessing the potential navigation impacts of submarine cable installation there (Exh.CW-CJN/SBW-2-R at 44). The Company stated that the alternative route would not cross or be located near any mapped federal channels (id. at 31). Cape Wind stated that where the jet plow crosses any privately maintained channel, the cables would be buried a minimum of 6 feet below the bottom of the channel and thus would not interfere with continued use of the channel (id.). In response to assertions by Mr. Williams, witness for Save Popponesset Bay, that jet plowing would likely cause the walls of existing channels in Popponesset Bay to slump and partially fill the channel bottom (thus reducing the navigable depth of the channel) the Company indicated that it would take into account the maintenance of existing channel depths in the design and engineering of its final work plan (id.).

Maps provided by the Company indicate that the alternative route would cross the Steamship Authority ferry route to Martha's Vineyard in federal waters (Exh. EFSB-T-7). The Company also identified a mapped channel at the entrance to Cotuit Bay (Exh. EFSB-T-8(B), Att.). Cape Wind noted that the HDD operation required to install cable below Popponesset Spit would require use of a jack-up barge, which would create a temporary navigational obstacle inside Popponesset Bay during the two to four weeks of HDD work (Exh. CW-1, at 5-50).

(ii) Intervenors

Save Popponesset Bay's witness, Mr. Williams, testified that Popponesset Bay contains "a significant network of existing and planned navigational channels" (Exh. SPB-PJW at 5 and Fig. 1). He stated that these channels are relatively narrow, and that the proposed submarine cables will cross a number of them (id. at 6). Mr. Williams stated that the fluidizing of bottom sediments by the jet plow will likely cause the slopes of the channels to slump and partially fill in the bottom of the channels at the cable crossings, thus reducing the navigable depth of the channels and restricting tidal flows (id.). Mr. Williams stated that methods to avoid and to mitigate channel side-slumping should be identified (id.). Mr. Williams also raised questions regarding how cable burial depths would be verified, noting that placement of the cables at the required depth is critical to avoid damage to the cable and vessels from groundings and anchor drag (id. at 3).

Mr. Williams stated that cable installation work in the summer months would significantly impact navigation, since the landward staging area for the HDD cable installation under Popponesset Spit would block the navigational channel used by boaters from Popponesset Creek (id. at 4; Tr. 16, at 2139-2142). In addition, Save Popponesset Bay argued that the floating cable installation process, whereby each of four cables is floated across Popponesset Bay prior to jet plowing, would block boat traffic, specifically noting that recreational boaters from Popponesset Island and Popponesset Creek could not access Nantucket Sound (SPB Brief at 11).

(c) Analysis

The record indicates that significant commercial and recreational boating occurs in Nantucket Sound, including Lewis Bay and Popponesset Bay and other areas off the southern shores of Cape Cod. Installation of the Company's proposed submarine cables along either the primary or alternative route therefore can be expected to have impacts on navigation in this area while marine construction is taking place.

With respect to testimony that jet plowing may cause "slumping" of navigational channels at cable-crossings, Cape Wind has stated that it will include the maintenance of current channel depths in the Company's marine construction work plans.

The record indicates that marine construction of approximately 12,000 feet of the primary route would take place directly within the North Channel, and that the primary route would cross the path of the Nantucket ferries. The Company has indicated that its marine construction activities would be closely coordinated with the Coast Guard, the Steamship Authority and private ferry operators. This consultation should be effective in minimizing impacts on much of the existing commercial navigation in Lewis Bay. However, to help ensure that potential navigational impacts on all individuals or groups, including commercial fishermen and recreational boaters, would be avoided or minimized, the Siting Board directs the Company to also consult with the Harbormasters of the Towns of Barnstable and Yarmouth, in order to coordinate the scheduling of marine construction activities, or to arrange other mitigation measures. With the implementation of this consultation condition, the Siting Board finds that navigational impacts of the proposed transmission lines along the primary route would be

minimized.

The record indicates that, because of its shallow depths and narrow entrance (300 feet), Popponesset Bay is more navigationally constrained than Lewis Bay. While the record does not indicate the duration of the proposed floating-cable installation work in Popponesset Bay, it appears possible that this work could significantly, or even entirely, obstruct navigation through the bay, particularly for boaters attempting to leave from or return to Popponesset Island and Popponesset Creek. The exact location of the jack-up barge in relation to the entrance to the Popponesset Bay is not in evidence; therefore, it is not possible to determine whether boaters would, or would not, be able to navigate around it. However, at a minimum, it appears likely that the presence of the barge in the vicinity of the narrow entrance to the bay for a period of several weeks would impair navigation in the area to some degree. Consequently, the Siting Board finds that the primary route is preferable to the alternative route with respect to navigational impacts.

x. Conclusions on Marine Construction Impacts

In Sections III.C.2.a.ii to ix, above, the Siting Board has found that: (1) impacts associated with disturbance of marine sediments along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to disturbance of sediments; (2) with implementation of the eelgrass documentation condition, eelgrass impacts of the proposed transmission lines along the primary route would be minimized, and that the alternative route would be preferable to the primary route with respect to eelgrass impacts; (3) shellfish impacts of the proposed transmission lines along the primary route would be minimized, and that the primary and alternative routes would be comparable with respect to shellfish impacts; (4) impacts of the proposed transmission lines on fish would be minimized, and that the primary route would be preferable to the alternative route with respect to fish impacts; (5) impacts of the proposed transmission lines on protected marine species would be minimized, and that the primary and alternative routes would be comparable with respect to protected marine species impacts; (6) with implementation of the protected birds condition, impacts of the proposed transmission lines on protected coastal shorebirds would be minimized, and that the primary route would be preferable to the alternative route with respect to protected

bird impacts; (7) impacts of the proposed transmission lines on marine archeological resources along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to marine archeological impacts; and (8) with implementation of the navigation condition, impacts of the proposed transmission lines on navigation along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to navigation impacts. Accordingly, the Siting Board finds that, with the implementation of the stated conditions, the marine construction impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to marine construction impacts.

b. Land Construction Impacts

In this section, the Siting Board reviews the environmental impacts associated primarily with construction of the land portion of the proposed transmission lines. These impacts include impacts on wetlands and water resources, land resource impacts, traffic impacts, and noise impacts.

i. Wetlands and Water Resources

(a) Primary Route

The Company stated that the proposed project along the primary route would result in temporary alterations to areas subject to protection under the Massachusetts Wetlands Protection Act, the Barnstable Wetlands Protection Ordinance, and the Yarmouth Wetlands Protection By-Laws and Regulations (Exh. YAR-7). In addition to coastal wetlands located at or near the New Hampshire Avenue landfall (see Section III.C.2.a.ii(a), above), the Company identified six inland resource areas located within 100 feet of the primary route (Exhs. EFSB-W-15; EFSB-SS-22-S, Att. at 5-52 to 5-55). The Company stated that the inland resource areas include vegetated wetlands, ponds, brooks, and Riverfront Areas (Exh. CW-1, at 5-31 to 5-32).[90] The Company indicated that the NSTAR ROW lies within the 100-foot buffer zone of one of the inland

[90] Temporary impacts to the 200-foot Riverfront Area would affect approximately 0.08 acres (Exh. EFSB-W-19).

wetlands; however, there are no wetlands, streams, or water resources within the NSTAR ROW (Exh. EFSB-W-15; Tr. 6, at 743).

The Company stated that any impacts to wetland resource areas would be temporary, and asserted that impacts to inland wetlands would be avoided by installing the transmission lines in paved streets and maintained ROWs, and avoiding regulated culverts during construction (Exhs. EFSB-W-19; YAR-16). The Company stated that all areas disturbed by trenching and installation of the underground lines would be backfilled and restored to existing conditions (Exh. YAR-7). In addition, indirect impacts to down-gradient salt marsh and inland wetlands would be avoided by the installation of erosion and sediment controls prior to construction (id.; Exh. YAR-16).

The Company asserted that construction of the proposed transmission lines would not result in changes to surface or groundwater hydrology (Exh. EFSB-L-10). Cape Wind has agreed to provide the Town of Yarmouth Department of Public Works ("DPW") with documentation showing that its transmission lines would not degrade or cause galvanic corrosion to the Town's water system along the route (Exh. CW-CO-2, at 4).

The primary route travels through the Zone I wellhead protection areas of three public water supply wells (Exh. CW-1, at 5-9).[91] MDEP has stated that it would typically prefer that utilities be installed outside of Zone I areas; however, the Company noted that MDEP staff have indicated they would allow the installation as long as alternative routes have been evaluated and the areas affected were minimized to the extent possible (Exh. EFSB-L-12). The Town of Yarmouth has agreed to allow the installation of the transmission lines through any designated Zone I areas, subject to Cape Wind complying with the applicable MDEP laws and regulations and receiving authorization from the MDEP regarding the Zone I wellhead protection regulations (Exh. CW-CO-2, at 2, 4).

The primary route also crosses through MDEP Zone II wellhead protection areas,

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[91] The Company stated that the Zone I area is the area within a 400-foot radius around a well that pumps more than 100,000 gallons per day (Exhs. CW-1, at 5-9; EFSB-L-12).

(Exhs. CW-1, at 5-9; EFSB-L-12).[92] The Company stated none of the restrictions for siting various land uses within Zone II areas would affect the proposed project along the primary route (Exh. EFSB-L-12).

The northern portion of the primary route (north of Jabinette's Pond) would be located within a zone of contribution to the Town of Yarmouth's water supply wells and aquifer protection district (Exhs. CW-1, at 5-7; EFSB-L-9). The boundaries of the aquifer protection district are based upon the delineation of the zones of contribution to public supply wells, pursuant to the Yarmouth Zoning By-laws (Exh. EFSB-L-9). The Company stated that prohibited uses in the aquifer protection district are typically those associated with the discharge of contaminated waters and hazardous materials (id.).

(b) Alternative Route

The Company stated that, in addition to wetlands located in or near the Mashpee Town Landing landfall (see Section III.C.2.a.ii(b), above), the alternative route along the NSTAR ROW would pass through 13 inland wetlands, the 100-foot buffer zone of two wetlands, and the Riverfront Area of four perennial streams (Exhs. CW-1, at 5-34; EFSB-W-27). The Company acknowledged that limited temporary and permanent impacts to wetlands, wetland buffer zones, and Riverfront Areas likely would result from the placement of utility poles, construction of access roads, and vegetative clearing associated with construction of the proposed transmission lines along the alternative route (Exh. EFSB-W-29). In particular, the Company stated that some construction would involve work in various wetland buffer zones (Tr. 6, at 805). The Company asserted that it would attempt to avoid placing poles in wetlands by spanning the wetlands along the alternative route; nonetheless, pole installation is expected to result in minimal but permanent filling in of wetlands, wetland buffer zones, and Riverfront Areas (Exhs. EFSB-W-29; EFSB-W-30; Tr. 6, at 806).

The alternative route travels through the Zone I wellhead protection areas of four public

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92 The Company stated that the Zone II area is that area of an aquifer that contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (Exhs. CW-1, at 5-9; EFSB-L-12).

water supply wells but does not enter the Zone II area of any well (Exh. CW-1, at 5-9).

(c) Analysis

The record demonstrates that the primary route would enter wetland buffer zones and a regulated Riverfront Area as it travels in paved roadways and along the existing NSTAR ROW. With regard to groundwater and the associated wellhead protection areas, the Company would adhere to applicable MDEP regulations before constructing in any designated Zone I area. Based on the limited encroachment into wetland buffer areas and Riverfront Area, the use of paved roadways, and the adherence to regulations concerning wellhead protection areas, the Siting Board concludes that construction of the proposed facilities along the land portion of the primary route, in the street and in the NSTAR ROW, would result in no permanent impacts, and only minimal temporary impacts, to water resources. Consequently, the Siting Board finds that the wetlands and water resource impacts of the proposed transmission lines along the primary route would be minimized.

The alternative route traverses 13 inland wetlands, four of which are associated with perennial streams and adjacent Riverfront Areas. While the Company will attempt to avoid impacts to these wetlands, it may be necessary to place a limited number of poles in wetlands, resulting in permanent impacts. In addition, construction of access roads along the 12.2-mile length of the NSTAR ROW may result in temporary or permanent wetland impacts. These temporary and permanent impacts exceed the very limited temporary impacts to wetlands buffer zones associated with construction along the primary route. The record indicates that construction impacts on groundwater and hydrology along the primary and alternative routes would be comparable. Overall, the Siting Board finds that the primary route would be preferable to the alternative route with respect to wetlands and water resource impacts.

ii. Land Resources

(a) Primary Route

The Company asserted that the primary and alternative routes are configured to use existing developed or disturbed landscapes, thereby eliminating or reducing temporary and

permanent impacts to vegetative cover (Exh. CW-1, at 5-11). The Company also asserted that impacts to natural communities resulting from the installation of the proposed transmission lines would be minimal as the line is to be located below grade, within streets and existing ROWs (Exh. YAR-6).

According to the NHESP, the in-street portion of the primary route crosses three Priority/Estimated Habitats containing nine state-listed plant and four state-listed wildlife species (Exhs. CW-1, at 5-12; EFSB-L-21; EFSB-RR-34; Tr. 6, at 791).[93] The Company stated that impacts to these species would be minimal since the transmission lines would be located in previously disturbed areas, and stated that it would work in coordination with the Yarmouth and Barnstable Conservation Commissions, the MDEP and the NHESP to ensure that listed species would not be affected (Exh. CW-1, at 5-14 to 5-15; Tr. 6, at 791). According to the USFWS, there are no federally-listed or proposed threatened or endangered species located in or along the proposed route (Exhs. CW-1, at 5-14 to 5-15; EFSB-L-21).

The Company stated that because the primary route would be located entirely in streets and along an existing NSTAR ROW, minimal tree clearing would be required and the potential for damage to trees during construction would be limited (Exh. EFSB-L-1). The Company stated that clearing along the NSTAR ROW would consist of limited trimming of branches that may have grown into the ROW, and removal of trees located mainly at the point where the route joins the NSTAR ROW (id.; Tr. 6, at 723).

The Company stated that it conducted a terrestrial reconnaissance archeological survey ("reconnaissance survey") of the land portions of the primary and alternative routes; this survey consisted of a review of background information and a walkover survey by archeologists

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93 The nine plant species are: quill-leaf arrowhead (*Sagittaria teres*); redroot (*Lachnanthes caroliana*); inundated beakrush (*Rhyncospora inundata*); long-beaked bald-rush (*Rhyncospora scirpoides*); Wright's panic-grass (*Dichanthelium wrightianum*); Commons' panic-grass (*Dichanthelium commonsonianum*); Mattamuskeet panic-grass (*Dichanthelium mattamuskeetense*); pondshore knotweed (*Polygonum puritanorum*); and Plymouth gentian (*Sabatia kennedyana*) (Exh. CW-1, at 5-12). The four animal species are: comet darner (*Anax longipes*); New England bluet (*Enallagma laterale*); Pine Barrens bluet (*Enallagma recurvatum*); and water-willow stem borer (*Papaipema sulphurata)* (id.).

(Exhs. EFSB-SS-22-S2, at 4; EFSB-L-24).[94] The reconnaissance survey found no previously recorded archeological sites or historic properties within the anticipated area of physical disturbance along the primary route (Exh. EFSB-SS-22-S2, at 10 and App. 5-E at 2). However, three clusters of documented historic buildings are located in the vicinity of the route; two of these clusters are located directly along the route (Exh. EFSB-SS-S2, at 8).[95] The Company indicated that it does not anticipate any impact to these properties as a result of the construction of the proposed transmission lines (Tr. 6, at 816).[96]

The Company indicated that although New Hampshire Avenue extends to the water's edge, the landfall is not a public boat landing, and is accessible only to pedestrians (Exhs. CW-1, at 4-4; EFSB-L-32). A town beach, known as Englewood Beach, is located off of the east side of New Hampshire Avenue (Exh. YAR-19).

The Company stated that the proposed construction in the coastal zone, which includes certain marine and land portions of the primary route, would require a consistency review under the CZM program (Exh. CW-1, at 1-14 to 1-16). As discussed in Section III.C.2.a.ii, above, the Company asserted that the proposed transmission lines would be a "coastally dependent" use of the coastal zone, as defined for CZM program purposes (id.). The Company also indicated the siting of the proposed transmission lines would be consistent with CZM program policies relevant to any land use impacts of the project, including Public Access Policy #1, which relates

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94 A reconnaissance survey is used to determine the scope of an intensive locational archeological survey, which is conducted under permitting from the State Archaeologist (Exh. EFSB-SS-22-S2, at 4, 5). In August, 2003, the Company indicated that it expected the intensive archeological survey to be undertaken within several months (Tr. 6, at 817). As of the close of the record, the Siting Board had not received results of the intensive survey (Exh. EFSB-RR-36).

95 These clusters include: (1) four buildings along Route 28/Main Street at the intersection of Berry Avenue and Higgins Crowell Road; (2) six buildings along Berry Avenue, north of the landfall and south of Route 28; and (3) four buildings along Route 28/Main Street near Camp Street, located west of the route (Exh. EFSB-SS-22-S2, at 8).

96 The Company noted that it has not identified on which side of the street the historic buildings are located (Tr. 6, at 816). The proposed alignment of the transmission line lies on the east side of Berry Avenue and continues along the east side crossing Route 28 onto Higgins Crowell Road (Exh. EFSB-SS-1).

to existing public recreation sites, and Protected Areas Policy #3, which relates to designated or registered historic districts and sites (id. at 5-4, 5-5). The Company stated that, because the proposed transmission lines are sited underground in the public way, they would not adversely affect the Englewood Beach recreation area or identified historic sites adjacent to the primary route along New Hampshire Avenue (id.).

(b) Alternative Route

In addition to Priority/Estimated Habitat on Popponesset Spit (see Section III.C.2.a.ii(b), above), the NHESP has determined that the alternative route along the NSTAR ROW would traverse one vernal pool, located in the area of Old Mill Road and the Quaker River in Mashpee, and one Priority/Estimated Habitat, located in the area around Hathaway Ponds in Barnstable (Exhs. CW-1, at 5-16; EFSB-SS-3B). No federally listed or proposed threatened or endangered species are known to occur on or immediately adjacent to the NSTAR ROW (Exh. EFSB-L-21).

The Company stated that construction of the proposed transmission lines along the alternative route would require clearing an additional 60 feet of the NSTAR ROW between the Mashpee Substation and Shootflying Hill Road, a distance of approximately 8.5 miles (Exh. EFSB-L-27; CW-1, at Figs. 4-3, 4-3a; Tr. 6, at 724). Additional clearing would not be required along the ROW between Shootflying Hill Road and the Barnstable Switching Station, as the proposed transmission lines would be placed between two existing transmission lines located in the ROW (Tr. 6, at 724-725).

The reconnaissance survey found three recorded archeological sites within or in immediate proximity to the alternative route (Exh. EFSB-SS-22-S2, App. E at 3). The Company reported one previously recorded ancient Native American archeological site within or adjacent to the anticipated area of disturbance (Exh. EFSB-L-24). The Company noted that the boundaries of the archeological site have not yet been delineated; consequently, its extent and exact location are not known (id.). The Company stated that, if avoidance of the area is not an option, additional field studies may be undertaken to refine the boundaries of the site and to gather further data on the site (Exh. EFSB-L-35). The archeological reconnaissance report concluded that overall, the alternative route possesses a higher archeological sensitivity than the

primary route, due to the longer length of the route and its proximity to more known prehistoric and historic archeological sites (Exh. EFSB-SS-22-S2, App. E at 4).

(c) Analysis

The record demonstrates that the land resource impacts of the proposed transmission project along the primary route would be temporary and minimal due to the placement of the transmission lines under streets and along the existing NSTAR ROW. The Company has stated that it would work with the Yarmouth and Barnstable Conservation Commissions, the MDEP and the NHESP to ensure that any potential impacts to rare or endangered species are minimized.

With regard to the clusters of historically significant homes, the Siting Board notes that the largest cluster, six homes, is located directly along the primary route. The Company has not identified on which side of Berry Avenue the homes are located, or whether the MHC or the Town of Yarmouth would require special construction techniques or other measures to avoid impacts to the homes. The Siting Board encourages the Company to work in collaboration with the MHC and the Town of Yarmouth on the placement of the transmission lines relative to the homes along Berry Street to avoid construction impacts on the properties from the installation of the ductbank. Accordingly, the Siting Board finds that the land resource impacts of the proposed transmission lines along the primary route would be minimized.

The record indicates that construction of the proposed transmission project along the alternative route would require the clearing of a 60-foot wide, approximately eight-mile long, portion of the NSTAR ROW. In contrast, construction along the primary route would not require any tree clearing, with the exception of minimal trimming of trees and brush at isolated locations. The record indicates that impacts to endangered or protected species along the land portion of the primary and alternative routes would be minimal, because the limited number of mapped priority areas are located in proximity either to paved streets or to the previously disturbed NSTAR ROW. Finally, a previously recorded ancient Native American archeological site has been identified near the alternative route landfall location. Construction of the landfall at that location may require significant mitigation; alternately, the landfall may need to be relocated. In light of the potential impacts to an archeological site, and the significant tree clearing required along the

alternative route, the Siting Board finds that the primary route would be preferable to the alternative route with respect to land resources impacts.

iii. Traffic

(a) Primary Route

Cape Wind stated that construction of the proposed transmission lines along the primary route would result in temporary traffic impacts (Exh. CW-1, at 5-44). The Company stated that the transmission lines would be located within and along New Hampshire Avenue, Berry Avenue, Higgins Crowell Road and Willow Street, which are owned and maintained by the Town of Yarmouth; in addition, the transmission lines would cross Route 28 and Route 6, which are owned and maintained by the Massachusetts Highway Department (id. at 5-46). The Company indicated that, during the construction period, the width of roadway available to traffic would be limited to approximately 18 to 22 feet, and that construction of the ductbank would progress approximately 150 feet a day over the five-month period (id. at 5-44 to 5-45).[97] Cape Wind indicated that it would use an HDD under Route 6 to prevent traffic disruption (Tr. 6, at 798). Cape Wind noted that traffic could be routed around construction activity on most of New Hampshire Avenue via streets that connect to Berry Avenue and New Hampshire Avenue with access to Route 28 (Exh. EFSB-RR-28). The Company also indicated that it would need to close the portion of New Hampshire Avenue between the landfall and Shore Road while landfall construction takes place; however, it asserted that this portion of New Hampshire Avenue is not heavily traveled (Tr. 6, at 755). In addition, the Company noted that construction on New Hampshire Avenue would not affect most traffic destined for Englewood Beach, a nearby town beach with parking access from New Hampshire Avenue, since on-land construction would not take place during the summer traffic season (Exh. YAR-19).

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[97] The land portion of the proposed transmission lines would be installed in two phases. Phase I, which would last for five months, would involve excavation to install the ductbank; Phase II, which also would last for five months, would involve the installation of the cables through the ductbank, and would require minimal excavation (Exh. EFSB-T-6).

Cape Wind and the Town of Yarmouth have entered into a Host Community Agreement which addresses a number of traffic-related issues (Exh. CW-CO-2). Cape Wind has agreed to avoid construction along the Yarmouth streets and the portion of the NSTAR ROW in Yarmouth between Memorial Day and Labor Day, with limited exceptions – Yarmouth may allow construction through June 15 subject to the consent of the Yarmouth DPW, and may allow work on Higgins Crowell Road in the summer months if the Town also is performing work on Higgins Crowell Road at that time (id.; Tr. 6, at 714).[98] Cape Wind also has agreed to provide street improvements for Higgins Crowell Road, Berry Avenue and New Hampshire Avenue, including widening Higgins Crowell Road (Exh. CW-CO-2).

Cape Wind stated that it would develop a Traffic Management Plan in consultation with Yarmouth once the route for the transmission line is finalized (Exh. EFSB-T-10). The Traffic Management Plan would address signage, police details, maintenance of ingress and egress from off-street facilities, temporary markings, barriers, and other traffic control measures, notification of construction schedules and locations, coordination with other public works projects, and pedestrian safety (id.; Exh. EFSB-T-11). The Company noted that as part of the Traffic Management Plan, it would work with Town officials and school administrators to identify school bus stops and pedestrian routes that might be affected by construction, and to ensure that they would be kept open and safe during the construction period (Exh. EFSB-T-11).

(b) Alternative Route

Cape Wind stated that the in-street segments of the alternative route would be located within and along Mashpee Neck Road, Quinaquisset Avenue, and Orchard Road, all of which are owned and maintained by the Town of Mashpee (Exh. CW-1, at 5-48). The Company noted that Mashpee Neck Road is a residential road and is not a route to Popponesset Beach; consequently, the Company expects traffic impacts to be the same throughout the year (Tr. 6, at 720). However, Cape Wind noted that the Cape Cod Commission has requested that there be no

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[98] Approximately 90% of the NSTAR ROW is located in Barnstable, and there are no seasonal construction restrictions for that portion of the ROW (Exh. EFSB-2(e), Att.; Tr. 6, at 714).

construction in roadways during the summer months; it therefore expects that in-street construction along the alternative route would be subject to restrictions similar to those for construction along the primary route (id. at 719).

The Company asserted that construction techniques and mitigation methods would be identical for the primary and alternative routes (Exh. CW-1, at 5-49). However, it indicated that since the in-street portion of the primary route, at 4 miles, is longer than that of the alternative route, at 1.9 miles, it would require more intersection crossings and additional construction time (id.).

(c) Analysis

The record demonstrates that construction of the proposed transmission lines along the primary route has the potential to create temporary traffic impacts on Higgins Crowell Road, Berry Avenue and New Hampshire Avenue. These impacts would be mitigated in part by scheduling construction outside the summer peak travel period. The Company has provided a list of issues that would be addressed in a Traffic Management Plan, including mitigation measures to address the safety of pedestrian, bus, and vehicular traffic to the two elementary schools located on Higgins Crowell Road. The Company has agreed to work with Town of Yarmouth officials and school administrators to identify specific measures to further mitigate traffic impacts, but has not yet provided a draft of the Traffic Management Plan for the proposed project. The Siting Board notes that it is crucial that the Company and the Town of Yarmouth develop a workable Traffic Management Plan in a time frame that allows for notification to residents and businesses. Consequently, to ensure that all outstanding issues can be resolved in a timely fashion, the Siting Board directs the Company to submit a draft Traffic Management Plan to Yarmouth officials and school administrators at least six months prior to the commencement of construction. The Siting Board finds that, with the implementation of this condition, the construction traffic impacts of the proposed transmission lines along the primary route would be minimized.

The record indicates that traffic impacts during construction along either the primary or the alternative route would be temporary, and that proposed mitigation would be similar and

addressed through Traffic Management Plans developed in consultation with the respective host towns. However, the in-street portion of the primary route, at four miles long, is twice the length of the in-street portion of the alternative route; the primary route therefore would require a longer period of in-street construction. In addition, the in-street portion of the alternative route is somewhat less traveled than the primary route. Accordingly, the Siting Board finds that the alternative route would be preferable to the primary route with respect to construction traffic impacts.

iv. Noise

(a) Primary Route

The Company indicated that the only noise associated with the transmission project would be noise from construction (Exh. CW-1, at 5-66). The Company stated that land-based construction activities would include excavation, construction, and the movement of construction vehicles, and that these activities would be audible near the cable route (id.; Exh. EFSB-L-31).

The Company indicated that along the primary route in Barnstable and Yarmouth, 260 residences are located within 50 feet of the center of the proposed ductbank, in streets, or within 50 feet of the edge of the NSTAR ROW (Exh. EFSB-L-7). The Company further stated that the residences abutting the public ways generally are located approximately 30 feet from the street (id.). The primary route also passes two schools on Higgins Crowell Road: the Mattacheese Middle School and the Marguerite E. Small School (Exh. CW-1, at 4-6).[99]

The Company stated that construction noise mitigation would consist of scheduling all work during the daytime hours, ensuring that all construction equipment and trucks have properly functioning noise mufflers, minimizing equipment idling, and either shielding equipment or locating the equipment away from sensitive receptors (Exhs. CW-1, at 5-67; EFSB-L-31).

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[99] The Company stated that the centerline of the primary route would be approximately 870 feet from the nearest building at the Mattacheese School, 400 feet from the nearest public area, and 100 feet from the nearest playground or field (Exh. EFSB-L-7; Tr. 6, at 745). At the Marguerite E. Small School, the centerline would be approximately 275 feet from the nearest building, 150 feet from the nearest public area, and 100 feet from the nearest playground or field (Exh. EFSB-L-7; Tr. 6, at 745).

(b) Alternative Route

The Company stated that land construction activities along the alternative route would include HDD, excavation, construction, and the movement of construction vehicles (Exhs. EFSB-L-31; CW-1, at 5-66). The Company indicated that HDD operations at the Mashpee Town Landing landfall would operate for 20 to 24 hours a day, producing noise on a continuous basis (Tr. 10, at 1329). As discussed further in Section III.C.2.d, below, the Company stated that noise levels associated with the HDD rig (a maximum sound level ("L_{max}") of 78 dBA at 50 feet) are comparable to those for the excavators and backhoes (80 to 84 dBA at 50 feet) (Exhs. EFSB-L-31; EFSB-SS-S at 5-124). The transition vault, situated within the HDD staging area, would be located approximately 100 feet from the nearest two residences, one southwest and one northeast of the transition vault (Exhs. EFSB-SS-1B; EFSB-RR-27).

(c) Analysis

The record demonstrates that the noise impacts of the proposed project along the primary route would be limited to temporary noise impacts associated with construction activities. Construction noise impacts would be minimized by confining work to daytime hours. Further mitigation for construction noise includes employing proper muffling and idling limitations on construction equipment, as well as shielding and placement of construction equipment. The Siting Board notes that the noise mitigation measures proposed by the Company, consisting of limiting construction to daytime hours, installing muffling, adhering to idling restrictions, and using shielding and optimal placement of the construction equipment, would be consistent with approaches to mitigation that the Siting Board has accepted in past cases. The Siting Board finds that the construction noise impacts of the proposed transmission lines along the primary route would be minimized.

The noise impacts of the proposed project along the alternative route also would be limited to temporary noise impacts associated with construction activities, and the same mitigation measures would be employed. However, the Company expects it would use HDD, rather than jet-plowing, at the Mashpee Town Landing landfall. The record indicates that construction noise associated with HDD can be significant, and that HDD operations would

continue for 20 to 24 hours per day. Accordingly, the Siting Board finds that the primary route would be preferable to the alternative route with respect to noise impacts.

v. Conclusion on Land Construction Impacts

In Sections III.C.2.b.i to iv, above, the Siting Board has found that: (1) the wetlands and water resource impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to wetlands and water resource impacts; (2) the land resource impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to land resources impacts; (3) with the implementation of the proposed condition, the construction traffic impacts of the proposed transmission lines along the primary route would be minimized, and that the alternative route would be preferable to the primary route with respect to construction traffic impacts; and (4) the construction noise impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to noise impacts. Accordingly, the Siting Board finds that with the implementation of the stated condition, the land construction impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to land construction impacts.

c. Permanent Impacts

In this section, the Siting Board reviews the permanent environmental impacts associated with the construction and operation of the proposed transmission lines. These impacts include land use and visual impacts, and electromagnetic frequency impacts.

i. Land Use and Visual Impacts

(a) Primary Route

The transmission lines along the primary route would make landfall at New Hampshire Avenue, and would travel underground for four miles in existing public ways through residential

and commercial areas in Yarmouth, until they intersect with the NSTAR ROW; the lines then would travel underground for 1.9 miles along the NSTAR ROW until they reach the Barnstable Switching Station (Exh. CW-1, at 1-4, 5-7). The Company asserted that views of the existing transmission lines on the NSTAR ROW would not change, as there would be minimal tree clearing along the route (Tr. 6, at 723).

The Company indicated that along the primary route in Barnstable and Yarmouth, the zoning is predominantly residential, with the exception of the intersection of Route 28 and Berry Avenue, which is developed with small businesses and zoned B2 (Exh. CW-1, at 5-7). The Company stated that 260 residences are located within 50 feet of the center of the proposed ductbank, in streets, or within 50 feet of the edge of the NSTAR ROW (Exh. EFSB-L-7). The primary route also passes two schools on Higgins Crowell Road: the Mattacheese Middle School and the Marguerite E. Small School (Exh. CW-1, at 4-6).

The Company indicated that with use of the primary route, permanent impacts to inland wetland resources would be avoided by installing the transmission lines in paved streets, and along an alignment in the NSTAR ROW that would include no wetland crossings (Exhs. EFSB-W-19; YAR-16). The alignment also would avoid any impact on Englewood Beach, a Town recreation area located off of the east side of New Hampshire Avenue (Exh. YAR-19).

(b) Alternative Route

The transmission lines along the alternative route would make landfall at the Mashpee Town Landing on Mashpee Neck Road, and would travel for 1.9 miles in existing public ways through residential areas in Mashpee, until they intersect with the NSTAR ROW, where one of the lines would terminate; the remaining line then would travel overhead along the NSTAR ROW through residentially-zoned areas for 12.3 miles (Exh. CW-1, at 1-13, 5-7). The Company indicated that much of the NSTAR ROW runs through residential back yards and side yards (Tr. 6, at 729-731). Overall, 94 residences (all in Mashpee) would be located within 50 feet of the center of the proposed ductbank, in a street, while 401 residences (36 in Mashpee and 365 in Barnstable) would be located within 50 feet of the edge of the NSTAR ROW (Exh. EFSB-

RR-26).

As discussed in Section III.C.2.b, above, the Company expects to clear approximately 60 feet of currently-vegetated ROW along the eight miles of ROW between the Mashpee Substation and Shootflying Hill Road, leaving approximately 40 feet of ROW nearest the northern edge uncleared (Exh. EFSB-L-27; Tr. 6, at 733-734).[100] This portion of the ROW is 210 feet wide and is occupied by two transmission lines – the 23 kV 88 Line, located approximately 35 feet from the southern edge of the ROW, and the 115 kV Line 115, located approximately 75 feet from the southern edge of the ROW (Exh. EFSB-L-2; Tr. 6, at 726). The new transmission line would be located approximately 130 feet from the southern edge of the ROW (Exh. EFSB-L-2). The Company acknowledged that views of the existing transmission lines from some of the residences along the northern edge of the NSTAR ROW are presently screened by woods, and stated that, after the ROW is cleared, some residences may have open views of the transmission lines in the ROW, while views from other residences may continue to be screened (Tr. 6, at 729). The Company indicated that the new transmission line would be mounted on single wooden pole structures, while the existing Line 115 is mounted on wooden double pole H-frame structures (Exh. EFSB-L-2).

The Company stated that use of the alternative route would require the construction of a new riser station on a 50-by-100 foot cleared area at the Mashpee Substation at the intersection of Orchard Road and Route 28 (Exh. CW-1, at 1-13; Tr. 6, at 736, 744;). The Company asserted that the visual impact of the riser station would be minimal, since it would be located within the 10-acre substation property (Tr. 6, at 737). However, the Company acknowledged that some areas to the south of the ROW may have views of the riser station, since there is not much vegetation along the southern boundary of the parcel (id. at 738).

The Company stated the alternative route along the NSTAR ROW would pass through 13 inland wetlands and the Riverfront Area of four perennial streams (Exhs. CW-1, at 5-34; EFSB-W-27). The Company acknowledged that limited permanent impacts to wetlands and

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[100] The Company stated that the vegetation along the northern edge of this portion of the ROW varies in height and density, from low-growing wetland species to dense woods (Tr. 6, at 727-728).

Riverfront Areas along the alternative route likely would result from construction of the proposed transmission lines, including installation of utility poles and access roads (Exh. EFSB-W-29). The Company asserted that it would attempt to avoid placing poles in wetlands by spanning the wetlands along the alternative route; nonetheless, pole installation is expected to result in minimal but permanent filling in wetlands and Riverfront Areas (id.; Exh. EFSB-W-30; Tr. 6, at 806).

(c) Analysis

The record demonstrates that construction of the transmission lines along the primary route would not result in any permanent visual impacts, because the transmission lines would be installed underground, within streets and the NSTAR ROW.[101] Removal of vegetation along the NSTAR ROW would be limited to minimal trimming of branches and brush. In addition, with use of the primary route, the proposed transmission line project would include no siting through inland wetlands or through Riverfront Area except within paved roadway. Accordingly, the Siting Board finds that the land use and visual impacts of the proposed transmission lines along the primary route would be minimized.

With use of the alternative route, the new transmission line would run overhead along the NSTAR ROW, which accounts for much of the route. Additionally, construction along the NSTAR ROW would require substantial clearing of existing trees and vegetation. The record demonstrates that the NSTAR ROW passes through the back and side yards of numerous homes, many of which may be directly affected by the removal of vegetation which screens views of the transmission lines located in the ROW. The Company has acknowledged the increase in open views of the existing and proposed transmission lines.

Overhead transmission line construction along the alternative route's NSTAR ROW also would traverse numerous wetlands and Riverfront Areas. While many of these resources likely

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[101] As part of the consistency review under the CZM Program, any land use impacts of the transmission lines will be reviewed for consistency with applicable CZM policies, including Public Access Policy #1 and Protected Areas Policy #3 (see Section III.C.2.b.ii, above).

could be spanned, some displacement of resource areas for placement of transmission line poles is expected. Accordingly, the Siting Board finds that the primary route would be preferable to the alternative route with respect to land use and visual impacts.

ii. Electric and Magnetic Fields

In this section, the Siting Board reviews the potential impacts of electric and magnetic fields ("EMF") associated with the proposed transmission lines.

(a) Primary Route

The Company conducted an assessment of existing measured and predicted future magnetic fields[102] associated with the proposed 115 kV transmission lines, for both an average wind farm output of 168 MW and a maximum wind farm output of 420 MW (Exh. EFSB-E-3, Att. at 12). In addition, the Company provided revised predictions of magnetic field levels assuming a higher peak wind farm output of 454 MW and a modified circuit configuration (Exh. EFSB-E-3-S; Tr. 10, at 1361-1363, 1370).[103] The Company asserted that, although the higher output would increase magnetic field levels, the new circuit configuration would have a cancelling effect, resulting in magnetic field levels that are either the same as those calculated for a 420 MW output, or lower by 0.5 to 1.0 milligauss ("mG") (Tr. 10, at 1363-1364, 1371).

The Company's modeling indicated that the new transmission lines laid in streets would generate maximum above-ground magnetic fields of approximately 6 mG for a wind farm output

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[102] The Company stated that, because the proposed transmission lines would be effectively contained within a grounded metallic shielding, electric fields associated with the cable would be negligible (Exh. CW-1, at 5-54). Further, the operating voltage of NSTAR's existing overhead transmission and distribution lines would not be changed by the addition of the proposed facilities; therefore, the existing electric field would not change (id.). Consequently, the Company performed no measurements or modeling of the electric fields which would be produced by the proposed transmission lines (id.).

[103] The circuits were reconfigured from 14 circuits to 16 circuits to allow for an additional fiber optic circuit (Exh. EFSB-E-3-S). The arrangement changed from a seven-over-seven configuration to an eight-over-eight configuration, with a more centralized array as the cables are now on the interior six conduits of the duct bank (id.; Tr. 10, at 1362).

of 168 MW and 16 mG for an output of 454 MW (Exh. EFSB-E-3-S). Maximum magnetic fields under the new transmission lines in the NSTAR ROW were modeled as 15 mG for a 168 MW output, and 42 mG for a 454 MW output (id.).

In order to assess the effect of these magnetic fields, the Company measured existing ambient magnetic field levels at various points along the route and calculated the combined magnetic fields from existing sources and the new transmission lines. The Company measured maximum existing field levels ranging from 4 mG to 34 mG at peak loads along public ways (Exh. EFSB-E-3, at 9). These field levels would increase to between 8 and 32 mG with the wind farm output at 168 MW, and to between 17 and 32 mG with the wind farm output at 420 MW (Exh. EFSB-E-3, Bulk Att. at 13).

The Company measured existing field levels along the NSTAR ROW ranging from a maximum of 127 mG directly under the lines, to 56 mG at the north edge of the ROW and 12 mG at the south edge of the ROW (Exh. EFSB-E-3, Bulk Att. at 15). The combined magnetic fields for the existing overhead lines and the new underground lines would remain at 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, under either wind farm output level (id.). The Company noted that the magnetic field impact of the proposed transmission lines would be negligible because the fields from the existing overhead lines would overshadow the fields created by the new underground transmission lines (id.). Finally, the Company noted that the existing measured field strength directly under the lines in front of the Marguerite E. Small School (5 mG, or 9 mG at peak load), would not be affected by construction of the proposed transmission lines (Exh. CW-1, at 5-55).

The Company asserted that magnetic field impacts of the proposed transmission lines both along the street and at the edge of the NSTAR ROW would be minimized through optimal phase arrangement (Company Brief at 201). The Company stated that it would normally operate the wind farm with both 115 kV cable circuits energized, and that the power would flow equally between the two circuits (Exh. EFSB-E-1). The cables of each circuit would be arranged in a delta configuration with reverse phasing of the conductors (Exh. EFSB-E-4).

The Company noted that the existing magnetic field levels at the edge of the NSTAR ROW are less than the 85 mG level previously accepted by the Siting Board, and that the

addition of the proposed transmission lines would not increase the edge of the ROW field strengths along the primary route (Exh. CW-1, at 5-62). The Company asserted that there have been no scientific studies demonstrating that human exposure to magnetic fields results in adverse impacts to human health (Tr. 10, at 1399-1400; Company Brief at 199). Dr. Valberg, the Company's witness on EMF, noted that epidemiological studies concerning long-term effects of people living close to power lines are ongoing in Great Britain, with the results showing no adverse effects (Tr. 10, at 1417-1418). While acknowledging that previous studies showed statistical associations between childhood leukemia and magnetic fields, Dr. Valberg argued that less weight is being placed on the possibility that such associations reflect causal factors since laboratory studies have failed to determine how such an effect could take place (id. at 1419).

For locations ranging from zero to 30 feet above the sea floor, the Company modeled magnetic field levels associated with the underwater cables at wind farm outputs of 168 MW, 420 MW (alternative route), and 454 MW (primary route) (Exhs. CW-1, at 5-62 to 5-63; EFSB-E-3-S). Based on its modeling, the Company stated that magnetic fields above the sea floor would range from 1 mG to 22 mG with wind farm output at 168 MW, and from 3 mG to 60 mG with wind farm output at 454 MW (Exhs. CW-1, at 5-62 to 5-63; EFSB-E-3-S). The Company noted that any existing magnetic fields are the natural magnetic fields of the earth (Exh. CW-1, at 5-62). The Company noted that its calculations of marine magnetic fields did not assume optimal phasing and did not account for attenuation of magnetic fields by the wire metal jacket surrounding the cable (Tr. 10, at 1391-1392).[104]

The Company asserted that magnetic fields from the transmission lines would not have an adverse impact on the marine environment (Exh. CW-1, at 5-63). The Company explained that marine organisms are sensitive to direct current, rather than 60-cycle hertz alternating current (id. at 5-64). The Company further asserted that the highly localized nature of the potential magnetic fields means both that exposures are not likely to occur, and that if they do occur, they will be of a short duration as birds or marine-based or land-based wildlife pass by the cables (Exh. MA-69). The Company asserted that the use of three conductor cables, which minimizes the spacing

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[104] The Company estimated that magnetic fields would be reduced by a minimum of 15% to 20%, depending on the exact nature of the steel armor casing (Tr. 10, at 1393-1394).

between phases, serves to reduce magnetic field strength, as does the 6-foot burial depth (id.; Exh. EFSB-E-3).

Dr. Valberg asserted that there are no affirmative studies that have identified problems resulting from magnetic fields created by existing submarine cables, or evidence that alternating current would affect the sensory perception of animals (Tr. 10, at 1389). However, Dr. Valberg noted that he extrapolated from information on general animal systems, as he was not aware of any studies specifically on marine organisms and EMF (id. at 1389, 1416).

Dr. LeGore, witness for the Alliance, stated that several types of fish are highly sensitive to electromagnetic fields, which may affect the movement and behavior of the fish (Exh. APNS-RSL at 17). However, he stated that he was satisfied with information provided for the Company on this matter by Dr. Valberg (Tr. 17, at 2174-2175).

(b) Alternative Route

In order to assess the effect of the proposed facilities on EMF along the alternative route, the Company measured existing ambient magnetic field levels at various points along the route. The Company's measurements show that maximum existing magnetic field levels under peak load along public ways range from 2 mG to 3 mG (Exh. EFSB-E-3, Bulk Att. at 14). The Company calculated that, with the new transmission lines in operation, these levels would rise to 7 mG (assuming a wind farm output of 168 MW) and 17 mG (assuming a wind farm output of 420 MW) (id. at 13).

The Company's measurements show that existing magnetic field levels along the NSTAR ROW west of the Mashpee Substation[105] range from a maximum of 14 mG directly under the lines to 0.5 mG at the north edge of the ROW and 2 mG at the south edge of the ROW (id. at 17).

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105 Line 115 and Line 77 run west from the Mashpee Substation along the NSTAR transmission ROW (Exh. EFSB-E-3, Att. at 16). The proposed transmission line would run east from the Mashpee substation, and thus would not be located in this part of the ROW; however, the interconnection of the proposed transmission project at the Mashpee substation would alter power flows on the lines extending west (as well as east) from the Mashpee Substation, resulting in changes in magnetic field levels.

The measurements along the NSTAR ROW located east of the Mashpee Substation,[106] between the Mashpee Substation and Shootflying Hill Road, range from a maximum of 47 mG directly under the lines to 1 mG at the north edge of the ROW and 7 mG at the south edge of the ROW (id.). The measurements show that existing field levels along the NSTAR ROW between Shootflying Hill Road and the Barnstable Switching Station range from a maximum of 210 mG directly under the lines to 95 mG at the north edge of the ROW and 21 mG at the south edge of the ROW (Exh. EFSB-RR-52).

Table 3, below, presents the Company's predictions of magnetic fields that would be present during facility operation, at peak load.[107] The Company explained that the maximum in-ROW EMF levels would occur immediately below the existing Line 115, and noted that load and output conditions producing these maximum impacts would occur only a small portion of the time that the wind farm was operating (Exh. EFSB-E-10). The Company noted that the changes in line-by-line power flow along the NSTAR ROW with the addition of the wind farm output and the proposed transmission lines causes significant decreases in magnetic field strength at the north edge of the ROW (Exh. EFSB-RR-52).

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106 Line 115 and Line 88 runs east from the Mashpee Substation along the NSTAR transmission ROW (Exh. EFSB-E-3, Att. at 16).

107 The Company also modeled power flows on the Shootflying Hill Road-to-Barnstable segment of the ROW under light load conditions (Exh. EFSB-RR-52). Existing field levels under light load conditions range from a maximum of 83 mG directly under the lines, 36 mG at the north edge of the ROW, and 8 mG at the south edge of the ROW; projected field levels under light load would be 40 mG directly under the lines, 58 mG at the north edge of the ROW, and 9 mG at the south edge of the ROW, assuming a wind farm output of 168 MW, and 173 mG directly under the lines, 31 mG at the north edge of the ROW, and 10 mG at the south edge of the ROW under a wind farm output of 420 MW (id.).

Table 3. Combined Magnetic Fields at Peak Load - Alternative Route

Scenario and Location	210-ft. ROW West from Mashpee Substation	210-ft. ROW East from Mashpee Substation	270-ft. ROW Shootflying Hill Road to Barnstable Substation
AVERAGE OUTPUT			
Under Lines	90 mG	68 mG	138 mG
North-edge ROW	3 mG	4.5 mG	58 mG
South-edge ROW	5 mG	8 mG	19 mG
HIGH OUTPUT			
Under Lines	197 mG	173 mG	181 mG
North-edge ROW	6 mG	12 mG	36 mG
South-edge ROW	11.5 mG	13 mG	24 mG

Source: Exhs. EFSB-E-3, Bulk Att. at 17; EFSB-RR-52

The Company explained that EMF increases on the NSTAR ROW portion of the alternative route are greater than for the NSTAR ROW portion of the primary route because of: (1) the increased load on the new line and Line 115 along the alternative route; and (2) the higher production of magnetic fields from overhead conductors as compared to in-ground conductors (Tr. 10, at 1425-1426). The Company indicated that the proposed transmission lines along the NSTAR ROW portion of the alternative route would have a single pole design with the phased conductors arranged in a delta configuration (Exh. EFSB-E-6). The Company asserted that this conductor arrangement would provide for the lowest possible edge-of-ROW magnetic fields (id.).

The Company acknowledged that, because the NSTAR ROW runs through the back and side yards of existing residences, it is possible that people residing along the ROW could be engaging in activities closer than the edge of the ROW (Tr. 6, at 1397). The Company estimated that half-way in from the northern edge of the ROW the magnetic fields could be between 40 and 50 mG (id. at 1399). The Company asserted that this level of exposure would not result in adverse health effects, given the limited periods of time that people likely would be within the ROW during peak load conditions (Tr. 6, at 1400).

Finally, the Company calculated magnetic field levels at Popponesset Spit to determine

impact to bathers; it determined that magnetic fields would be approximately 2 mG with the wind farm output at 168 MW, and 4 mG with output at 420 MW (Exh. CW-1, at 5-63).

(c) Analysis

In a previous review of proposed transmission line facilities, the Siting Board accepted edge-of-ROW levels of 85 mG for magnetic fields. 1985 MECo/NEPCo Decision, 13 DOMSC 119, at 228-242. The Siting Board has used this edge-of-ROW level in subsequent facility reviews to determine whether anticipated magnetic field levels are unusually high. See CELCo Decision, 12 DOMSB 305, at 348, 349; Norwood Municipal Light Department, 5 DOMSB 109, at 145 (1997); MASSPOWER, Inc., 20 DOMSC 301, at 401-403 (1990). Here, assuming the maximum export of electricity from the wind farm to the Barnstable Switching Station, the maximum magnetic field levels along the primary route would be 32 mG directly above the proposed transmission lines in the street, and 56 mG at the edge of the ROW, representing either no or minimal increase above existing EMF levels. The in-street and edge-of-ROW levels would remain well below levels found acceptable in the 1985 MECo/NEPCo Decision.

More recently, the Siting Board has inquired into the current scientific literature regarding the possible impact of exposure to magnetic fields on human health. CELCo Decision, 12 DOMSB 305, at 345-346; Southern Energy Kendall, LLC, 11 DOMSB 255, at 383-386 (2000) ("SE Kendall Decision"); Sithe Mystic Decision, 9 DOMSB 101, at 196-199. The Siting Board has consistently found that, although some epidemiological studies suggest a correlation between exposure to magnetic fields and childhood leukemia, there is no evidence of a cause-and-effect association between magnetic field exposure and human health. CELCo Decision, 12 DOMSB 305, at 348-349; SE Kendall Decision, 11 DOMSB 255, at 385-386; Sithe Mystic Decision, 9 DOMSB at 198-199. The record in this proceeding is consistent with the record developed in previous proceedings, and leads to the same conclusion. Thus, the record in this case does not support a conclusion that the EMF levels anticipated as a result of the proposed transmission project would pose a public health concern. Finally, with regard to magnetic field effects associated with the marine portion of the transmission lines, studies to date have not identified problems in the vicinity of existing submarine cables, and epidemiological research has

not found that alternating current would affect the sensory perception of animals. Further, the Company has implemented mitigation such as minimizing the spacing between phasing, sufficient burial depth, and a steel armor covering of the cables to minimize the magnetic field levels. Accordingly, the Siting Board finds that the magnetic field impacts of the proposed transmission lines along the primary route would be minimized.

The record demonstrates that, assuming the maximum export of electricity from the wind farm using the alternative route, the maximum magnetic field levels in the street would be 17 mG directly above the proposed transmission lines, a minimal increase from the existing level of 3 mG. Magnetic field levels along the NSTAR ROW would vary considerably. Where the ROW is 210 feet wide, the edge-of-ROW measurements would be well below 85 mG; however magnetic field levels directly under the transmission lines increase from 14 mG to 197 mG, when the wind farm is running at full capacity. While edge-of-ROW levels are significantly lower than within the ROW, the Company acknowledged that some back and side yards extend into the existing NSTAR ROW, where magnetic field levels would be higher.

In summary, while edge-of-ROW measurements for the alternative route are below levels found acceptable in 1985 MECo/NEPCo Decision, operation of the proposed transmission lines along the primary route results in little or no increase in magnetic fields. Accordingly, the Siting Board finds that the primary route would be preferable to the alternative route with respect to magnetic field impacts.

iii. Conclusions on Permanent Impacts

In Sections III.C.2.c.i and ii, above, the Siting Board has found that: (1) the land use and visual impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to land use and visual impacts; and (2) the magnetic field impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to magnetic field impacts. Accordingly, the Siting Board finds that the permanent impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route

with respect to permanent construction impacts.

d. Alternative Construction Methods – HDD

In the sections above, the Siting Board has examined the potential impacts of the construction and operation of the proposed transmission lines, assuming currently proposed construction techniques. However, at an earlier point in the proceeding, the Company proposed to achieve landfall at New Hampshire Avenue using horizontal directional drilling, rather than jet plowing. Because a change in construction techniques at this location would markedly alter the construction impacts along the primary route, the Siting Board addresses these tradeoffs here.

i. Land Use Impacts

The Company stated that, if HDD were used to install the submarine cables in the nearshore area, four approximately 800-foot long boreholes would be drilled six to twenty feet below the seabed or ground, beginning at a site upland of the New Hampshire Avenue seawall and traveling seaward to a temporary offshore pit and cofferdam, where jet plow installation of the remaining submarine cable would begin (Exhs. CW-1, at 1-8 to 1-9; EFSB-C-2A; EFSB-W-18; EFSB-RR-39). The Company stated that approximately 840 cubic yards of sediment would be excavated if HDD were used, including 180 cubic yards for the boreholes and 660 cubic yards for the offshore pit (Exhs. EFSB-W-25; EFSB-RR-39). The Company indicated that completion of the HDD would require approximately four to six weeks, and that work would occur for 20 to 24 hours a day (Exh. EFSB-RR-30). The Company initially stated that it selected HDD for use in the area of the New Hampshire Avenue landfall to minimize potential impacts in the intertidal zone and the nearshore area (Exh. EFSB-W-18). The Company stated that use of HDD in the area of the landfall would avoid some temporary and permanent impacts to coastal wetlands, including areas of coastal bank, coastal beach, and seabed (Exhs. EFSB-W-19; EFSB-W-15, sheet 2). The Company subsequently supported its preference for use of jet plowing at the New Hampshire Avenue landfall by stating that: (1) HDD and jet plowing would have similar environmental impacts; (2) HDD is a more complicated process than jet plowing; (3) the coastal bank at the New Hampshire Avenue site is man-made and is not an ecologically

valuable coastal wetland resource; and (4) jet plowing would significantly reduce traffic-related construction impacts, as it would require less construction and less time to complete than an HDD (Tr. 1, at 10-11; Tr. 6, at 754, 764-765, 775-779, 787-789).

ii. Construction Traffic

Cape Wind indicated that use of HDD, rather than jet plowing, at the landfall location would alter the expected traffic impacts along New Hampshire Avenue (Exh. EFSB-RR-14). If HDD were used, a transition vault would be built on New Hampshire Avenue adjacent to the Englewood Beach Recreation area, approximately 300 feet north of the landfall and 200 feet north of Shore Road (Exhs. CW-CO-3; EFSB-RR-27, Bulk Att.; Tr. 6, at 750-751). The Company explained that, to construct the transition vault in this location, it would need to occupy the full width of New Hampshire Avenue for the period of the HDD operation, obstructing frontages of two residences and the Englewood Beach recreation area, and blocking travel from Berry Road to points on New Hampshire Avenue south of the work area, including access to Shore Road (Exhs. EFSB-RR-27, Bulk Att.; EFSB-RR-30; Tr. 6, at 752, 754). The Company noted that, if jet plowing were used, the transition vault could be located south of the intersection with Shore Road, and only the portion of New Hampshire Avenue between the landfall and Shore Road, which is not heavily traveled, would be closed (Exh. EFSB-RR-27; Tr. 6, at 755). Cape Wind noted that it perceived that the jet plow proposal has been favorably received by Town of Yarmouth representatives (Exh. EFSB-RR-28).[108]

iii. Construction Noise

Cape Wind stated that HDD operations at the New Hampshire Avenue landfall would operate 20 to 24 hours a day, seven days a week, for four to six weeks (Exh. EFSB-RR-30; Company Brief at 206). The Company explained that the equipment used to drill the bore holes

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[108] The Host Community agreement does not directly address construction methods to be used by the Company. However, a major focus of the agreement is the scheduling and coordination of project construction to minimize impacts on the local community, including traffic impacts (Exhs. CO-2; EFSB-RR-28; Tr. 1, at 10).

and pull back the transmission line would be located in a transition vault on New Hampshire Avenue, adjacent to the Englewood Beach recreation area (Exhs. CW-1, at 1-8; EFSB-L-31).

The Company estimated that the L_{max} for the HDD would be 78 dBA at 50 feet,[109] and that the average sound levels ("L_{eq}") would be approximately 73 dBA at 50 feet, and 61 to 67 dBA at 200 feet (Exh. EFSB-L-31). The Company estimated that, absent mitigation, L_{max} noise levels at the closest residence to the northwest would be 79 dBA, and L_{max} noise levels at the closest residence to the southwest would be 77 dBA (Exh. EFSB-RR-29).[110]

The Company stated that, if it were to use HDD at the New Hampshire Avenue landfall, it would use good engineering practices, such as sound barriers, to mitigate noise impacts in a reasonable manner (Exh. EFSB-RR-31). The Company stated that a typical sound barrier, such as those used in highway sound attenuation, is solid wood and 10 feet high (id.).[111] It estimated that the use of sound barriers could reduce L_{max} noise levels from 79 dBA to 74 dBA at the nearest residence to the northwest, and from 77 dBA to 69 dBA at the nearest residence to the southwest (Exh. EFSB-RR-29).

iv. Analysis

In its initial filings in this proceeding, Cape Wind indicated that it intended to use horizontal directional drilling at the New Hampshire Avenue landfall in order to minimize impacts to coastal wetlands in the near-shore area. Since that time, the Company has concluded that any reduction in impacts to coastal wetlands would be outweighed by significant traffic and noise impacts on New Hampshire Avenue residents. The Siting Board agrees with this conclusion. Most of the wetland impacts that would result from jet plowing at the New

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109 The Company noted that the sound levels for the HDD rig are comparable to those for the excavators and backhoes (80 to 84 dBA at 50 feet) (Exhs. EFSB-L-31; EFSB-SS-22-S, Att. at 5-124).

110 The Company noted that noise impacts at the residences were modeled for a second floor window (Exh. EFSB-RR-29).

111 The Company stated that the average cost of materials and installation for a sound barrier is $140 per linear foot for a 10-foot high wall; $185 per linear foot for a 12-foot high wall; and $235 per linear foot for a 14-foot high wall (Exh. EFSB-RR-54).

Hampshire Avenue landfall site, described in Section III.C.2.a, above, would be temporary; moreover, the coastal bank that would be left undisturbed if HDD techniques were used is a man-made concrete wall with limited ecological value. The noise and traffic impacts on New Hampshire Avenue residents, on the other hand, would be significant.

The record indicates that use of HDD at the New Hampshire Avenue landfall would result in the four-to-six week closure of a portion of New Hampshire Avenue that is more heavily traveled than the smaller, southern portion that would be closed for construction of the transition vault using the jet plow method. Further, a recreation area and two residences front onto the transition vault location; direct access to these properties would be blocked or limited during construction.

In addition, for four to six weeks, residents would be affected by continuous nighttime construction noise, based on an expected 20-to-24 hour construction day, at a noise level comparable to that generated by a backhoe or excavator. The Company has estimated that the use of a 10-foot high noise barrier would reduce expected noise levels by 5 dBA to 8 dBA, depending on the distance from the transition vault. However, even with the use of the sound barriers, the resultant L_{max} noise levels would range from 69 dBA to 74 dBA at the nearest residences for nighttime construction.

Given the significant disruption that would be associated with use of HDD at the New Hampshire Avenue landfall, the Siting Board cannot find, on this record, that construction traffic and noise impacts would be minimized along the primary route if HDD were used to make landfall. Should the Company choose, either for technological reasons or because of restrictions imposed by another agency, to pursue use of HDD at the New Hampshire Avenue landfall, additional proceedings before the Siting Board would be required to determine whether and how that approach could be undertaken consistent with minimizing noise and traffic impacts. Specifically, to allow use of HDD to achieve landfall at New Hampshire Avenue, the Siting Board would require the Company to make a project change filing, providing: (1) an analysis of both existing and predicted construction period L_{eq}, L_{90} and L_{max} noise levels at affected residences, and proposed and possible mitigation to minimize residential noise impacts; and (2) an analysis of proposed and possible mitigation to minimize traffic impacts on residents,

particularly for those homes in close proximity to the transition vault. Necessary mitigation might include: (1) for noise, the use of noise barriers of different heights and widths or temporary enclosures surrounding the HDD operations, and limitations on hours of nighttime construction; and (2) for traffic, development of an ingress and egress plan, including detailed notification procedures that would be applied in advance of the construction period, and specific measures addressing the residences located on New Hampshire Avenue between Shore Road and Berry Avenue.

e. Conclusions on Environmental Impacts

In Sections III.C.2.a, III.C.2.b, and III.C.2.c, above, the Siting Board has reviewed the record evidence regarding the marine construction impacts, the land-based construction impacts, and the permanent impacts of the proposed transmission lines, and has imposed mitigation where necessary to minimize the environmental impacts of the proposed transmission lines. Based on its review of the record, the Siting Board finds that Cape Wind has provided sufficient information regarding environmental impacts and potential mitigation measures to allow us to determine that it has achieved the proper balance among environmental impacts.

In Section III.C.2.a, above, the Siting Board found that, with implementation of the stated conditions, the marine construction impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to marine construction impacts. In Section III.C.2.b, above, the Siting Board found that, with implementation of the stated condition, the land construction impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to land construction impacts. In Section III.C.2.c, above, the Siting Board found that the permanent impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to permanent impacts. Consequently, the Siting Board finds that the environmental impacts of the proposed transmission lines along the primary route would be minimized, and that the primary route would be preferable to the alternative route with respect to environmental impacts.

3. Cost

a. Description

The Company initially estimated the cost of the proposed transmission lines along the primary route to be $79,510,000, and the cost of the proposed transmission lines along the alternative route to be $68,610,000 (Exh. CW-1, at 5-67 and Table 4-4). The Company stated that these cost estimates would be subject to refinement as plans for the proposed project are developed (Exh. CW-1, at 5-67). The Company attributed the higher cost of the primary route primarily to the longer length of in-street cable required for that route (id.). However, the Company stated that it considered the costs of the proposed project along the primary and alternative routes to be comparable (id.).

During the proceeding, the primary route evolved in a number of ways that could affect the cost of construction. First, the initial cost estimates assumed an 11-mile submarine cable and the use of HDD at the New Hampshire Avenue Landfall (id. at Table 3-1). As discussed above, the anticipated length of the submarine cable is now approximately 12.2 miles, and the Company intends to use jet-plowing, rather than HDD, at the landfall. The Company asserted that the increased length of the submarine cable would increase costs slightly, but did not provide a revised cost estimate (Exh. EFSB-RR-84).[112] The Company stated that the use of jet plowing rather than HDD at the landfall would reduce costs by approximately $460,000 (Exhs. EFSB-RR-55; EFSB-RR-56).[113]

Second, the initial cost estimates for both the primary and alternative routes assumed the use of two switched shunt reactors, at a cost of $600,000 each (Exh. CW-1, at Table 4-4; Tr. 11, at 1497-1500). However, NSTAR indicated that the proposed transmission line, if built along the primary route, may need additional reactive power compensation in the form of more switched shunt reactors; additional switched shunt reactors would not be required for the

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112 The Company has assumed a cost of $3.7 million per mile for the submarine cable (Exh. CW-1, at 3-4, Tables 3-1, 4-4).

113 In addition, as discussed in Section III.C.2.b, above, the cost of installing a sound barrier at the New Hampshire Avenue landfall in conjunction with the use of HDD could range from $14,000 to $23,500, assuming a 100-foot long wall (Exh. EFSB-RR-54).

alternative route (Tr. 11, at 1495-1500).

The Company stated that it likely would use a jack-up barge, rather than the cable-laying vessel, for cable installation inside Popponesset Bay on the alternative route, due to the shallow and narrow characteristics of Popponesset Bay (Exh. CW-1, at 5-51). The Company stated that the cost estimates for the routes included a built-in cost for specific installation and design difficulties that would affect the cost of installing the transmission lines (id. at 4-28).[114]

Save Popponesset Bay asserted that cable installation through Popponesset Spit and Popponesset Bay would be difficult and expensive (SPB Brief at 3). Specifically, Save Popponesset Bay argued that the shallow waters of Popponesset Bay would make installation difficult and costly, noting that the Company had recognized that installation would be challenging due to the size of the cable-laying vessel and the size and depth of Popponesset Bay (SPB Brief at 4, citing Exh. CW-1, at 4-11, 4-13, 5-51). Save Popponesset Bay asserted that the Company's cost estimates ignored the higher construction costs that would result from the slower rate of installation, mitigation of adverse impacts, and time-of-year restrictions (SPB Brief at 6). Specifically, Save Popponesset Bay pointed to the use of a standard unit price per foot for installation on both routes, which it argued led to an underestimate of the costs associated with installation in Popponesset Bay (id.). Save Popponesset Bay stated that it is not unreasonable to assume that, due to the difficulty of installation in Popponesset Bay, the length of cable installed per day would be half that estimated for the overall route, potentially doubling the cost of cable installation in Popponesset Bay (Exh. SPB-PJW at 4).[115]

In response, the Company stated that it has factored in the appropriate cost estimates for the alternative route (Tr. 10, at 1454-1457). However, the Company acknowledged that unanticipated time-of-year restrictions would add cost to the proposed project (id. at 1454).

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[114] Table 4-4 of the Petition lists the following for marine installation costs for the primary and alternative routes: (1) quantity of cable at $3.7 million per mile (landfall HDD included); (2) one 1000-foot HDD for the alternative route at $1.5 million (Exh. CW-1, at Table 4-4).

[115] Based on the estimates of the marine portion of the transmission lines along the alternative route, the increase in cost would be on the order of $5 to $6 million dollars (Exh. CW-1, at Table 4-4; Tr. 10, at 1473).

b. Analysis

The Company's initial cost estimates indicate that the cost of constructing the proposed transmission project along the primary route is approximately $11 million higher than the cost of construction along the alternative route. However, the initial estimates of project costs along the primary route appear low in light of later testimony. Specifically, the expected length of the marine portion of the primary route has increased by approximately 1.2 miles from original estimates, likely resulting in additional costs of approximately $4.4 million. Further, the possible need for a third switched shunt reactor could increase the cost of the proposed project along the primary route by an additional $600,000. Partially offsetting these increases, the decision to use jet plowing rather than HDD at the New Hampshire Avenue Landfall should reduce construction costs along the primary route by $460,000. Overall, the cost of the proposed project along the primary route is likely to be approximately $4.5 million higher than the original estimate, or approximately $15.5 million more than the estimated cost of the proposed project along the alternative route.

The Siting Board notes that it is quite likely that the construction cost estimates provided by the Company for the alternative route, through Popponesset Bay and underneath Popponesset Spit, have been underestimated. In particular, the record suggests that the potential difficulties associated with construction through Popponesset Bay and under Popponesset Spit are significantly greater than those likely to be encountered along the marine portion of the primary route. For example, the burial of cables in shallow water between the two HDDs adds complexity to the construction process, and may extend the construction period for that portion of the project beyond what was originally anticipated. Moreover, as discussed in Section III.C.a., above, there is the possibility of seasonal restrictions to protect the piping plover, terns, fish and shellfish during vulnerable time periods. Aside from the cost of the additional HDD, the Company's cost estimates do not reflect such challenges.

Although the increased costs associated with the construction of the proposed project along the alternative route are not known at this juncture, and may be significant, it is not likely that they would approach the approximately $15.5 million difference between the current cost

estimates for the two routes. Accordingly, the Siting Board finds that the alternative route is slightly preferable to the primary route with respect to cost.

4. Reliability

a. Description

The Company noted that the primary and alternative routes both provide an interconnection with the Barnstable Switching Station, the main bulk power substation on Cape Cod (Exh. CW-1, at 5-68). However, the Company asserted that the primary route has a reliability advantage over the alternative route, both because it would be entirely underground and because its initial point of interconnection is closer to the Barnstable Switching Station (id.). Specifically, the Company noted that the primary route interconnects directly with the Barnstable Switching Station, while the alternative route interconnects on the Mashpee ROW and then continues for a considerable distance before ultimately delivering power to the Barnstable Switching Station (Tr. 11, at 1515-1517).

The Company asserted that the risk of outages is significantly less on an underground transmission line than on an overhead line, because underground lines are less exposed to the elements (Tr. 11, at 1490). However, the Company noted that when a failure does occur on an underground line, it is more difficult to locate the source of the failure and it therefore may take longer to correct the problem (id. at 1491). Overall, the Company suggested that the primary route, which is entirely underground, is less susceptible to interruptions and thus more reliable than the alternative route (id. at 1506).

The Company noted that the primary route has more miles of underground cable than the alternative route, and thus would supply a higher level of reactive power and require a greater number of switched shunt reactors to compensate for the additional reactive power (id. at 1495). However, the Company stated that, after voltage compensation, the reliability of the system would be the same regardless of whether the primary or alternative route is selected (id. at 1502).

The Company asserted that the reliability of the marine portions of the primary and alternative routes would be essentially the same (Tr. 11, at 1507). Specifically the Company noted that the design, trenching, and installation methodologies for the cable would be the same

for either route, and that the same standard repair method would be used along either route (id. at 1507-1508).

As discussed in Section III.C.2.a.ii(b), above, Save Popponesset Bay asserted that Popponesset Spit is susceptible to breaching during severe storms and that a breach at the location of the submarine cable crossing could damage the cable (Exh. SPB-PJW at 7).

b. Analysis

The record shows that underground transmission lines typically experience fewer outages than overhead lines, as they are less exposed to weather and other hazards. However, once an outage has occurred, underground lines may take longer to repair, as it is more difficult to isolate the source of the problem. Thus, the reliability of the underground primary route and the overhead alternative route may not be substantially different. In addition, the record indicates that additional switched shunt reactors may be needed along the primary route to compensate for the higher levels of reactive power produced by the longer underground cables; however, with such mitigation in place, the reliability of the two routes would be similar. Accordingly, the Siting Board finds that the primary route and the alternative route are comparable with respect to reliability.

5. Conclusions on Transmission Line Routing

In Section III.C.2, above, the Siting Board found that the primary route would be preferable to the alternative route with respect to environmental impacts. In Section III.C.3, above, the Siting Board found that the alternative route would be preferable to the primary route with respect to cost. In Section III.C.4, above, the Siting Board found that primary and alternative routes would be comparable with respect to reliability. Based on its review of the record, the Siting Board finds that Cape Wind has provided sufficient information regarding costs, reliability, and environmental impacts to allow the Siting Board to determine whether it has achieved the proper balance between environmental impacts, cost and reliability.

To make this determination, the Siting Board must weigh the environmental advantages of the primary route against the cost advantages of the alternative route. In its analyses in Section

III.C.2, above, the Siting Board identified several key advantages of the primary route over the alternative route. In particular, the Siting Board determined that the transmission lines along the primary route would have no permanent visual impacts, while the twelve-mile overhead segment of the transmission line along the alternative route potentially would be visible from backyards, side yards, and street crossings, and the eight miles of clearing required could increase views of existing transmission lines on the NSTAR right-of-way; that construction in Popponesset Bay would take longer than in Lewis Bay, would potentially affect sensitive barrier beach and estuary areas, and would have a greater potential for impacts on fish, coastal shorebirds, and navigation; and that construction noise and wetlands impacts potentially were greater along the alternative route than along the primary route. In Section III.C.3, the Siting Board was unable to identify the extent to which the costs of constructing the transmission lines along the primary route would exceed those of constructing along the alternative route; however, the differential would not exceed $15.5 million, and likely would be considerably less. Overall, the Siting Board concludes that the elimination of the potential for permanent visual impacts, coupled with lower overall construction impacts both on land and under water, outweighs the less clearly defined cost benefits of the alternative route. Accordingly, the Siting Board finds that the primary route is preferable to the alternative route with respect to providing a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost.

IV. DECISION

The Siting Board's enabling statute directs the Siting Board to implement the energy policies contained in G.L. c. 164, §§ 69H to 69Q, to provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. G.L. c. 164, § 69H. In addition, the statute requires that the Siting Board determine whether plans for the construction of energy facilities are consistent with current health, environmental protection, and resource use and development policies as adopted by the Commonwealth. G.L.c. 164, § 69J.

In Section II.A.4, above, the Siting Board found that, to establish that there is a need for additional transmission resources to interconnect the wind farm with the regional transmission

grid, Cape Wind shall submit to the Siting Board copies of all permits required for Cape Wind to begin installation of wind farm equipment in Nantucket Sound.

In Section II.B, the Siting Board found that the Barnstable Interconnect is preferable to both the Harwich Alternative and the New Bedford Alternative with respect to providing a reliable energy supply for the Commonwealth, with a minimum impact on the environment at the lowest possible cost.

In Section III.A, above, the Siting Board found that Cape Wind and NSTAR developed and applied a reasonable set of criteria for identifying and evaluating alternatives to the proposed project in a manner which ensures that it has not overlooked or eliminated any siting options which, on balance, are clearly superior to the proposed project. The Siting Board also found that Cape Wind and NSTAR identified a range of practical transmission line route alternatives with some measure of geographic diversity. Consequently, the Siting Board found that Cape Wind and NSTAR have considered a reasonable range of practical siting alternatives.

In Section III.C, above, the Siting Board found that the primary route would be preferable to the alternative route with respect to providing a reliable energy supply to the Commonwealth with a minimum impact on the environment at the lowest possible cost. The Siting Board also found that with the implementation of the proposed mitigation and conditions, the environmental impacts of the proposed facilities along the primary route would be minimized with respect to marine construction impacts, land construction impacts and permanent impacts.

In Section III.C.2.d, above, the Siting Board reviewed trade-offs of use of HDD in lieu of jet plowing to install the transmission lines at the New Hampshire Avenue landfall along the proposed route. The Siting Board held that, should the Company choose, either for technological reasons or because of restrictions imposed by another agency, to pursue use of HDD at the New Hampshire Avenue landfall, additional proceedings before the Siting Board would be required to determine whether and how that approach could be undertaken consistent with minimizing noise and traffic impacts. Specifically, to allow use of HDD to achieve landfall at New Hampshire Avenue, the Siting Board would require the Company to make a project change filing, providing: (1) an analysis of both existing and predicted construction period L_{eq}, L_{90} and L_{max} noise levels at affected residences, and proposed and possible mitigation to minimize residential noise impacts;

and (2) an analysis of proposed and possible mitigation to minimize traffic impacts on residents, particularly for those homes in close proximity to the transition vault.

In Sections I.C.2 and III.C, above, the Siting Board reviewed the environmental impacts of the proposed transmission lines in light of related regulatory or other programs of the Commonwealth, including programs related to wetlands and riverfront protection, water supply wellhead protection, rare and endangered species, tidelands and waterways, water quality certification, marine fisheries, coastal zone management, ocean sanctuaries, historic preservation, and underwater archeology. As evidenced by the above discussions and analyses, the proposed transmission lines along the primary route would be generally consistent with the identified requirements of all such programs.

Accordingly, the Siting Board APPROVES the proposal of Cape Wind and NSTAR to construct two approximately 18-mile, 115-kilovolt underground electric transmission lines along the primary route identified by Cape Wind and NSTAR. This approval is subject to compliance by Cape Wind and NSTAR with the following conditions:

(A) No wind turbines will be built in state waters.

(B) There shall be no construction in Yarmouth between Memorial Day and Labor Day, unless permission is given in writing in advance by the Town of Yarmouth.

(C) Construction in Yarmouth shall not occur prior to 7 a.m. or after 5 p.m., unless permission is given in writing in advance by the Town of Yarmouth.

Prior to the commencement of construction:

(D) To establish that there is a need for additional transmission resources to interconnect the wind farm with the regional transmission grid, Cape Wind shall submit to the Siting Board copies of all permits required for Cape Wind to begin installation of wind farm equipment in Nantucket Sound.

(E) To minimize marine construction impacts on eelgrass beds, the Siting Board directs Cape Wind to aerially photograph the entrance to Lewis Bay in the month of July, immediately prior to jet-plowing, under conditions conducive to documenting the extent of eelgrass beds, to use the photographs in finalizing the exact location of jet-plowing, and to provide such photographs to the Siting Board. The Siting Board also directs Cape Wind to provide this documentation to the Yarmouth Shellfish Warden. Also, Cape Wind shall file a Notice of Intent with the Yarmouth Conservation Commission and fully consult with the Yarmouth Division of Natural Resources prior to commencing with construction.

(F) To minimize marine construction impacts on protected coastal shorebirds, the Siting Board directs Cape Wind to work with the ACOE, NHESP, and MDMF, and with Mass Audubon, if Mass Audubon wishes to participate: (1) to determine whether seasonal restrictions, or some other protective measures, are appropriate to minimize potential impacts on protected coastal shorebirds and their habit along the primary route and, if so, to develop appropriate seasonal restrictions and/or other protective measures; and (2) to determine whether protected coastal shorebirds should be included in the Company's comprehensive environmental monitoring plan and, if so, to develop an appropriate monitoring protocol. Cape Wind shall file with the Siting Board, prior to the commencement of marine construction, documentation of the seasonal restrictions, any additional protective measures, and any monitoring protocol.

(G) To help ensure that potential navigational impacts on all individuals or groups, including commercial fishermen and recreational boaters, would be avoided or minimized, the Siting Board directs Cape Wind to consult with the Harbormasters of the Towns of Barnstable and Yarmouth, in order to coordinate the scheduling of marine construction activities, or to arrange other mitigation measures.

(H) To minimize construction traffic impacts, the Siting Board directs Cape Wind, and NSTAR as appropriate, to submit a draft Traffic Management Plan to Yarmouth officials and school administrators at least six months prior to the commencement of construction.

(I) To minimize impact to potential historic sites on Berry Avenue, the Siting Board directs Cape Wind to consult with the Yarmouth Historical Commission prior to commencing construction.

(J) Prior to applying for a street opening permit, Cape Wind shall provide detailed noise and traffic management information to the Town of Yarmouth.

Because the issues addressed in this Decision relative to this facility are subject to change over time, construction of the proposed facility must commence within three years of the date of the decision**.**

In addition, the Siting Board notes that the findings in this Decision are based upon the record in this case. A project proponent has an absolute obligation to construct and operate its facility in conformance with all aspects of its proposal as presented to the Siting Board. Therefore, the Siting Board requires Cape Wind and NSTAR to notify the Siting Board of any changes other than minor variations to the proposal so that the Siting Board may decide whether to inquire further into a particular issue. Cape Wind and NSTAR are obligated to provide the Siting Board with sufficient information on changes to the proposed project to enable the Siting Board to make these determinations.

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M. Kathryn Sedor
Presiding Officer

Dated this 11th day of May, 2005

APPENDIX A

ALTERNATIVE NEED ANALYSIS

In Section II.A.1, above, the Siting Board adopted a new standard of review for transmission lines that interconnect power plants with the electric transmission system, and analyzed the need for the proposed lines under that standard. As discussed in Section II.A.1, above, the Siting Board adopted this new standard in response to statutory changes that have been enacted since the Turners Falls/MECo/NEPCo precedent was last used. However, parties developed a record and briefed the case assuming the use of a standard similar to that used in two earlier Siting Board cases, Turners Falls and MECo /NEPCo.[116] Therefore, in this section, the Siting Board reviews need for the proposed transmission lines using Turners Falls and MECo/NEPCo as guidance.[117]

A-I. Scope of Review

In this section, the Siting Board considers whether the proposed transmission line is needed using its Turners Falls/MECo/NEPCo precedent as guidance. Because the standards of review are stated differently in the two relevant Siting Board decisions, and because Cape Wind and the Alliance have offered additional interpretations of the standards, the Siting Board finds it appropriate, as a preliminary matter, to clarify the scope of the analysis under this precedent.

As discussed in Section II.A.1, above, the Siting Board in Turners Falls reviewed a proposal to construct a 1.2-mile, 115 kV transmission line which would interconnect a non-jurisdictional 20 MW coal-fired cogeneration plant with the transmission grid. Turners Falls Decision, 18 DOMSC 141. In that decision, the Siting Board required the proponent to show: (1) that there was a need within New England for the power generated by the non-jurisdictional

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116 At the close of evidentiary hearings, the Siting Board issued briefing questions regarding the appropriateness of using Turners Falls and MECo/NEPCo as precedent.

117 The Siting Board notes that the need analysis in Section II.A, above, is independent of the analyses in other sections of the decision. Thus, if need were analyzed using Turners Falls and MECo/NEPCo as guidance, the findings in Sections I, II.B, III, and IV, above, would not change.

generating facility; and (2) that the transmission facility would provide benefits to Massachusetts. Id. at 153-155. The Siting Board found a need for the power from the plant based on a power sales contract between Turners Falls Limited Partnership (the developer of the power plant) and UNITIL (a bulk power purchaser for two New Hampshire electric utilities). Id. at 155-156. The Siting Board found benefits to Massachusetts based on: (1) economic benefits to Strathmore Paper Company, a local employer that would purchase steam from the power plant; and (2) conveyance of an easement along the proposed transmission right-of-way to the DEM for use as a bike path. Id. at 160-164.

In MECo/NEPCo, the Siting Board reviewed a proposal to construct a 3.2-mile, 69 kV transmission line which would interconnect a non-jurisdictional 40 MW gas- and oil-fired cogeneration plant with the transmission grid. In this case, the proponent was required to show that: (1) power from the non-jurisdictional plant was needed on either economic efficiency or reliability grounds; and (2) the existing transmission system was inadequate to support the new power source and additional energy resources were necessary to accommodate it. Id. at 395. The Siting Board found need for the power plant based on a power sales contract between Pepperell Power Associates (the developer of the power plant) and Cambridge Electric Light Company (a Massachusetts electric utility). Id. at 396-397. The Siting Board also found that the existing transmission system was inadequate to support this new power source, and that additional energy resources (the proposed transmission line) were necessary to accommodate the new power source. Id. at 397-403.

Cape Wind argues that the Siting Board should use the principles set forth in MECo/NEPCo, slightly modified, to review the need for the Company's proposed transmission lines. Cape Wind proposes that the Siting Board adopt the following analysis:

> Whether the proponent is a utility or a non-utility developer, the proponent must first establish that the power from the non-jurisdictional cogeneration plant is needed on either reliability, economic efficiency [or environmental] grounds. If it can be established that the cogeneration plant is needed, the proponent must then show that the existing transmission system is inadequate to support this new power source and that additional energy resources are necessary to accommodate this new power source

(Cape Wind Brief at 21). [118]

The Alliance argues for more extensive modifications to the MECo/NEPCo standard (Alliance Brief at 36-38). The Alliance accepts that the proponent of an interconnecting transmission line may show need for the power from a non-jurisdictional power plant on reliability, economic efficiency, or environmental grounds (id. at 36-37). However, it argues that the Siting Board should consider the positive and negative attributes of the power plant as potentially offsetting each other, and require a petitioner to show:

> (1) a need for the transmission line by demonstrating that there is a need for the specific power to be produced by the power plant on reliability, economic efficiency, or environmental grounds; and (2) there is a net positive contribution in at least one of these areas which is not offset by negative effects in the others

(id. at 37-38). In response, Cape Wind argues that this "netting of individual need bases" is contrary to statute and applicable precedent, and could lead to the rejection of facilities shown to be needed on reliability or economic grounds in accordance with the Siting Board's mandate (Cape Wind Reply Brief at 24-25).

The Siting Board agrees with Cape Wind and the Alliance that a modified version of the standard articulated in MECo/NEPCo is appropriate for the purposes of this review, and that the standard should allow for a showing of need for the power from the Cape Wind generator on reliability, economic, or environmental grounds. In addition, the Siting Board will consider other bases for establishing need for the power from the wind farm, examining on its merits any argument that does not fit easily into the three established bases for a finding of need.

However, the Siting Board will not adopt the Alliance's proposal for a more extensive reworking of Turners Falls and MECo/NEPCo. Historically, the Siting Board has never required project proponents to show need for a facility on more than one basis, for the very good reason that many facilities have been needed primarily, or entirely, for a single purpose – typically, for reliability. The fact that such projects had costs and environmental impacts was a given, and did

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[118] Cape Wind notes that, since MECo/NEPCo, the Siting Board's review of need has evolved to include environmental objectives as a possible basis for a need determination (Cape Wind Brief at 21, n.8).

not alter the need analysis. Similarly, a facility could be required for a single purpose unrelated to reliability – for example a project required to comply with the environmental regulations of another agency. It is therefore sufficient to show need for a project on *one* basis, so long as that basis is adequately supported.[119]

The Alliance recognizes that its proposal goes beyond existing Siting Board precedent,[120] and argues that the Siting Board should "strengthen" its precedent specifically for offshore power plants to fill a perceived regulatory gap (Alliance Brief at 35-36). The Siting Board does not believe that the Turners Falls/MECo/NEPCo precedent, and our jurisdiction over the proposed transmission line, can be interpreted to serve the purpose suggested by the Alliance. In addition, in Section II.A.1, above, the Siting Board has explained why the Turners Falls/MECo/NEPCo analysis is no longer consistent with the Siting Board's mandate and practice, and has established a new standard of review that will be used in the future for transmission lines that interconnect power plants, including offshore power plants. Thus, there is no need to strengthen Turners Falls and MECo/NEPCo in anticipation of future cases.

Therefore, in the following sections, the Siting Board will review the need for the proposed transmission line using the following standard adapted from MECo/NEPCo, which is adopted *for the purpose of this section only*:

In order to demonstrate the need for a jurisdictional transmission line which would

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119 In cases where the benefits provided by a proposed project are modest, the Siting Board may separately consider whether the costs or impacts of the project outweigh its benefits. For example, in the MMWEC Decision, 12 DOMSB 18, at 71, the Siting Board found environmental and economic need for a natural gas pipeline, but noted that, because the identified benefits might be modest, it was possible that the benefits of the proposed pipeline could be outweighed by its other environmental impacts. After reviewing the environmental impacts of the proposed pipeline, the Siting Board concluded that these impacts did not outweigh the economic and environmental benefits of the project. Id. at 149.

120 The Siting Board notes that, in Turners Falls, it found need for the energy from a coal plant without tabulating the plant's environmental impacts, and that, in MECo/NEPCo, it found need for the energy from a gas- and oil-fired plant based solely on a signed and approved contract for the plant's output. Turners Falls, 18 DOMSC at 151-165; MECo/NEPCo, 18 DOMSC at 11-12.

> interconnect a non-jurisdictional power plant, the proponent must establish: (1) that the power from the non-jurisdictional power plant is needed on reliability, economic, environmental or other grounds; and (2) that the existing transmission system is inadequate to interconnect this new power plant and, thus, that additional transmission resources are necessary to accommodate this new power plant.

Cape Wind has advanced reliability, economic, and environmental need arguments for the power that would originate at the wind farm and that would be transported by the proposed transmission lines. These are general classes of need arguments that fit Siting Board precedent. In addition, the Company has argued that the power is needed to meet the Commonwealth's Renewable Portfolio Standard ("RPS"). Each of these arguments is outlined and evaluated below.

A-II. Need for Energy: Reliability

A. Wind Farm Capacity

1. Company

The Company stated that the wind farm's maximum potential delivery of energy at Barnstable Switching Station would not exceed 454 MW (Tr. 3, at 418-419). The Company projected that the wind farm would produce 420 MW or more approximately 15% of the year; between 100 MW and 420 MW approximately 42% of the year; and less than 100 MW approximately 43% of the year, including periods of no power amounting to approximately 10% of the year (Exhs. EFSB-RR-9; EFSB-RR-10). The Company expected that power production generally would be highest in the months of December through March and lowest during early morning hours in the summer months (Exh. EFSB-RR-17). On average, the Company expects the wind farm's MW output to be 36% of its total capacity (Exh. APNS-N-11; Tr. 3, at 422-423; Tr. 4, at 539).

The Company stated that the wind farm's capability rating would be less than its maximum output, but asserted that it would make a significant capacity contribution to regional supply adequacy (Exh. CW-DCS-2-R at 10). The Company initially stated that the wind farm would provide approximately 100 MW of summer-rated capacity, based on the Independent System Operator of New England's ("ISO-NE") then-existing policy of assigning wind farms a

capacity rating of 25% as an initial value counted towards total Installed Capacity ("ICAP") (Exh. CW-1, at 2-7; Tr. 3, at 413-415). The Company later indicated that ISO-NE had altered its policy, and would now accept engineering projections for the first year and actual seasonal operating history data for time periods when ISO-NE needs capacity thereafter (Tr. 3, at 413-415). The Company did not update its anticipated capacity rating in light of the new ISO-NE procedures (Exh. CW-DCS-2-R at 10).

2. Alliance

Jeffrey Byron, a witness for the Alliance, testified that wind-generated power does not contribute to system reliability because the system operator cannot rely on wind plants to be available when needed (Exh. APNS-JB-1, at 11, 15). Mr. Byron contended that adding generating capacity or new transmission lines does not necessarily improve the reliability of the grid (id. at 4).

Mr. Byron accepted the hypothesis that there could be a peak in demand in the future, for which the contribution of the wind farm could prevent loss of load; however, he argued that the energy could not be counted on in such a situation (id. at 11; Tr. 14, at 1874-1877). Mr. Byron also asserted that the turbines to be used in the wind farm are substantially untested and that previous wind generator designs have not met manufacturers' expectations for life span (Exh. APNS-JB-1, at 22). Finally, the Alliance argued that the Siting Board has never found that power from a generating plant that cannot be dispatched is needed for reliability purposes (Alliance Reply Brief at 7).

3. Company Rebuttal

In rebuttal, Cape Wind asserted that any facility with a capability rating greater than zero can be expected to make a contribution to resource adequacy (Exh. CW-DCS-2-R at 10). In response to the assertion that the turbines themselves would be unreliable, the Company stated that the 3.6 MW turbines it has selected have markedly improved operating reliability, relative to previous generations of wind turbines (Exh. CW-CO-2, at 2). The Company asserted that the availability factor of General Electric's previous generation of 1.5 MW turbines is over 97%

(id. at 3).

4. Analysis

In prior cases where it has reviewed the need for generating facilities to meet regional capacity needs, the Siting Board has required proponents to determine the year in which there would be a need for the nameplate capacity of the facility, on the assumption that this capacity typically would be available to meet capacity needs. See, e.g., ANP Bellingham Energy Company, 7 DOMSB 39, at 76-78 (1998) ("ANP Bellingham"); ANP Blackstone, 8 DOMSB 1, at 33-35. In this instance, however, the record indicates that the wind farm is projected to deliver on average approximately 36%, or 163 MW, of its maximum output of 454 MW. The record also indicates that generation would tend to be lower than average in the summer, when New England electric demand is at its peak; thus, the summer capacity rating of the wind farm is likely to be less than 163 MW, and substantially less than its nameplate capacity.

The Alliance has argued that the Siting Board may not find a reliability need for the wind farm, as its output is intermittent, and cannot be assured at any particular point in time. The Siting Board notes that, because all generating facilities are subject to unplanned outages, no generating facility can be relied on absolutely to be available at times of peak demand. The Siting Board notes the expertise of ISO-NE in the matter of developing capacity factors for intermittent facilities such as hydro-electric projects and wind generators, and concludes that it is appropriate to find reliability need for intermittent facilities based on their likely summer capacity rating, rather than the higher nameplate capacity. Here, the record demonstrates that ISO-NE intends to assign capacity ratings to wind farms based initially on engineering projections, and later on actual seasonal operating history data. The Company's original projection of a capacity rating of 100 MW was based on ISO-NE's capacity rating policies at the time of filing; the Siting Board accepts it for purposes of this review.

B. Regional Need

1. Company

The Company argued that additional generating capacity will be needed in New England to meet anticipated growth in the demand for electricity, to replace retirements of existing generation, and to maintain capacity reserve margins (Exh. CW-1, at 2-7). The Company predicted that 110 MW of capacity would be needed for reliability purposes beginning in summer 2007, with higher levels of capacity needed in later years (Exh. EFSB-N-9-S; Tr. 3, at 472-479). The Company also predicted that, under a high growth scenario or a hot weather scenario, there could be a capacity shortfall before 2007 (Tr. 3, at 483).

In support, the Company provided an analysis prepared by La Capra Associates, LLC ("La Capra") of the need for additional generating capacity in New England (Exhs. CW-1, at 2-4; EFSB-N-9-S). The Company stated that it used methods consistent with ISO-NE's Resource Adequacy Assessment to prepare this analysis, reviewed ISO-NE documents, and considered more recent developments that may affect supply and demand for power (Exh. CW-1, at 2-9, 2-13; Tr. 3, at 467-468).

As a basis for its analysis, the Company developed five forecasts of summer peak load, each based on the April 2003 NEPOOL Forecast of Capacity, Energy, Loads, and Transmission ("CELT Report") (Exhs. CW-1, at 2-10; EFSB-N-9-S). Three of these forecasts – a base case, a high load growth case, and a low load growth case – incorporate differing assumptions as to load growth while assuming normal summer weather (Exhs. APNS-N-7; APNS-N-7(b), Att.; EFSB-N-9-S). For its base case, the Company assumed an annual growth rate in peak demand of 1.74%, consistent with assumptions in the 2003 CELT Report (Exh. EFSB-N-9-S). For its high growth rate case, the Company assumed that peak demand would grow 2.65% annually (id.). For its low growth case, the Company used a "low economic growth" scenario from NEPOOL that reflected an average annual growth rate of approximately 0.41% (id.). In addition, the Company provided two forecasts to reflect extreme weather conditions: a hot weather case having a 10% chance of being exceeded, and a mild weather case having a 90% chance of being exceeded according to the 2003 CELT Report (id.).

The Company assessed the need for additional capacity under each of the five forecast scenarios by adjusting for the effects of demand-side management programs and net purchases and sales from other regions, adding in a 15% installed capacity reserve requirement,[121] and comparing the resulting demand with the capacity projected to be available from existing and developing generation (Exh. CW-1, at 2-9, 2-10, 2-11; Tr. 3, at 472-479). The Company took its estimates of the effects of demand-side management and net purchases and sales from ISO-NE (Exh. CW-1, at 2-11).

To develop estimates of available generating capacity, the Company obtained an initial inventory of regional supplies from the 2002 CELT Report; it then identified unit-specific supply assumptions that warranted adjustments through May 2003, and adjusted further for expected attrition (id. at 2-8 to 2-16; Exh. EFSB-N-9-S; Tr. 3, at 473, 477). In its modeling, the Company assumed the announced retirement of New Boston Unit 1, and assumed that 25% of plants with an operating life over 40 years would be retired, and that 50% of plants with an operating life over 50 years would be retired (Exhs. CW-1, at 2-15; APNS-N-7(d), Att.). In comments made subsequent to its modeling, the Company noted the decision by Exelon to retire Mystic Units 4, 5, and 6, and noted pressure on Salem Harbor Units 1, 2, and 3 as perhaps representative of increased pressure to retire plants; the Company asserted that additional generation may be needed sooner than anticipated by the La Capra model (Exh. EFSB-N-9-S). The Company's demand, supply, and need projections for 2004 through 2010 are shown in Table A-1, below.

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121 The Company asserted that the 15% reserve requirement has historically been linked to a one-day-in-ten-years loss-of-load expectation adopted by the Northeast Power Coordinating Council ("NPCC") (Exhs. EFSB-N-1, Att. at 45; EFSB-N-8, Att. at 12; Tr. 3, at 476-478).

Table A-1
Need for Capacity in New England, 2004-2010, Summer Capacity (MW)

BASE CASE	2004	2005	2006	2007	2008	2009	2010
Peak Demand	25,690	26,000	26,290	26,620	26,990	27,390	27,820
Required Capacity	29,544	29,900	30,234	30,613	31,039	31,499	31,993
Available Supply	31,284	31,153	30,562	30,503	30,845	30,502	30,495
Surplus / (Need)	1740	1253	328	**(110)**	**(194)**	**(997)**	**(1498)**
HIGH LOAD GROWTH CASE	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Peak Demand	26,130	26,730	27,330	27,990	28,710	29,460	30,280
Required Capacity	30,050	30,740	31,430	32,189	33,017	33,879	34,822
Available Supply	31,284	31,153	30,562	30,503	30,845	30,502	30,495
Surplus / (Need)	1234	413	**(868)**	**(1686)**	**(2172)**	**(3377)**	**(4327)**
LOW LOAD GROWTH CASE	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Peak Demand	25,230	25,250	25,220	25,230	25,270	25,330	25,420
Required Capacity	29,015	29,038	29,003	29,015	29,061	29,130	29,233
Available Supply	31,284	31,153	30,562	30,503	30,845	30,502	30,495
Surplus / (Need)	2269	2115	1559	1488	1784	1372	1262
HOT WEATHER CASE	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Peak Demand	27,710	28,050	28,370	28,730	29,130	29,560	30,020
Required Capacity	31,867	32,258	32,626	33,010	33,500	33,994	34,523
Available Supply	31,284	31,153	30,562	30,503	30,845	30,502	30,495
Surplus / (Need)	**(583)**	**(1105)**	**(2064)**	**(2537)**	**(2655)**	**(3492)**	**(4028)**
MILD WEATHER CASE	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Peak Demand	24,620	24,910	25,190	25,510	25,860	26,250	26,660
Required Capacity	28,313	28,647	28,969	29,337	29,739	30,188	30,659
Available Supply	31,284	31,153	30,562	30,503	30,845	30,502	30,495
Surplus / (Need)	2971	2506	1593	1166	1106	314	**(164)**

"Peak Demand" estimated by La Capra; "Required Capacity" assumes an additional 15% reserve margin; "Available Supply" estimated by La Capra as "Base Supply." Selected years shown here. Source: Exh. EFSB-N-9-S.

2. Alliance

The Alliance argued that the proposed wind farm would produce power at a time of an unprecedented surplus of supply in New England (Alliance Reply Brief at 10). The Alliance argued that there is no need for the power that would be produced by the wind farm (id. at 10).

3. Analysis

The Company has provided an analysis, similar to those accepted by the Siting Board in generating facility cases prior to the 1997 restructuring of the electric industry, of the need for additional generating capacity in New England for the years 2003-2011. The Company provided three demand scenarios based on load growth: a base case scenario, representing a demand case with a 50% chance of being exceeded, a high load growth scenario, and a low load growth scenario representing essentially static electric demand. The Company also provided cases that reflect extreme and mild weather scenarios. The Siting Board finds that the three demand scenarios presented represent a reasonable range of load growth scenarios for purposes of this review, and that the extreme and mild weather cases provide indicators of the sensitivity of supply adequacy to weather contingencies. The Siting Board further finds the Company's reliance on NEPOOL projections of demand-side management and net purchases and sales, and its use of a 15% reserve margin, to be appropriate for purposes of this review.

The Company has projected available supplies by adjusting resource levels listed in the 2002 CELT Report to account for retirement and project cancellation decisions made through May 2003, and for anticipated future retirements. The Siting Board has previously accepted the assumption of 25% retirement, by capacity, of fossil fuel plants in operation over 25 years. ANP Bellingham, 7 DOMSB 39, at 75. The Siting Board concludes that the Company's assumption that 25% of plants with an operating life over 40 years would be retired, and that 50% of plants with an operating life over 50 years would be retired, is consistent with current trends, and thus reasonable. Therefore, the Siting Board finds that the Company's estimate of available supplies is appropriate for purposes of this review.

As shown in Table A-1, additional capacity would be needed in New England by 2007 for

reliability purposes under the base load growth case, and by 2006 in the high load growth case.[122] Under the base case, 110 MW of power would be needed by the New England system in 2007, 197 MW would be needed in 2008, 997 MW would be needed in 2009, and 1498 MW would be needed in 2010. Based on the record, the Siting Board finds that there is a need in New England for at least 110 MW of energy resources beginning in 2007 and beyond.[123] The Siting Board therefore finds that there is a need for the capacity provided by the wind farm beginning in 2007 for reliability purposes.

C. Other Reliability Benefits

1. Company

The Company asserted that the wind farm would improve local reliability by providing an additional source of energy at the Barnstable Switching Station (Exh. CW-1, at 2-5). At present, the Canal Electric power plant is the only source of generation located on Cape Cod (Tr. 1, at 139). NSTAR maintained that under certain contingencies, the availability of the proposed wind farm could forestall localized outages that otherwise would occur (Tr. 3, at 377-387). For example, NSTAR stated that if the Canal Switching Station were lost to service, the Cape Cod

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122 Under the extreme weather case, there would be inadequate capacity to meet load and maintain the 15% reserve margin requirement beginning in 2004.

123 Historically, the Siting Board has analyzed the need for new generating capacity both within New England and within Massachusetts. ANP Blackstone, 8 DOMSB 1, at 26-35; ANP Bellingham, 7 DOMSB 39, at 60-83; Altresco Lynn, Inc., 2 DOMSB 1, at 19-92 (1993). The Siting Board notes that, following the enactment of the 1997 Electric Restructuring Act, Massachusetts electric distribution companies are no longer allowed to own generation, and generally do not enter into long-term supply contracts to serve the load within their service territories. Thus, the Siting Board can no longer identify generating units that are dedicated over the long term to serving Massachusetts load, and therefore cannot project the need for additional capacity to meet the requirements of Massachusetts electric customers. However, we note that Massachusetts is part of a tightly interconnected regional power grid, and constitutes approximately 40% of New England load. A regional shortage of power thus is very likely to affect Massachusetts electric customers. The Siting Board therefore concludes that, if additional energy resources are needed in New England for reliability purposes, these additional energy resources also are needed to reliably serve Massachusetts load.

region would be interconnected to the grid only through the Bourne Switching Station, which does not have sufficient capacity to supply all of Cape Cod (id. at 378-380). NSTAR stated that under this scenario, an outage could be avoided if the wind farm were generating at least half its capacity; if the wind were lighter and output lower, power from the wind farm would help limit the extent of outages (id. at 379-385). Similarly, NSTAR noted that energy from the wind farm would improve reliability in the Cape Cod area under the contingency of the loss of a double-circuit tower between Canal Electric and the Bourne Switching Station (id. at 504). NSTAR noted that both contingencies have a low probability of occurrence (id. at 383-384, 503-504).

NSTAR indicated that demand growth on Cape Cod would create a need for voltage support within the next few years (id. at 386-387). Cape Wind stated that the proposed transmission lines would provide approximately 120 megaVAR ("MVAR") of reactive power on a continuous basis (Exhs. CW-DCS-2-R at 20; EFSB-RR-12; EFSB-RR-65).[124] NSTAR noted that this new source of reactive power would allow it to postpone planned voltage support projects such as the installation of 20 to 60 MVAR of capacitor banks (Tr. 3, at 387-389). Cape Wind acknowledged that the reactive power from the transmission lines may not always be needed, and that Cape Wind may need to provide a switched shunt reactor for the NSTAR system to compensate for unneeded reactive power (Tr. 1, at 147; Tr. 3, at 512-513).

In addition, Cape Wind stated that the turbines themselves would be able to produce or absorb reactive power, as needed, thus providing bidirectional reactive power under electronic control (Tr. 1, at 124, 143, 145). The Company stated that the wind turbine generators would produce from 0 MVAR to 226 MVAR, depending on wind power output and on power factor setting (Exh. EFSB-RR-65).

Cape Wind further asserted that the wind farm would improve electric system reliability by supplying renewable energy during peak winter periods (Exh. CW-DCS-2-R at 44-45). In support, Cape Wind asserted that New England is highly dependent on natural gas for power generation, citing a 2003 ISO-NE study which concluded that 42% of New England generating capacity will be fueled by natural gas by 2005 (id. at 43). Cape Wind noted that the ISO-NE

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[124] Transmission lines buried underground or undersea provide reactive power, unlike overhead lines (Tr. 1, at 119, 147-148).

report indicated that natural gas production levels in North America have leveled off; the Company therefore suggested that significant additional pipeline capacity is unlikely, and asserted that gas supply constraints may adversely affect the reliability of gas-fired generation during the coldest part of the heating season (id. at 44-45).

2. Alliance

Mr. Byron, a witness for the Alliance, asserted that wind-generated resources cannot provide reactive power (Exh. EFSB-APNS-6). The Alliance argued that any reliability benefit of fuel diversity, per se, should be reflected in the reliability characteristics of the plant itself (Alliance Reply Brief at 30).

3. Analysis

The record shows that, under certain scenarios, the availability of energy from the wind farm could limit or forestall an electric outage on Cape Cod. However, NSTAR has stated that such contingencies are very low probability events; in addition, NSTAR has not provided an analysis demonstrating that additional energy resources are needed, or will be needed, to meet ISO-NE reliability standards. The Siting Board concludes that, while the wind farm may provide local reliability benefits under certain contingencies, these benefits, in and of themselves, would not be sufficient to establish need for the energy from the wind farm.

In addition, the record shows that the proposed transmission cables would generate a steady supply of reactive power, obviating or delaying the need for NSTAR to install capacitors. The record shows that the wind farm turbines can supply or absorb reactive power as required and indicates that at times there is some need for additional reactive power to provide voltage support. Thus, the proposed transmission lines will consistently provide needed reactive power to the grid on Cape Cod and the wind turbines will be able to provide reactive power when they are operating. Although the net effect of providing voltage support is positive, NSTAR's alternative of installing capacitors has not been shown to have substantial costs. The Siting Board concludes that these modest voltage support benefits, in and of themselves, would not be sufficient to establish need for the energy from the wind farm.

The record shows that the wind farm would act as a hedge against risks associated with the availability of natural gas and other fossil fuels. The record suggests that gas supply constraints may adversely affect the reliability of gas-fired generation during the coldest part of the heating season. Therefore, there is a possibility that the wind farm could improve system reliability during peak winter electricity use in the future, although the likely extent of any such improvement was not established. Thus, while agreeing that the wind farm may be beneficial by reducing reliance on gas-fired generation, the Siting Board concludes that these benefits, in and of themselves, would not be sufficient to establish need for the energy from the wind farm.[125]

D. Effect of Variable Output on Grid Reliability

1. Alliance

The Alliance argued that interconnection of the wind farm would degrade, rather than improve, the reliability of the New England electric grid. Specifically, the Alliance asserted that generation levels from the wind farm would regularly change or cease unexpectedly, placing additional challenges on the system operator, which is required to balance electric supply and demand (Exh. APNS-JB-1, at 10). The Alliance asserted that wind-generated electricity is intermittent, constantly changing, and relatively unpredictable (id.); however, it did not quantify the level of intermittence or unpredictability. The Alliance stated that ISO-NE would have to procure an increased amount of regulation services from other generators to compensate for the lack of operator control over the wind farm's output (id. at 13).

2. Company

The Company asserted that its project would not cause risks to reliable operation of the electric system (Exh. EFSB-RR-2). The Company acknowledged that volatility can present challenges to the system operator (Exh. CW-1, at 2-8). As an indicator of the likely volatility of output from the wind farm, the Company provided information from its meteorological test tower

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[125] The Siting Board notes that the diversity benefits of renewable energy facilities generally are reflected in the legislature's enactment of the RPS statute. The need for energy from the wind farm to meet RPS is addressed in Section A-III, below.

for April, May, and June 2003 showing that the average wind speed is 19 miles per hour (mph), and that hour-to-hour variations in wind speed average about 1 meter per second (m/s), or 2.2 mph (Exhs. EFSB-RR-49; EFSB-RR-50). The Company concluded that the median error in its day-ahead forecast would be approximately 10% of the wind farm's capacity, or less than 0.002% of peak load in New England, and that the median error in its hour-ahead estimate of power generation would be less than 5% of the wind farm's capacity (Exhs. CW-DCS-2-R at 14; EFSB-RR-7).

The Company noted that electric grids must routinely contend with varying and uncertain demand, and with unexpected outages (Exh. CW-DCS-2-R at 13). The Company stated that ISO-NE must plan for an unexpected loss of Units 8 and 9 at Mystic Station in Everett, totaling 1400 MW; the Company therefore argued that ISO-NE would be prepared to respond to the unexpected loss of the 452 MW wind farm (id. at 19). The Company also argued that ISO-NE is experienced in dealing with variability caused by unpredictable levels of system demand, noting that the peak hourly load record of 25,715 MW in New England on August 14, 2002, exceeded the normal weather condition peak load summer outlook by more than 6% (Exh. CW-1, at 2-8). The Company noted that the wind farm's annual output represents approximately 1% of the region's power supply (Tr. 3, at 445).

The Company stated that ISO-NE and various New England transmission owners are conducting a System Impact Study to assess system performance impacts of the proposed interconnection of the wind farm, to ensure no degradation of reliability (Tr. 1, at 143-155; Tr. 3, at 464).

3. Analysis

The record demonstrates that the electric power generated by the wind farm would be variable and not wholly predictable, and suggests that the ISO-NE may need to procure an increased amount of regulation services from other generators to compensate for this variability. However, the record also demonstrates that the margin of variability in wind farm output would be smaller than certain other generation contingencies. In addition, the record indicates that any reliability issues will be identified in the forthcoming System Impact Study, and that the wind

farm will not be permitted to interconnect to the New England transmission grid until it is shown that interconnection will not adversely affect the reliability of the transmission grid. Therefore, the Siting Board finds that the variability or unpredictability of the energy generated by the wind farm is unlikely to adversely affect the reliability of the electric system. The cost implications of the need for increased regulation services are discussed in Section A-IV, below.

E. Conclusions on Reliability Need

In the sections above, the Siting Board has found that: (1) there is a need in New England for at least 110 MW of energy resources beginning in 2007 and beyond; (2) there is a need for the capacity provided by the wind farm beginning in 2007 for reliability purposes; and (3) the variability or unpredictability of the energy generated by the wind farm is unlikely to adversely affect the reliability of the electric system. Consequently, the Siting Board finds that there is a need for the power provided by the wind farm beginning in 2007 for reliability purposes.

A-III. Need for Energy: Qualified RPS

A. Company

The Company argued that the renewable energy from the wind farm is needed for compliance with Massachusetts and Connecticut renewable portfolio standards (Company Brief at 32-39). The Company noted that Massachusetts and Connecticut have recently enacted statutes requiring retail electric suppliers to acquire increasing percentages of energy from specified renewable energy sources over time (Exh. CW-1, at 2-18; Tr. 4, at 610). In both Massachusetts and Connecticut, wind power is among the technologies that may be counted towards RPS targets (Exh. CW-1, at 2-18). The Company reported that Massachusetts enacted its RPS statute based on an understanding that renewable power provides fuel diversity and technology diversity, consumes no fossil fuel, and has air emission benefits (Tr. 4, at 610-611).

The Massachusetts RPS requires each retail electricity supplier to obtain RPS "new renewable" attributes[126] corresponding to a minimum of 1.0% of electricity consumed in 2003;

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[126] In the RPS context, "new renewables" are energy projects that meet specific criteria with (continued...)

the requirement increases by one-half percentage point each year until the requirement is 4.0% in 2009, then increases to 5.0% in 2010 (Exh. CW-1, at 2-19, Table 2-4).[127] Combining these percentages with forecasted electric consumption, the Company projected that compliance with the Massachusetts RPS will require approximately 733 gigawatt-hours ("GWh") per year of new renewable power in 2004, increasing to 1256 GWh per year in 2006 and 2658 GWh per year by 2010 (Exh. EFSB-RR-18, Att.). The Company indicated the Connecticut RPS would require additional renewable energy, rising from an estimated 237 GWh in 2004 to 2408 GWh in 2010 (id.).

The Company also anticipated market-driven demand for green attributes in Massachusetts, Connecticut, Rhode Island, and Maine by 2005 (Exh. CW-1, at 2-20). The Company projected that this market demand for "green power" would rise from zero in 2003 and 76 GWh in 2004 to 757 GWh in 2010 (Exh. EFSB-RR-18, Att.). Combining the Massachusetts and Connecticut RPS requirements with anticipated demand for green energy attributes, the Company predicted that total demand for new renewable energy in New England would increase from 636 GWh in 2003 to 2468 GWh in 2006, and 5822 GWh in 2010 (id.).

The Company projected that new renewable power sources currently approved by the Massachusetts Division of Energy Resources ("DOER") will provide approximately 447 GWh annually from 2004 through 2010 (id.).[128] The Company projected that known sources that have

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126 (...continued)
respect to source of energy and date of commercial operation (Exh. CW-1, at 2-18). Generators of electricity sell the attributes of their power separately from the electrical output itself (Exh. PO-1).

127 Eligibility under Massachusetts rules as a new renewable energy source is an attribute tracked through certificates in the NEPOOL Generation Information System ("GIS") (Exh. CW-1, at 2-18; Tr. 4, at 609-613). In Massachusetts, a load-serving entity that fails at the end of the year, and after the various trading periods in the NEPOOL GIS, to procure sufficient renewables is assessed an "alternative compliance mechanism," which is $50 per megawatt-hour ("MWh") of shortfall measured against its RPS requirement (Tr. 4, at 623-624).

128 The largest contributors listed by the Company are Indeck West Enfield, a biomass plant, producing 167 GWh annually, and four landfill gas plants, each producing 42 to 46 GWh
(continued...)

not yet applied to DOER for certification could provide an additional 33 GWh annually (id.; Exh. EFSB-N-9-S).

Based on these estimates, the Company concluded that New England would need an additional 1989 GWh of renewable resources to meet statutory and market demand in 2006, increasing to 5343 GWh in 2010 (Exh. EFSB-RR-18, Att.). The Company estimated the total energy production of the wind farm to be 1437 GWh (Exhs. CW-1, at 2-17; EFSB-RR-49).

B. Alliance

The Alliance challenged the level of need for renewable energy in Massachusetts, noting that applications for interconnection of nearly 300 MW of onshore wind projects have been filed with NEPOOL since May 2003 (Exh. APNS-JB-1, at 38). In addition, the Alliance argued that the Siting Board may not consider an argument based on the need for renewable energy to meet the requirements of the Massachusetts RPS (Alliance Reply Brief at 7). In support, the Alliance argued that the Siting Board has never found that power from a generating plant is needed for reliability based on the plant's impact on a market other than the electricity market (id.). The Alliance also argued that the Siting Board's G.L. c. 164, § 69H mandate with respect to an "energy supply for the commonwealth" concerns energy and not green credits, which the Alliance considers to be a separate product (id. at 11).

C. Analysis

General Law c. 25A, § 11F, the Renewable Energy Portfolio Standard for Retail Electricity Suppliers, requires that every retail supplier of electricity provide a minimum percentage of kilowatt-hour sales to end-use customers from renewable energy generating sources. 225 CMR § 14.07 requires retail electricity suppliers serving Massachusetts customers to hold increasing levels of renewable energy in their energy supply portfolios, beginning at 1.0%

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128 (...continued)
annually (Exh. EFSB-N-9-S). The Company excluded from its calculation the Indeck Jonesboro plant, which was mothballed in January 2003; the facility had eligible generation which the Company had estimated at 192 GWh (id.; Exhs. CW-1, at Table 2-6; EFSB-N-6 and -6(a), Att.; EFSB-RR-18, Att).

in 2003 and increasing to 5.0% in 2010. This requirement, by design, creates a need for renewable energy attributes that is separable from the need for capacity or energy to serve New England load. Because the RPS is an energy policy of the Commonwealth, established by statute, with clear relevance to the Siting Board's mandate to provide for "a reliable energy supply for the commonwealth with a minimum impact on the environment at the lowest possible cost," the Siting Board concludes that it is appropriate to examine the need for renewable energy to meet the requirements of the Massachusetts RPS.

Table A-2, below, summarizes forecasts of demand for new renewable energy to meet RPS and green demand, and lists supplies available from DOER-approved sources and other potential sources of renewable energy. As shown in Table A-2, the record demonstrates that Massachusetts electric suppliers will be required to obtain 991 GWh of new renewable energy attributes in 2005, rising to 2658 GWh in 2010 in order to comply with G.L. c. 25A, § 11F. The record also shows that 671 GWh annually are available from DOER-qualified projects, if the mothballed Indeck Jonesboro biomass plant is included. That leaves a shortfall of 320 GWh in 2005, and 1987 GWh in 2010. Including the additional 300 GWh of possible new renewable energy identified by the Alliance, the shortfall would be reduced to 20 GWh in 2005 and 1687 GWh in 2010. By this more conservative analysis, the full 1437 GWh of the proposed wind farm would be needed beginning in 2010. The Siting Board therefore finds that there will be a need for additional renewable resources to meet the requirements of the Massachusetts RPS beginning in 2005, and that there will be a need for the full renewable output of the wind farm to meet the requirements of the Massachusetts RPS beginning in 2010.

Because Massachusetts is not the only New England state with a renewable portfolio standard, the Siting Board also considers the regional need for new renewable resources. The record indicates that the level of new renewable resources needed to comply with both the Massachusetts and Connecticut RPS will rise from 1473 GWh in 2005 and 2150 GWh in 2006, to 5066 GWh in 2010. Under this analysis, the full 1437 GWh of the wind farm would be needed beginning in 2005 to meet regional demand; if the additional 300 GWh of new renewable energy identified by the Alliance materializes, the 1437 GWh from the proposed wind farm would be needed beginning in 2006. Consequently, the Siting Board finds that there will be a

need for the renewable resources provided by the wind farm to meet regional RPS requirements beginning in 2006.

Table A-2
Need for Renewable Energy in New England, 2004-2010 (GWh per year)

DEMAND	2004	2005	2006	2007	2008	2009	2010
MA Percentage Required [1]	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	5.0%
MA RPS Demand [2]	733	991	1256	1528	1808	2095	2658
CT RPS Demand [2]	237	481	894	1401	1839	2204	2408
Regional RPS Demand (CT + MA) [2]	970	1473	2150	2930	3647	4299	5066
Green Demand [2]	76	186	319	474	654	737	757
RENEWABLE SUPPLY	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Available "New" Renewables [2, 4]	671	671	671	671	671	671	671
Recent Wind Projects Applied to NEPOOL [3]	300	300	300	300	300	300	300
SURPLUS / (NEED)	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
MA RPS Demand vs. Available Renewables	62	**(320)**	**(585)**	**(857)**	**(1137)**	**(1424)**	**(1987)**
MA RPS Demand vs. Available Renewables + Applications	362	**(20)**	**(285)**	**(557)**	**(837)**	**(1124)**	**(1687)**
Regional RPS Demand vs. Available Renewables	**(299)**	**(802)**	**(1479)**	**(2259)**	**(2976)**	**(3628)**	**(4395)**
Regional RPS Demand vs. Available Renewables + Applications	1	**(502)**	**(1179)**	**(1959)**	**(2676)**	**(3328)**	**(4095)**

(1) Exh. CW-1, at Table 2-4. (2) Exh. EFSB-RR-18, Att. (3) Exh. CW-JB-1, at 38.
(4) Includes DOER-approved renewables (including the mothballed 192 MW Indeck Jonesboro plant), and other renewables identified by Cape Wind (Exhs. EFSB-N-6; EFSB-N-9-S; EFSB-N-15).

A-IV. Economic Need

The Company asserted that the power from the wind farm would be needed for economic purposes, arguing that the power would displace more expensive generation, lowering the clearing price in the New England spot market. The Company also argued that the dispatch of the wind farm would help reduce the price of natural gas during periods of peak gas demand, and that availability of renewable attributes from the wind farm would reduce the overall price of renewable portfolio certificates. The Alliance asserted that operation of the proposed wind farm would cause the system operator to pay more to manage variability in the supply and demand for electricity. The Siting Board examines these arguments below.

A. Displacement Savings

1. Company

The Company asserted that dispatch of the wind farm would provide economic benefits for the Commonwealth and the New England region by increasing competition in the wholesale electrical power market (Exh. CW-1, at 2-4, 2-5, 2-17). The Company asserted that, when operating, the wind farm would displace generating units at the top of the dispatch queue and cause cheaper units to set the New England spot market clearing price (id. at 2-5, 2-23). Cape Wind asserted that the wind farm would be self-scheduled and a price taker in the region's energy market; consequently, its dispatch would lower market clearing prices (Exh. DCS-2, at 36).

The Company engaged La Capra to model the effect on wholesale electricity prices of adding the wind farm's power to the New England electric supply (Exh. CW-1, at 2-24). The La Capra model is based on the idea of bid stack displacement, in which energy provided by the wind turbines would displace energy from the highest successful bidder in the bid stack at any specific time (Exh. APNS-N-15, Att.; Tr. 4, at 563). The Company stated that the wind farm would have an operating advantage over fossil-fuel-fired generating plants, because its short-run variable operating costs are near zero (Exh. APNS-N-15, Att.). The Company stated that whenever the wind turbines generate power, the wind farm will be called on-line before fossil units with higher operating costs (id.). The Company stated that, when its operation displaces a

generating unit at the top of the bid stack, a unit offering a lower bid will set the clearing price (id.).

The Company used PROSYM, a utility dispatch simulation program, to simulate the hourly dispatch of generators and the operation of the electric system in New England, New York, the Pennsylvania/New Jersey/Maryland Interconnection, and adjacent Canadian provinces including Quebec and Ontario (id.).[129] PROSYM's dispatch algorithm selects the lowest cost combination of bids from generators and available imports (id.). Wheeling charges and congestion charges are included in the model (id.). The model generates hourly clearing prices, total generation by technology, total emissions, and total fuel consumption (id.). The Company asserted that the model approximates the actual spot markets in the northeast (id.).

The Company used the PROSYM model to simulate the effect of the wind farm on the annual average energy clearing price in each of four load zones in New England,[130] for the years 2005 through 2009 (Exhs. APNS-RR-1; APNS-RR-1, Att.). The Company then multiplied the price effect by the anticipated total load for each zone for each year (Exhs. APNS-RR-1; APNS-RR-1, Att.).[131] The Company's model projected regional savings of approximately $4 million in 2005, $28 million in 2006, $28 million in 2007, $17 million in 2008, and $22 million in 2009, or an average of $19.8 million per year for the first five years of operation (Exhs. APNS-RR-1; APNS-RR-1, Att.). The Company adjusted its initial projection of

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129 The modeling was performed in Spring 2001 (Exh. EFSB-N-13; Tr. 4, at 573).

130 The Company defined the four load zones as Maine, NEMA-Boston, Connecticut, and the rest of New England (Exh. APNS-RR-1, Att.).

131 The Company asserted that, while the most immediate effect of the Cape Wind project would be on clearing prices in the spot market, the lower clearing prices would reduce prices in the forward market and thereby lead to price reductions for all customers (Exh. APNS-N-15, Att.; Tr. 4, at 563; Tr. 18, at 2364-2365). In support, the Company argued that forward prices are, to a large extent, expectations for spot prices, and that market participants will take the Cape Wind project into account when developing prices for forward power (Tr. 18, at 2465). In addition, the Company noted that power for most Massachusetts load is procured through short-term forward purchases, rather than through long-term contracts which would be slow to reflect the Cape Wind project due to less frequent contract renewals (id. at 2367).

$19.8 million per year up to an estimated $25 million per year, arguing that because prices and the price suppression effect both increase disproportionately when the market is tight, average savings under variable conditions would be higher than savings calculated for average conditions (Exh. APNS-RR-1). The Company also argued that higher prices should be weighted more heavily to account for the typically higher prices that accompany higher load (id.). In addition, the Company noted that fuel prices in October 2003 were 25% to 50% higher than prices widespread in early 2001, when the modeling was performed, and suggested that an analysis assuming the fuel prices prevailing in late 2003 would have yielded economic benefits 25% to 50% higher than the estimate of $25 million (i.e., $31 to $38 million) (id.; Tr. 18, at 2366-2367).

The Company stated that customers in southeastern Massachusetts would have savings slightly greater than customers elsewhere, due to transmission constraints on the export of wind farm output from the area (Tr. 4, at 553-554). Since over 40% of NEPOOL's total energy output is consumed in Massachusetts, the Company estimated that savings to Massachusetts consumers would likely be at least 40% of $25 million, or $10 million annually (Exhs. EFSB-RR-14; CW-DCS-2-R at 29; Tr. 4, at 555).[132]

2. Alliance

Mr. Byron, a witness for the Alliance, asserted that the wind farm could distort the electricity market in Massachusetts and New England, and reduce overall economic efficiency (Exh. APNS-JB-1, at 3). Mr. Byron stated that long-run marginal cost is the best measure of the economic efficiency of a generating plant (id. at 27). He estimated costs of various types of generators and concluded that, on a cost per MWh basis, the proposed offshore wind project would have higher long-run marginal costs than a combined-cycle natural gas-fired plant (id. at 23-37). Mr. Byron expressed doubt as to whether the wind farm would be constructed without the federal production tax credit and credits from the Massachusetts RPS, and indicated the two

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[132] In addition, the Company asserted on a conceptual basis that by displacing fossil fuel generating plants, the wind farm would put downward pressure on regional natural gas prices, providing savings to natural gas customers, and lowering costs of fossil fuels generally (Exhs. APNS-N-10; CW-DCS-2-R at 38). The Company did not attempt to quantify such an effect (Exhs. APNS-N-10; CW-DCS-2-R at 38).

sets of credits would provide revenue of about 1.8 cents per kWh and about 2.5 cents per kWh, respectively, to the project (id. at 30). Mr. Byron then asserted that a zero-bid plant distorts the market if it is not more economically efficient than a plant it displaces (id. at 28).

Mr. Byron also expressed concern that electricity producers with lower overall costs may be forced out of the market by the wind farm, which would sell electricity by bidding its short-term marginal operating cost, which is close to zero (id. at 37). Mr. Byron stated that the proposed wind farm must eventually cover its capital and operating costs or go out of business, and questioned whether the wind farm would in fact cover its costs (id. at 37-38).

On brief, the Alliance questioned whether a reduction in wholesale energy prices would have any effect on "wholesale sellers who provide power to the retail supplier who actually serve[s] retail customers" (Alliance Reply Brief at 24). The Alliance also argued that the Siting Board is not permitted to find that a self-scheduling plant brings economic efficiency benefits based solely on its potential impact on the wholesale clearing price in certain hours (id. at 22).

3. Company Rebuttal

In response, Cape Wind stated that its economic need argument focused primarily on the cost to consumers, noting that recovery of the fixed costs of the wind farm would be a risk taken on by project developers (Tr. 18, at 2316). Cape Wind noted that, historically, the Siting Board's analysis of economic need has focused on whether consumer benefits would be achieved in NEPOOL's energy market (Exh. CW-DCS-2-R at 28; Tr. 18, at 2317-2318). The Company asserted that in ANP Bellingham, the Siting Board accepted the results of an analysis of cumulative energy price savings as evidence of "economic efficiency" (Exh. CW-DCS-2-R at 28). The Company asserted that its analysis of the economic benefits created by displacement within the wholesale energy market is similar to that accepted by the Siting Board in prior proceedings (id.).

4. Analysis

The Company has argued that need for the energy from the wind farm can be demonstrated based on economic benefits, and has provided, in support, a dispatch analysis

showing the extent to which the wind farm, operating as a price taker, would reduce clearing prices in the New England energy market during its first five years of operation. In the past, the Siting Board has determined that, in some instances, utilities need to add energy resources primarily for economic efficiency purposes. Specifically, in Massachusetts Electric Company, 13 DOMSC 119, at 178-179, 183, 187, 246-247 (1985), and in Boston Gas Company, 11 DOMSC 159, at 166-168 (1985), the Siting Board recognized the benefit of adding economic supplies to a specific utility system. The Siting Board also noted in Eastern Energy Corporation Remand, 1 DOMSB 213 (1993) ("Eastern Energy Remand"), that because G.L. c. 164 requires a necessary energy supply to be provided with a minimum impact on the environment at the lowest possible cost, it is reasonable to conclude that a proposed facility may be necessary even if there is no additional need for supply capacity or transmission reasons. We stated that, in such a case, an applicant would be required to establish a record that supported a finding that the Commonwealth's energy supply would have lower costs or reduced environmental impacts with the addition of the proposed facility than it would have without the addition of the proposed facility. Eastern Energy Remand, 1 DOMSB 213, at 411-412.

More recently, in ANP Blackstone, the Siting Board found need for a generating facility based on cost savings as calculated using a dispatch model. ANP Blackstone, 8 DOMSB at 1, at 49-57. In MMWEC, the Siting Board found need for a natural gas pipeline based on likely economic benefits in the form of lower electric rates for MMWEC customers. MMWEC Decision, 12 DOMSB at 29, n.3, and at 60.

Here, the Company has provided a dispatch analysis similar to those accepted in ANP Blackstone and in MMWEC, projecting average annual savings of $19.8 million for New England customers over the first five years of operation of the wind farm. For purposes of estimating economic benefits, the Siting Board accepts the assumption that the wind farm will be a price taker in the energy markets, and thus will fall at or near the bottom of the regional dispatch queue whenever it is operating. The Siting Board also finds credible the Company's assumption that energy price reductions and anticipated price reductions in the spot market will be reflected in longer-term contracts for energy after standard offer service ceases in March 2005.

Cape Wind argued that its modeling protocol was conservative, and asserts that average

annual savings actually would be at least $25 million, with $10 million per year of this savings accruing to Massachusetts customers. The Siting Board agrees that savings may well be higher than those modeled based on average market conditions, and notes further that because the savings are sensitive to fossil fuel prices, savings would be higher than modeled if future fuel prices are higher than those prevailing in Spring 2001.

The Alliance has not challenged the Company's modeling techniques or assumptions. Rather, it has argued that economic efficiency should be analyzed based on a generator's long-run marginal cost as compared to those of other generators, rather than by its effect on energy prices. However, in past decisions, the Siting Board has evaluated economic need based on the actual costs that electric utilities or customers in Massachusetts and New England pay for the electricity they consume, not the long-run marginal cost of a project. The wind farm may be a project with relatively high capital costs and may receive government support;[133] however, its cost structure is relevant to the Siting Board's need analysis only insofar as it has cost implications for electric customers.

The record shows that the wind farm will tend to reduce market clearing prices for electricity because it typically will be bid into that market at its marginal operating costs, which are close to zero, and displace power plants with higher marginal costs. The savings resulting from this displacement would accrue to electric customers, and are estimated to be $25 million per year for New England customers, including $10 million annually for Massachusetts customers over the first five years of operation. Consequently, the Siting Board finds that operation of the wind farm would provide average annual savings of $25 million for New England customers, including $10 million annually for Massachusetts customers, during the first five years of operation.

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133 The Alliance characterizes this support as a market distortion; however, it also can be viewed as government intervention to remediate market failures. The Siting Board shares the Commonwealth's commitment to the development of new renewable energy resources, and views the implementation of renewable portfolio standards as an important part of that commitment. To the extent that the marketplace is influenced by these requirements, the Siting Board accepts such influence as presumptively warranted.

B. Other Economic Benefits

1. Company

The Company offered two additional arguments regarding regional economic benefits provided by the wind farm.[134] First, the Company asserted that the additional diversity provided by the wind farm would provide a hedge against financial risks associated with the availability of natural gas and other fossil fuels (Exh. CW-1, at 2-6). Although Cape Wind asserted that generating unit resource diversity has economic value and that increasing the use of renewable sources of energy is wise from a power supply portfolio perspective, it did not provide a quantitative estimate of that value (Exh. CW-DCS-2-R at 41, 46). However, the Company suggested that the Siting Board consider such a benefit qualitatively (id. at 46).

To illustrate indirect price benefits from renewable energy, La Capra noted that when hydroelectric production in the Pacific Northwest is poor, natural gas units run more frequently, gas storage is depleted, and upward pressure is placed on natural gas prices (Tr. 3, at 511). The Company predicted that the addition of non-fossil-fuel-fired resources in New England would leave more natural gas available for electric generation, domestic heating, and industry (id.). Lower consumption would tend to reduce fuel prices for electric generation, thus lowering electric prices and the price of fuels for other purposes as well (Tr. 4, at 565-567). The Company asserted that the extent of renewable generation is one of the key factors influencing the availability and price of natural gas in the next few years (Tr. 3, at 512). The Company also predicted that displacement of fossil-fuel plants by the wind farm would tend to reduce the volatility of fuel prices and argued that the wind facility's projected high winter output would help offset tight winter gas supplies (Tr. 4, at 567-568).[135] The Company asserted that, because

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134 The Company initially asserted that operation of the wind farm would provide economic benefits for Cape Cod by lowering the locational prices paid by Cape Cod consumers under the ISO-NE congestion management pricing system (Exh. CW-1, at 2-4, 2-5, 2-17, 2-25). However, after further analysis, the Company concluded that it was unlikely that the wind farm would reduce locational prices specifically for Cape Cod customers (Exh. EFSB-RR-14).

135 Cape Wind stated that the facility's output would be greatest from December through

(continued...)

natural gas prices are sensitive to supply-and-demand conditions, a relatively small reduction in consumption in New England could result in a large price reduction (Tr. 18, at 2391).

Second, the Company asserted that development of the wind farm would increase the supply of new renewable power assigned RPS certificates, thus tending to reduce the price paid by consumers for compliance with the Massachusetts RPS (Exh. CW-1, at 2-5; Tr. 4, at 625-637). The Company stated that the upper bound on plausible bilateral prices for Massachusetts qualified RPS certificates would be $50 per MWh (Tr. 4, at 624). The Company estimated that increasing the supply of RPS certificates would lower the price of Massachusetts qualified RPS certificates by at least $5 per MWh (id. at 625-637). Using this estimate of $5 per MWh, the Company projected savings for Massachusetts customers of just over $40 million, for the period 2007 through 2010 (Exh. EFSB-RR-19; Tr. 4, at 644).

2. Alliance

The Alliance argued that the wind farm is too small to exert any significant downward pressure on fuel prices (Tr. 14, at 1907-1908). Further, the Alliance argued that there is no evidence that construction and operation of the Cape Wind generator would reduce the number of hours that the price-setting plant would be fossil-fueled, and argued that electricity prices will continue to be closely tied to fossil fuel prices in New England (Alliance Reply Brief at 31, n.24). In addition, the Alliance argued that fuel diversity does not offer benefits with regard to cost, but rather comes at a high price through subsidies (id. at 32).

3. Analysis

The Siting Board agrees with the Alliance that operation of the wind farm is unlikely to change the extent to which fossil-fueled plants set the market clearing price for electricity. However, the record indicates that the addition of non-fossil-fueled resources such as the wind farm to the regional energy supply could reduce demand for fossil fuels during periods of high electricity demand, and thus marginally reduce fuel prices during periods when gas and oil prices

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[135] (...continued)
March (Exh. EFSB-RR-17).

are elevated due to high demand. The Company has not analyzed regional energy prices in sufficient detail to allow the Siting Board to determine the probability and likely magnitude of any ratepayer savings resulting from such an effect. The Siting Board therefore makes no finding regarding the economic benefits of the resource diversity provided by the wind farm.

With respect to the Company's second argument, the Siting Board notes that the RPS program imposes costs on load-serving entities in order to promote the use of renewable sources of energy. However, the supply and demand figures provided by the Company suggest that for several years there will be an insufficient number of RPS certificates whether or not the wind farm is built, so the estimated $40 million savings to Massachusetts customers is fairly speculative. The Siting Board therefore makes no finding regarding the level of consumer savings that would derive from the increased supply of RPS certificates provided by the wind farm.

C. Offsetting Costs

1. Alliance

The Alliance stated that ISO-NE would need to procure an increased amount of automatic generation control or other regulation services from existing generators, if the proposed wind farm were in operation, in order to compensate for the variability in output from the wind farm (Exh. APNS-JB-1, at 13, 19). The Alliance stated that electric customers would bear the cost of these regulation services (id. at 19).

2. Company

The Company stated that ISO-NE obtains regulation services to handle intra-hour variations in the load and resource balance on the electric system (Tr. 3, at 445). The Company explained that these intra-hour variations reflect both load and generation variations (id.). ISO-NE needs to be able to dispatch certain generators that can cover variations in demand and supply within an hourly period (id.).

The Company stated that the median error in its hour-ahead estimate of power generation would be about 10% of its capacity, or about 0.002% of New England peak load

(Exhs. CW-DCS-2-R at 14; EFSB-RR-7). The Company asserted that the wind farm would increase New England's regulation services requirements by 2% at most; it estimated that this additional cost would be a few million dollars per year, and thus much less than the estimated $25 million savings in wholesale electric costs (Exhs. CW-DCS-2-R at 26; EFSB-RR-11; Tr. 18, at 2289).

3. Analysis

The record indicates that ISO-NE may need to procure an increased level of automatic generation control or other regulation services if the wind farm is added to the grid, but that these additional costs would not exceed a few million dollars per year. The Siting Board finds that the cost of any additional regulation services made necessary by the wind farm would be significantly less than the expected displacement savings.

D. Conclusion on Economic Need

In the sections above, the Siting Board has found: (1) that operation of the wind farm would provide average annual savings of $25 million for New England customers, including $10 million annually for Massachusetts customers, during the first five years of operation; and (2) that the cost of any additional regulation services made necessary by the wind farm would be significantly less than the expected displacement savings. The Siting Board therefore finds that there is a need for the power generated by the wind farm for economic purposes during the first five years of operation.

A-V. Need for Energy: Environmental

A. Scope of Environmental Need

Cape Wind asserted that operation of the wind farm would provide the New England region with substantial benefits in the form of reduced system-wide emissions of pollutants, due to the displacement of fossil-fuel generators (Company Brief at 72). In support, the Company provided a dispatch analysis comparing regional emissions of sulfur dioxide ("SO_2"), nitrogen oxides ("NO_X"), and carbon dioxide ("CO_2"), with and without the wind farm (Exhs. CW-1, at

2-26 to 2-28; EFSB-RR-21).

The Alliance has argued that such an analysis is incomplete, in that it does not recognize other environmental impacts of constructing and operating the wind farm (Alliance Brief at 39). In support, the Alliance presented testimony on the noise impacts, fisheries impacts, and avian impacts of the proposed wind farm. Cape Wind also presented testimony on these impacts, as well as limited testimony on visual impacts, while arguing that Siting Board precedent limits the scope of the environmental need analysis to an analysis of comparative air emissions (Company Brief App. A at 8-10). Therefore, as an initial matter, the Siting Board must determine the scope of its review of environmental need for the wind farm.

Cape Wind accurately represents the Siting Board's precedent in this area. The Siting Board found need for a proposed facility for environmental purposes in four prior decisions – three involving generating facilities, and one involving a natural gas pipeline intended to provide an increased supply of natural gas to an existing generating facility. MMWEC Decision, 12 DOMSB 18, at 61-70; ANP Blackstone, 8 DOMSB 1, at 57-63; ANP Bellingham, 7 DOMSB 39, at 91-97; U.S. Generating Company, 6 DOMSB 1, at 43-45 (1997). In each of these cases, the need finding was based entirely on an analysis of the net reduction in air emissions that would result from the operation of a new generating facility, or from the increased use of natural gas at an existing generating facility, as documented by dispatch analyses showing expected emissions with and without the new power plant or fuel source.[136] Thus, in the past, the Siting Board has found environmental need based on an analysis of comparative air quality, without further analysis of other environmental impacts.

The Alliance has proposed expanding the environmental need analysis to include other impacts of the wind farm. An expanded environmental need analysis has not been warranted in past cases. However, the Siting Board notes that an expanded environmental need analysis may be useful in this case, because the wind farm's impacts likely would differ significantly both in

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[136] As mentioned earlier, after noting in the MMWEC Decision, 12 DOMSB 18, at 149, that identified economic and environmental benefits appeared modest, the Siting Board considered whether these benefits were outweighed by the environmental impacts of MMWEC's proposed pipeline project, and concluded they were not. See n.118, above.

type and extent from those of the generators that it would displace. However, the Siting Board notes that the environmental need analysis is a comparative analysis – it looks, not just at the impacts of the new facility, but at changes in regional impacts with and without the new facility. Therefore, an analysis of the impacts created by the operation of a new generator must be considered in the context of any changes in impacts caused by the displacement of other generators. For example, any analysis of the noise that would be produced by the operation of a new generator should be considered in the context of the possible reduction in noise at other locations caused by the less frequent dispatch of other generation facilities. In addition, a full comparative environmental analysis should take into consideration all important classes of environmental impacts, although impacts that either are minor, or are likely to be similar for the new and displaced generators, may be excluded.

In the following sections, the Siting Board considers the evidence provided by Cape Wind and the Alliance, placing it, where appropriate, into this comparative framework, and evaluating it on its merits and completeness.

B. Air Quality Impacts

1. Company

The Company stated that energy from the wind farm would be produced without perceptible air emissions, and would displace production of energy by fossil-fuel fired facilities in the region, thereby reducing regional emissions of criteria pollutants and CO_2 (Exh. CW-1, at 2-26, 2-27). To estimate the expected level of emissions displacement, the Company first estimated the annual energy output of the wind farm as 1437 GWh per year (id. at 2-17; Tr. 4, at 614). The Company then obtained marginal emission rates developed by ISO-NE in its NEPOOL Marginal Emission Rate Analysis for the year 2000 (Exh. CW-1, at 2-27; Tr. 5, at 657). The Company used these marginal emission rate data for SO_2, NO_X, and CO_2 to estimate the project's impact on state and regional emissions (Exhs. CW-1, at 2-27; EFSB-RR-21). The Company calculated that, had the wind farm been operating in 2000, regional air emissions in that year would have been reduced by approximately 4480 tons of SO_2, 1323 tons of NO_X, and 1,062,554 tons of CO_2 (Exhs. CW-1, at 2-28; EFSB-RR-21). The Company estimated that

approximately 40% of these emissions reductions, including 1792 tons of SO_2, 529 tons of NO_X, and 425,022 tons of CO_2, would have been released by facilities within Massachusetts (Exh. EFSB-RR-20).

The Company estimated that future regional reductions would be substantial but would gradually decline as the mix of generation changes (Tr. 5, at 665-668, 694). The Company also claimed that operation of the wind farm would result in reductions in regional mercury and particulate emissions, but did not quantify these reductions (Exh. CW-1, at 2-28; Tr. 5, at 694-695).

2. Analysis

Cape Wind has estimated reductions in emissions based on the average emissions of power producers at the margin for dispatch in 2000, and the total amount of power expected to be delivered from the wind farm. The Company did not attempt to predict marginal emissions rates for future years, but argued that in the short term, emissions reductions generally would be comparable to those in 2000. In prior cases involving proposed generating facilities, the Siting Board has accepted analyses based on expected displacement of other generators and on ISO-NE data on marginal emissions rates, similar to those presented here by Cape Wind, as evidence of the facility's potential to reduce regional air emissions of certain pollutants. Sithe Edgar Development LLC, 10 DOMSB 1, at 21, 26 (2000); see also Brockton Power, 10 DOMSB 157, at 187-188, and Sithe Mystic, 9 DOMSB 101, at 132. However, we note that the marginal emissions rates will change over time with the retirement of older, less efficient generation, and the development of newer, primarily gas-fired units. Consequently, the Siting Board finds that, in the near term, operation of the wind farm would reduce regional air emissions by approximately 4480 tons of SO_2, 1323 tons of NO_X, and 1,062,554 tons of CO_2 annually, and would reduce Massachusetts air emissions in Massachusetts by approximately 1792 tons of SO_2, 529 tons of NO_X, and 425,022 tons of CO_2 annually. The Siting Board also finds that, given its zero-emissions profile, operation of the wind farm will result in long-term reductions in regional and Massachusetts air emissions of unknown size.

C. Noise

1. Company

The Company's noise witness, Peter Guldberg, asserted that operational noise from the proposed wind farm would not be audible from onshore locations or to boaters (Exh. CW-PHG-1, at 5). Mr. Guldberg also asserted that underwater noise would "disappear into the ambient background sound levels of the sea" at distances over 110 meters (360 feet) and that it is unlikely that project operation would be audible to seals or porpoises (id. at 6, 7).

In support, Cape Wind presented a preliminary draft of its analysis of baseline and project noise levels. The Company indicated that it had collected baseline sound data at two offshore locations and at three coastal locations (Exh. EFSB-SS-22-S, Att. at 5-114). The two offshore locations were at Buoy G5 in the North Shipping Channel, about one mile north of the edge of the proposed wind farm, and at Buoy R20 at the edge of the Main Channel, about 1/3 mile south of the proposed wind farm (id. at 5-116). The three coastal locations were: 100 feet inland from the high water mark of a south-facing beach at Point Gammon in Yarmouth, 4.7 miles from the closest turbine; 80 feet inland from the high water mark at Oregon Beach in Cotuit, specified in the draft as 5.5 miles from the closest turbine; and 40 feet inland from an east-facing beach at Cape Poge in Edgartown, specified as 5.4 miles from the closest turbine (id. at 5-116, 5-120, 5-121).

The Company stated that it collected baseline sound levels from the two offshore buoy locations under conditions of clear skies, light winds, and light seas for periods of 20 minutes each between 10 a.m. and 12 noon on October 22, 2002 (id. at 5-118, 5-119). The time-averaged sound levels ("L_{eq}") at Buoys G5 and R20 were 46 and 51 dBA, respectively (id. at 5-119). Sound levels exceeded 90% of the time ("L_{90}") at Buoys G5 and R20 were 35 dBA and 37 dBA, respectively (id. at 5-119; Tr. 19, at 2586). Identified sources of the sound measured at the offshore buoys included aircraft, vessels, and waves slapping on the hull of the boat used for monitoring (Exh. EFSB-SS-22-S, Att. at 5-119; Tr. 19, at 2624).

The Company stated that it selected Point Gammon, Oregon Beach, and Cape Poge for background monitoring because they are coastal locations remote from high traffic areas (Exh. EFSB-SS-22-S, Att. at 5-119, 5-120). Measurements were collected over periods of four

to seven days in November and early December 2002 under a variety of wind conditions (id. at 5-120, 5-121).[137] At the lowest wind speed at which the turbines would generate power ("cut-in wind speed"), one-hour average L_{eq} sound levels ranged from 41 to 63 dBA (id. at Table 5-19). L_{eq} sound levels with an on-shore wind at the design wind speed were higher, ranging from 54 to 71 dBA (id. at Table 5-19). L_{90} sound levels ranged from 27 to 70 dBA, including a range of 34 to 66 dBA at the cut-in wind speed, and a range of 50 to 67 dBA with an on-shore wind at the design wind speed (id. at Table 5-19). Identified sources of sound at various locations included wave noise, wind, birds, aircraft, motor vehicles, and vessels (id. at 5-120, 5-121, 5-125).

The Company presented data provided by the prospective turbine manufacturer, General Electric, indicating that the total sound energy emitted by a single turbine ("sound power") would be 95 dBA at the cut-in wind condition, and 107 dBA at the design wind condition (id. at 5-115; Exh. CW-PHG-1-R, Att. A). For comparison, the Company indicated that an outboard motorboat or a typical diesel fishing boat could have a sound power level as high as 122 dBA (Exh. EFSB-RR-77; Tr. 15, at 2591). The Company indicated that the sound power of 130 turbines would be similar in magnitude to the sound power of a single powerboat, but that the distribution of sound frequencies could be very different (Tr. 19, at 2592-2594).

The Company modeled sound attenuation between 130 operating turbines located on Horseshoe Shoal and several locations (including the five baseline noise monitoring locations) under various wind conditions (Exh. CW-PHG-1-R, Att. A). The predictions were based on hemispherical sound wave divergence and atmospheric absorption of sound (Exh. EFSB-SS-22-S, Att. at 5-115; Tr. 19, at 2617).[138] The Company claimed that, excepting very low frequency

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[137] The Company measured sound levels in a series of frequency bands and also provided A-weighted sound levels for various wind conditions, including baseline sound levels at a cut-in wind speed (8 mph at the turbine height, or about 5 mph at 10 feet above the ground at Hyannis Airport) (Exh. EFSB-SS-22-S at 5-121; Tr. 19, at 2572). Among conditions when the turbines operate, ambient noise would be lowest at the cut-in wind speed (Tr. 19, at 2574).

[138] The Company included cylindrical spreading in its model, starting 2 kilometers

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sound, any relative enhancement of sound resulting from a temperature inversion and/or downwind receptor location is necessarily less than the excess diminution of sound caused by other factors (Exh. CW-PHG-1, at 4; Tr. 18, at 2406-2416).[139] The Company therefore did not make any separate prediction for enhanced propagation attributable to temperature or wind gradients (Tr. 18, at 2414).

The Company noted that turbine noise would be greater at the design wind speed than at the cut-in wind speed, but that background noise would generally increase by as much or more (Exh. EFSB-SS-22-S, Att. at Table 5-27). The Company predicted that the sound level from the wind turbines would be 30 dBA and 34 dBA at Buoys G5 and R20, respectively, at the cut-in wind speed, and 40 dBA and 45 dBA at design wind speed (id. at 5-125, 5-126). The Company predicted that the sound level from the wind turbines, as measured at Point Gammon, the closest point of land, would be 18 dBA at the cut-in wind speed, and 26 dBA at the design wind speed, with onshore winds (id. at figs. 5-40, 5-50). The data show that the modeled sound most closely approaches background levels in the frequency band around 80 cycles per second (Hz) (id.). In the 80 Hz band, the sound level at Point Gammon would be 34 dB at the cut-in wind speed

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138 (...continued)
downwind from turbines, only for low frequencies outside the range of human hearing (below 20 Hz), and only for times when winds exceed 20 mph (Exh. EFSB-SS-22-S, Att. at 5-115).

139 The Company provided ANSI and EEI descriptions of how sound waves can be bent toward a low-elevation receptor when the wind speed near the surface is lower than wind speeds aloft and the wind is toward a receptor, and/or when air temperatures near the surface are lower than air temperatures aloft (Exhs. CW-PHG-1-R, Att. E; EFSB-RR-78, Att.). However, the Company asserted that any tendency for sound to carry long distances due to temperature gradients and/or wind gradients is always overwhelmed by additional attenuation attributable to factors such as absorption by surfaces and turbulence (Exh. CW-PHG-1, at 4; Tr. 18, at 2406-2416). The Company's witness identified these other factors as: (1) imperfections in the reflectivity of the sea surface when it is not glassy smooth; (2) upward bending of sound waves due to cooler temperatures aloft in high wind conditions; (3) excess attenuation due to turbulence; and for inland receptors, (4) sound absorption by grass, trees, structures, and other barriers (Tr. 18, at 2415-2416).

(id. at Fig. 5-40).[140] At the location with the quietest (average) background level, Cape Poge on Martha's Vineyard, the Company predicted 17 dBA, with 33 dB in the 80 Hz band, as the maximum continuous level from project operation at the cut-in wind speed (id. at Fig. 5-48).

Table A-3, below, compares the Company's modeling and monitoring results for the cut-in wind speed, at which wind turbine noise is more likely to be noticeable, for representative locations.

Table A-3
Comparison of Modeled Sound Levels to Baseline Sound at Cut-In Wind Speed

MODELED SOUND RECEPTOR LOCATION	Distance from Wind Farm (miles)	Baseline Sound at Cut-In Wind Speed: Lower Range of L_{90}		Modeled Turbine Noise at Cut-In Wind Speed		Wind Farm Sound Level as Compared to Baseline	
		Full Spectrum (dBA)	80 Hz band (dB)	Full Spectrum (dBA)	80 Hz band (dB)	Full Spectrum (dBA)	80 Hz band (dB)
Buoy G5	1	35	NA	30	43	-5	NA
Buoy R20	0.37	37	NA	34	46	-3	NA
Point Gammon	4.7	39.6	39	17.8	34	-22	-5
Oregon Beach*	NA	34	20	17	34	-17	14
Cape Poge	5.4	40	29	17	33	-22	4

* Baseline monitoring data from Oregon Beach in Cotuit are compared to sound levels modeled for Wianno Beach. Data sources: Exhs. CW-PHG-1, at 6; EFSB-SS-22-S; EFSB-RR-76, Att. (Rounding and subtraction by EFSB staff).

The Company asserted that a sound would be inaudible if its full spectrum L_{eq} sound level were less than the baseline sound level, unless a pure tone situation were to result (Exh. EFSB-SS-22-S, Att. at 5-122; Tr. 19, at 2629-2630).[141] The Company concluded that the turbines would be inaudible on the basis that the Company's modeled A-weighted sound levels

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140 The Company indicated that the project sound spectrum has an energy peak at 80 Hz (Exh. EFSB-RR-76).

141 Within the context of audibility, the Company defines a pure tone as a 1/3-octave band that is 5 to 15 decibels higher than the mean of the two adjacent 1/3-octave bands (Exh. EFSB-SS-22-S, Att. at 5-122).

from the wind farm are lower than its measured average baseline sound levels (Exh. EFSB-SS-22-S, Att. at 5-122).

The Company stated that there are four planned perimeter foghorns which would operate during foggy conditions only (Tr. 19, at 2596). Sound power levels of the foghorns were not provided but the Company asserted that the foghorn sound has a range of one-half mile and would not be audible from shore (Exh. EFSB-SS-22-S, Att. at 5-127; Tr. 18, at 2386-2387).

2. Alliance

Erich Bender, Sc.D., the noise witness for the Alliance, contended that operational noise from the proposed wind farm would be audible both by boaters and from onshore locations, under some meteorological conditions (Exh. CW-APNS-EB-1, Att. at 3). Dr. Bender stated that the spherical spreading model used by Cape Wind would apply only in the absence of temperature inversion and wind gradients (Tr. 12, at 1593). Dr. Bender contended that the Company was incorrect in its assertion that wind and temperature gradients could not effectively focus sound and that any such effect would be overwhelmed by other types of attenuation (Exh. APNS-EKB at 3, 4; Tr. 12, at 1592-1598, 1677). Specifically, Dr. Bender suggested that cylindrical spreading would be more appropriate than spherical spreading as a model for the geometric dispersion of sound power at distances beyond about 300 or 600 feet from a source, for downwind receptors under certain meteorological conditions (Tr. 12, at 1618-1619, 1672). Dr. Bender stated that spherical spreading causes a reduction in sound pressure of 6 decibels with each doubling of distance, whereas cylindrical spreading reduces sound pressure by 3 decibels with each doubling of distance from a sound source (id. at 1597-1598). For instance, the difference between cylindrical spreading and spherical spreading between 1 km (3300 feet) and 8 km (5 miles) would be 9 decibels since there are three doublings of distance (id. at 1615). Using noise data collected in the late 1980s for a variety of turbines, and assuming cylindrical spreading beyond 300 meters, Dr. Bender estimated that turbine sound levels in shoreline residential areas would be 45 dBA to 55 dBA (Exhs. APNS-EKB at 4; EFSB-APNS-21; CW-APNS-EB-1, at 5; CW-APNS-EB-1-C at 3; EFSB-RR-59; Tr. 12, at 1603, 1618, 1634, 1642, 1649).

3. Analysis

The Company has provided modeling that predicts that the noise contribution of the wind turbines would be less than background sound levels at representative onshore and offshore locations. The Company's analysis predicts that wind farm noise would be 17 to 22 dBA less than background at onshore locations, and 3 dBA less than background at offshore receptors. The Company's modeling also predicts that noise from the wind turbines may surpass background sound levels in a low frequency band around 80 Hz at some coastal locations.

The Company's calculations reflect an assumption that sound in frequencies within the range of human hearing would spread hemispherically. The Alliance has challenged Cape Wind's assumption, arguing that a cylindrical dispersion model is more appropriate for certain meteorological conditions.[142] The Company asserts that, even when meteorological conditions enhance downwind sound propagation, other effects (e.g., air turbulence) would provide enough sound attenuation to keep noise from the wind farm at or below modeled levels.

The Siting Board notes that, since there is little to block or absorb sound traveling over open water, it is likely that sound will travel better than predicted by the Company at times when enhanced by wind or pressure gradients. Thus, actual sound levels at onshore receptors may occasionally exceed the sound levels listed in Table A-3, above. The extent to which these levels may be exceeded has not been established in this record. However, the Alliance's testimony suggests that, at times when sound spreads cylindrically beginning at 1 kilometer from the wind farm, actual sound levels at onshore receptors could temporarily exceed the levels listed in Table A-3 by up to 9 dBA; this would result in onshore noise levels that are 8 dBA to 13 dBA below background levels. These figures do not account for absorption of sound by the water surface, turbulence of the air, or other factors that would affect sound levels at receptor locations.[143]

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142 The record shows that sound propagation may be enhanced by: (1) temperature inversion, where air near the ground is cooler than air aloft; (2) wind blowing towards receptor locations; and (3) relatively calm water.

143 The Siting Board notes that there are several unquantified effects, including the (continued...)

The Company asserts that sound sources are inaudible if their A-weighted sound level is less than background, except in cases where a pure tone results. The Siting Board has never assessed thresholds of audibility; however, in prior cases where the Siting Board has reviewed projected ambient increases in the L_{90} sound level, witnesses have testified that increases in ambient sound of less than 3 dBA would not be perceptible as an increase in noise. See ANP Blackstone, 8 DOMSB 1, at 159; Nickel Hill Energy LLC, 11 DOMSB 83, at 181 (2000). Even the enhanced sound levels discussed above would not result in a 3 dBA increase in sound levels at onshore receptors. The Siting Board therefore concludes that total sound levels at the onshore monitoring locations selected by the Company would not be appreciably increased. However, because sound levels in the 80 Hz (low frequency) band are modeled as exceeding background levels at certain coastal locations, and because modeled levels may be exceeded, we conclude that low-pitched sound from the turbines might be distinguishable from background noise under certain meteorological conditions. It also appears likely that turbine noise would be heard by some boaters.

Based on the record, the Siting Board finds that, while the wind farm may be audible onshore when meteorological conditions permit, the noise levels produced by the wind farm would be lower than background noise levels onshore, and would not result in a perceptible increase in the overall noise levels at shore locations. The record does not contain information on the potential changes in noise levels at other locations that would result from the less frequent operation of generators displaced by the wind farm. However, the Siting Board notes that many fossil-fueled generators are located in close proximity to residential areas and result in significant increases in overall noise levels when operating. Therefore, the Siting Board finds that the noise impacts of the wind farm are likely to be less than those of many of the generators it would displace.

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[143] (...continued)
potential range of actual sound wave spreading geometries, any variations in turbine sound output over time, absorption due to air turbulence, and absorption by the water surface, that would cause sound levels to differ from any predictions made here.

D. Fisheries

1. Company

The Company asserted that benthic habitat conditions are very similar throughout much of Nantucket Sound (Exh. CW-CJN/SBW-2-R at 10). The Company asserted that adult and juvenile finfish are considerably mobile in the water column and would be capable of moving away from construction activities (id. at 11-12). The Company therefore asserted that finfish would be able to go elsewhere while marine construction activities are occurring (id. at 10-11).

The Company characterized the seabed as having lower invertebrate diversity than other areas off southern New England, but having high biomass and density (id. at 18).

The Company commissioned and provided a scour analysis which found that scour around the turbine pilings could reasonably be expected to a depth of 4.1 feet, with scour extending laterally as much as 33.1 feet from a pile (Exh. EFSB-SS-22, App. 5-B, at 7). The scour analysis concludes that it is not realistic to conclude that the pilings will have long-term, far-field effects on the composition of Horseshoe Shoal (id. at 7). To mitigate near-field effects, the Company proposes to install scour control mats (id. at Fig. 4).

Cape Wind asserted that criticism by Dr. LeGore and Mr. Weissman of the extent of its fisheries studies was based on information provided in the ENF for the project, rather than on the full case record (Exh. CW-CJN/SBW-2-R at 2, 4, 10, 15-16). Cape Wind contested some of Mr. Weissman's assertions about studies being inadequate. The Company qualitatively characterized investigations it had undertaken as numerous, extensive, and comprehensive (id. at 8, 17).

2. Alliance

Richard S. LeGore, Ph.D., provided testimony on potential benthic (sea-bottom) impacts of the wind farm. Dr. LeGore estimated that over 2 million cubic yards of sediment would be fluidized during project construction, and asserted that the habitat alteration associated with rearranging sediments by jet plow had not been properly characterized (Exh. APNS-RSL at 13-15; Tr. 17, at 2157). Dr. LeGore asserted that analysis is needed of the marine effects of construction noise, anchor line sweep during the construction of pilings, and scouring around the

base of pilings (Exh. APNS-RSL at 15, 17-18).

Dr. LeGore estimated that over 245,000 square feet of new hard surfaces would be created for colonization on piling surfaces, plus an unknown amount of hard surfaces in riprap (Exh. APNS-RSL at 16). This would affect local biological communities, which Dr. LeGore asserted should be characterized, whether positive or negative (id. at 16-17). Specifically, Dr. LeGore asserted that the level of environmental impact analysis for the project has been inadequate (id. at 4-19).[144] Dr. LeGore indicated that the characterization of existing benthic life was inadequate and criticized the characterization of bottom sediments (id. at 4-11; Tr. 17, at 2178).

Mark Weissman, also an Alliance witness, provided testimony on the value of fisheries habitat in Nantucket Sound. Mr. Weissman pointed out that the area supports a high level of fishing and boating (Exh. APNS-MW at 4). Mr. Weissman stated that Nantucket Sound has been designated EFH for sea clam (*Spisula solidissima*), long-finned squid (*Loligo pealei*), short-finned squid (*Illex illecebrosus*), blue shark (*Prionace glauca*), Atlantic mackerel (*Scomber scombrus*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*S. maculatus*), bluefin tuna (*Thunnus thynnus*), Atlantic cod (*Gadus morhua*), winter flounder (*Pleuronectes americanus*), yellowtail flounder (*P. ferruginea*), windowpane (*Scopthalmus aquosus*), fluke (*Paralichthys dentatus*), Atlantic butterfish (*Peprilus triacanthus*), scup (*Stenotomus chrysops*), and black sea bass (*Centropristus striata*) (id. at 5-6; Tr. 12, at 1683-1684).[145] Mr. Weissman stated that long-finned squid are believed to spawn on Horseshoe Shoal, and that individuals tend

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144 Dr. LeGore's criticisms include inadequate description of sampling, possibly too coarse sampling, lack of replicates, lack of description of heterogeneity and spatial variations, lack of seasonal stratification in sampling, inadequate particle size analysis, inadequate statistical analysis of diversity, taxonomic imprecision, and lack of analysis of larger mobile species such as whelks, crabs, and lobster, and incomplete statistical evaluation of the data (Exh. APNS-RSL at 4-11; Tr. 17, at 2159-2162, 2194-2199). Dr. LeGore asserted further that the evidence presented by the Company does not include the linear feet of jet-plowing that would be required to join turbines to the ESP (Exh. APNS-RSL at 13).

145 The Company also listed shortfin mako shark (*Isurus oxyrhinchus*) and cobia (*Rachycentron canadum*) as species with EFH in the project area (Exh. CW-2, at 7-16).

to return to their hatch location as spawning adults (Exh. APNS-MW at 17). Mr. Weismann asserted that bluefish (*Pomatomus saltatrix*), striped bass (*Morone saxatilis*), tautog (*Tautoga onitis*), bonito (*Sarda sarda*), herring, and alewives (*Brevoortia tyrannus*) are present in large numbers, as well (id. at 9).

Mr. Weissman stated that, compared to Georges Bank, Nantucket Sound has lower biomass levels but a more intensive recreational fishery (id. at 7). On the commercial side, Mr. Weissman stated that a majority of the state's 40 permitted spring squid draggers, 58 permitted fluke draggers, and 32 black sea bass potters work Nantucket Sound, and also that 11 of the State's weirs are in Nantucket Sound (id. at 11). Mr. Weissman asserted that the fish surveys conducted by Cape Wind were inadequate to characterize the fishery (id. at 7-10). Aside from effects on fish habitat, Mr. Weissman expressed concern about the ability of draggers and trollers to maneuver among the turbines while towing their nets and lines (id. at 19).

Mr. Weissman characterized Horseshoe Shoal as a large, well-established fish aggregating structure with considerable physical stability (id. at 14; Tr. 12, at 1696-1697). Mr. Weissman stated that the catch in Nantucket Sound annually returns some tens of millions of dollars to local fishermen and is important to the economy of Cape Cod and to Massachusetts (Exh. APNS-MW at 13). Mr. Weissman asserted that construction activities would cause mortality of benthic fauna, eggs, and juvenile fish, and would also cause dispersal of juvenile and adult fish and invertebrates (id. at 17).

Mr. Weissman asserted that the proposed turbine pilings would likely create continuous turbulence, erosion, and gullying due to strong tidal currents moving across Horseshoe Shoal (Exh. APNS-MW at 16; Tr. 12, at 1689-1690). He asserted that the existing shoal structure would likely be disrupted and replaced by large gullies and ridges (Exh. APNS-MW at 16, 18). Also, Mr. Weissman asserted that some fish species are attracted to vertical structures but that others avoid them (Tr. 12, at 1691). Mr. Weissman asserted that the import of such changes cannot be determined at this time but could be detrimental or beneficial (Exh. APNS-MW at 16, 18).

3. Analysis

As highlighted by Dr. LeGore, field studies of sea bottom life at Horseshoe Shoal have been limited, at least as reflected in the record of this case. The Company's argument that benthic habitat conditions are homogeneous is difficult to confirm without an extensive analysis of many sampling locations. However, it is not the role of the Siting Board to determine the scale and design of studies of the risk to fisheries posed by the proposed turbines, which are located outside of state waters. Benthic and fisheries studies will be evaluated by the ACOE as part of its review of the wind farm.

It is difficult to predict the scope of benthic and fishery implications of installing the turbines and connecting cables. The installation may alter the species composition in the area immediately surrounding the monopiles; however, the record does not demonstrate that the benthic and fishery impacts of the wind farm would extend beyond the area of the turbines. Mr. Weissman points out that Horseshoe Shoal in its present configuration is a beneficial feature from the point of view of fish and fisheries; consequently, any alteration carries with it some risk of disturbance to the existing marine community. However, the record provides no clear indication whether and to what extent any changes caused by the project would be, on balance, beneficial or harmful to the marine benthic community, shellfish, finfish, or fisheries.[146] The Siting Board therefore makes no finding with respect to the wind farm's impact on fisheries.

E. Birds

1. Company

The Company's witness, Paul Kerlinger, Ph.D., stated that he participated in a number of field and literature studies related to avian risk associated with the proposed wind farm (Exh. CW-PK-1-R, Att. A at 3). Dr. Kerlinger contended that avian risks would be low because: (1) bird use of Horseshoe Shoal is relatively low; and (2) the bird species that are present are not

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[146] The Siting Board notes that a small number of fossil-fueled generators, primarily those that use once-through cooling, have significant negative fisheries impacts. However, since these plants are only a fraction of the New England generating fleet, we do not include off-setting fisheries impacts from displaced generation in our analysis of the environmental need for the wind farm.

likely to collide with the turbine rotors (id. at 4). Dr. Kerlinger also contended that generating electricity with wind power would have advantages for birds, compared to combustion of coal, oil, and natural gas (id. at 4 to 8).

Dr. Kerlinger contended that among a dozen or more wind power facilities in the United States, excluding Altamont Pass, California, estimated avian fatalities have averaged about two birds per turbine per year (id. at 10). Dr. Kerlinger stated that bird mortality was low at wind power sites in Minnesota and Montana that he characterized as having relatively high use by waterfowl and raptors (id. at 11). Dr. Kerlinger indicated that wind turbines in California and in Spain had high raptor mortality (id.; Tr. 20, at 2704). He stated that these areas had dense resident and/or migratory populations of raptors that used the areas of the turbines (Exh. CW-PK-1-R, Att. A at 12; Tr. 20, at 2704). Dr. Kerlinger speculated that the high bird mortality at the Altamont Pass wind power site may be due to the close spacing of turbines, the irregular topography of the site, and unusually high level of site use by raptors (Exh. CW-PK-1-R, Att. A at 13, 15). Dr. Kerlinger stated that migrating songbirds have had large-scale fatality events from communication towers (Tr. 20, at 2693-2694). He stated that the vast majority of avian fatalities from communication towers have occurred at towers taller than 500 feet with guy wires and Federal Aviation Administration ("FAA") lighting that does not blink; some fatalities also occur at other types of towers which have associated spotlights or sodium vapor lamps (Exh. CW-PK-1-R, Att. A at 21). Dr. Kerlinger indicated that the FAA requires flashing lights on wind turbines, rather than steady lighting (id. at 22)

The Company described the Cape Wind turbines as having blades extending from 75 feet above the water surface to 416 feet high, and as being spaced at least 1400 feet apart (id. at 15). The Company calculated the collision probability for birds flying through the plane of the rotor of a single turbine, for representative species. The Company calculated that the chance of a blackpoll warbler being hit by a blade is less than one percent, while a much larger black-backed gull flying through the same area would have a 5.6 % chance of being hit by a blade; these calculations assume no evasive action by the birds (Exh. EFSB-RR-71).

Dr. Kerlinger discussed the likelihood of collision risk among various orders of birds, in the context of the Horseshoe Shoal site. Birds that might be present include various groups of

waterbirds including seabirds, waterfowl, and shorebirds; raptors; and migrating landbirds. He stated that loons, grebes, and alcids are not common in the area, and furthermore tend to fly low over water, suggesting that these birds would not be struck by a blade (Exh. CW-PK-1-R, Att. A at 15, 20). Among pelagic seabirds, Dr. Kerlinger indicated that gannets tend to fly as high as the rotor-swept area, but these birds are not generally abundant in Nantucket Sound (id. at 22; Tr. 20, at 2691).

Dr. Kerlinger stated that a quarter million long-tailed ducks roost in Nantucket Sound in the winter but conceded that the nocturnal location of long-tailed ducks within Nantucket Sound is not well established (Tr. 20, at 2708-2713). He stated that long-tailed ducks and other sea ducks such as scoters and eiders fly low over water, generally below 50 feet, and that some of these species have been observed in Europe to fly around wind turbines (Exh. CW-PK-1-R, Att. A at 15, 20; Tr. 20, at 2688-2689). On the other hand, he stated that brant tend to migrate at a very high elevation (Tr. 20, at 2691).

Dr. Kerlinger indicated that shorebirds coming off the east coast of North America generally reach altitudes above 1000 feet within a few miles of the shoreline (id. at 2697). He asserted that piping plover and least terns, which are protected species, do not forage in the area and rarely fly over Horseshoe Shoal, based on species habitat preferences (Exh. CW-PK-1-R, Att. A at 18). He also asserted that these species have not been shown to be collision prone (id.). Dr. Kerlinger indicated that there is some overlap between the height at which foraging terns fly and the lower end of turning blades (Tr. 20, at 2714-2715). He indicated that roseate terns departing staging areas at Monomoy Island at the end of the summer would tend to fly out over the Atlantic, and would therefore tend to miss Horseshoe Shoal (id. at 2686). However, Dr. Kerlinger did not offer information on the arrival time or direction of arrival of terns in the spring (id. at 2686-2687). Gulls, which are common in the area, and cormorants tend to fly higher over water than most other waterbirds; consequently, they would be at the height of blades more often than other birds; however, Dr. Kerlinger indicated that these birds typically do not collide with turbines or towers in other locations (Exh. CW-PK-1-R, Att. A at 34-35; Tr. 20, at 2691).

Dr. Kerlinger stated that raptors rarely migrate across Horseshoe Shoal, preferring to take routes over land as much as possible (Exh. CW-PK-1-R at 15; Tr. 20, at 2681-2683). Dr. Kerlinger stated that migrating songbirds tend to fly higher over water than over land (Tr. 20, at 2697). Dr. Kerlinger predicted that because the wind turbines and the ESP would lack steady and intense lighting, would lack guy wires, and would be less than 500 feet tall, the turbines would not attract significant numbers of night flying migratory birds (Exh. CW-PK-1-R, Att. A at 21; Tr. 20, at 2719-2720).

Dr. Kerlinger stated that data from the National Wind Coordinating Committee indicate that an average of about 2 birds are killed per turbine per year (Exh. EFSB-RR-80). He stated that turbines at the Waddensee, a coastal lake in the Netherlands with a high level of bird activity, kill an average of 0.04 to 0.14 birds per turbine per day, which is 8 to 25 times higher than the North American average (Tr. 20, at 2706). He indicated that in his opinion, the wind farm would have mortality rates lower than those at the Waddensee (id. at 2705-06). Allowing for uncertainties, Dr. Kerlinger expressed confidence that bird mortality from the wind farm would not exceed 4 birds killed per turbine per year (id. at 2708).

Asked for comparisons, Dr. Kerlinger provided estimates based on research conducted by others (Exh. EFSB-RR-80). He cited information that free ranging cats kill many birds, with an estimate from Wisconsin of between 3.9 and 143 birds killed per cat per year (id.). He cited studies of bird mortality from collisions with windows, yielding estimates ranging from 0.65 to 33 birds killed per house per year (id.). As an average among a thousand television broadcast towers over 800 feet in height, Dr. Kerlinger provided an estimate of 1250 birds killed per tower per year (id.).

Dr. Kerlinger indicated an understanding that fossil fuel use was detrimental to bird populations (Exh. CW-PK-1-R, Att. A at 6-8; Tr. 20, at 2719).

2. Alliance

The Alliance's witness, Michael Morrison, Ph.D., also provided testimony on potential impacts to birds. Dr. Morrison indicated that wind turbines at Altamont Pass, California, have a high incidence of bird kills (Exh. APNS-MLM at 2). He asserted that there are virtually no data

on the impact of offshore wind developments on birds, and no data on wind farms of the size proposed (id. at 2). Dr. Morrison also asserted that standard guidelines recommend multiple years of intensive, rigorous avian data collection prior to wind farm construction (id. at 3). Dr. Morrison contends that insufficient data have been collected in the project area on bird abundance, bird movement, and bird behavior, and that the data that have been collected are flawed (id. at 3, 4).

Dr. Morrison asserted that Dr. Kerlinger's statements about a lack of mortality from towers less than 500 feet tall are untested due to an absence of long-term studies of such towers (id. at 27). Dr. Morrison also indicated that existing data on bird collisions at wind farms in North America come primarily from the west, which, he suggested, would not represent conditions in the east (id. at 27, 28).

Dr. Morrison stated that studies from Altamont Pass indicate that turbines with a larger rotor-swept area tend to kill more birds than do smaller turbines (Tr. 19, at 2470). He also stated that most of the bird fatalities occur at a small number of turbines in particular locations, usually near the end of a ridge (id. at 2474). Dr. Morrison said studying bird mortality at offshore wind parks in Europe was difficult because stricken birds sink or get eaten immediately (id. at 2476).

Dr. Morrison indicated that he was unable to estimate the potential hazard to birds from the Cape Wind turbines due to inadequate data (id. at 2555-2556). In response to additional questioning, Dr. Morrison stated that avoidance of air pollution would be beneficial to birds, and that extraction of fossil fuels has potential negative impacts on bird habitat (id. at 2527-2529).

3. Analysis

Cape Wind has provided evidence leading to a conclusion that bird mortality associated with operation of the wind farm would be no more than four birds per turbine per year, which is relatively low compared to some other hazards to birds. The Alliance has challenged this estimate, arguing primarily that the available bird studies were not sufficiently thorough to make accurate projections.

As of the close of the record, actual field studies of bird usage of Horseshoe Shoal were limited. Nevertheless, the record does contain an evaluation of potential risks of avian mortality

based on a combination of field visits, historical knowledge of regional bird activity, characteristic behavior of birds using the area, and observed mortality due to structures including wind turbines at other locations. The record shows that there is high raptor mortality at the Altamont Pass wind turbines associated with high raptor use of the area. The record shows that circumstances at Horseshoe Shoal would differ from those at Altamont Pass, so that high raptor mortality would not be expected. The witness for Cape Wind provided information sufficient to support an estimate of mortality of no more than four birds per turbine per year; this translates to no more than 520 birds per year in aggregate. The record shows that this mortality rate is relatively low compared to some other hazards faced by bird life.

However, there are some factors that have not been adequately determined to date. Specific uncertainties identified during the hearings include the circumstances of tern arrival in the spring; the vulnerability of foraging roseate and common terns to rotor collisions; and the spatial distribution within Nantucket Sound of the large winter population of roosting long-tailed ducks. Behavior of brant around turbines may need to be investigated as well. Also, there is uncertainty as to the possibility of high mortality events in atypical weather conditions. Some of these issues may well be resolved in ongoing proceedings before other federal and state regulatory agencies.

Based on the record, the Siting Board finds that the wind farm would cause avian mortality, but that the mortality would be modest relative to some other causes of avian mortality. Uncertainty remains as to the wind farm's likely effects on several avian species. The Siting Board notes that the record contains only qualitative information on the potential benefits to birds of reduced operation of existing fossil-fueled generating facilities, based on air emissions and oil spills. Moreover, in past reviews of generating facilities, the Siting Board has not investigated adverse impacts on birds either from emissions or fuel handling; therefore, it cannot draw on its findings in those cases. The Siting Board therefore makes no finding as to the extent of any benefits to bird populations resulting from the displacement of other power plants by the wind farm.

F. Visual Impacts

1. Company

The Company indicated that the proposed wind farm would consist of 130 wind turbines, each approximately 420 feet in height from the water to the top of the blade, arrayed over an approximately 24 square mile area of Horseshoe Shoal in Nantucket Sound (Exhs. CW-1, at 1-3; CW-2, at 2-2 to 2-3; EFSB-SS-22-S, Att. at Table 5-6; EFSB-RR-22; EFSB-RR-23). The closest land locations in different directions from the wind farm include Point Gammon in Yarmouth, 4.7 miles to the north, Cape Poge on Martha's Vineyard, 5.5 miles to the southwest, and points in Nantucket approximately 11 miles to the south and southeast (Exhs. EFSB-RR-22, Att.; EFSB-RR-23, Att.).

The Company stated that the theoretical maximum distance of visibility of a 420-foot structure located at sea, from a point 10 feet above sea level, is approximately 27.1 nautical miles, or 31.2 statute miles, based on standard visibility charts (Exh. EFSB-RR-22). Charts provided by the Company show that all of Nantucket Sound is within 27.1 nautical miles of Horseshoe Shoal (Exh. EFSB-1).

The Company asserted that a number of factors would affect the visibility of the wind farm, including sky cover, curvature of the earth, color of the turbines, and presence of line-of-sight obstructions (Exh. EFSB-RR-22). The Company provided visual simulations from twelve representative locations on Cape Cod, Martha's Vineyard and Nantucket, at distances from the wind farm ranging from 5.4 miles to 14.1 miles (Exh. EFSB-RR-22, Att.). Wind turbines are generally visible in the simulations, although their appearance varies based on the context of respective views (id.).[147, 148] The Company stated that the simulations are

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[147] The vertical and horizontal scale of the wind farm, as it appears in the view simulations, varies based on the distance from the vantage point to the wind turbines (Exh. EFSB-RR-22, Att.). For example, in the views from the closest vantage points, the wind turbines along the horizon generally extend to all or nearly all of the view field, while in the most distant views they generally extend to a portion of the view field (id.). The varying width of the wind farm, as seen from different vantage points measured perpendicular to the line of sight, also affects how much of the view field in each simulation is encompassed by the array of wind turbines (id.). The total view field of

(continued...)

conservative, in that the sky cover conditions are assumed to be clear in all of the views (Exh. EFSB-RR-22).

2. Analysis

The Company has provided visual simulations indicating that the wind farm's turbines would be visible from points on the surface of Nantucket Sound, excepting some shoreline embayments, and from points on Cape Cod, Martha's Vineyard, and Nantucket with water views toward Horseshoe Shoal. The Company's simulations suggest that the appearance of the wind farm would vary based on distance and other factors. As seen from the nearest vantage points in the Company's analysis – generally coastal points located five to seven miles away in Barnstable and Yarmouth on Cape Cod and on the northeast side of Martha's Vineyard – the wind farm would appear as extending over a substantial portion of the seaward horizon in each simulation, creating significant visual impacts.

The Company argued that visual impacts have been analyzed assuming clear conditions – a worst-case assumption. While it is true that clear conditions are present only part of the time, no evidence has been provided as to the percent of time visibility might be less than shown, or the extent to which visual impacts might be reduced under conditions of impaired visibility. Consequently, the Siting Board finds that the wind farm turbines would be visible from onshore and offshore locations, and that their appearance would vary based on distance and other factors, including weather.[149]

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147 (...continued)
each of the simulations in the Company's analysis is identified, and ranges from 38.7 degrees to 44 degrees (id.).

148 The Company stated that the wind turbines would be blue-gray (Exh. EFSB-RR-22, Att.; Tr. 20, at 2756). However, the Company noted that the wind turbines appear black in several of the views with the position of the sun behind the facilities, and white in several of the views with the position of the sun behind the vantage point (Exh. EFSB-RR-22, Att.; Tr. 20, at 2756-2757).

149 The Siting Board notes that operation of the wind farm could reduce the frequency with which steam plumes from existing power plants are seen, and could preclude or delay the (continued...)

G. Conclusions on Environmental Need

In the sections above, the Siting Board has considered certain direct and indirect environmental impacts of the construction and operation of the wind farm, with a view towards determining whether the energy from the wind farm is needed for environmental purposes.[150] The record clearly documents significant and lasting air quality benefits resulting from the wind farm's displacement of other, primarily fossil-fueled, generators.

However, to conclude that the wind farm project will provide environmental benefits, these air quality benefits must be balanced with identified noise, visual, avian, and fisheries impacts, and with the potential for other impacts and benefits. As discussed above, the onshore noise impacts of the wind farm would be minimal, as it would not result in a perceptible increase in overall noise levels at onshore locations. Simulations contained in the record suggest that the wind farm would result in significant visual impacts in nearby waters and some onshore areas under clear conditions; the extent, if any, to which visual impacts might be less than simulated (e.g., in reduced-visibility weather) was not demonstrated. Operation of the wind farm would result in relatively modest avian mortality. The direct impacts of the wind farm on fisheries are unknown, and could be positive or negative.

The wind farm may have other indirect benefits, although these are not well-defined in the record. As discussed above, operation of the wind farm may result in the less frequent operation of existing generators with significant noise impacts, and may indirectly benefit bird populations by reducing impacts on birds from fossil-fueled generation (e.g., impacts from spills related to fuel delivery). However, the extent of these benefits cannot be assessed based on the

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149 (...continued)
development of a new power plant with associated visual impacts in another location. However, based on the current record, no assessment was made of the extent to which visual impacts from generation in other locations might be reduced.

150 The Siting Board notes that the environmental benefits of renewable energy facilities generally are reflected in the legislature's enactment of the RPS statute. The need for energy from the wind farm to meet RPS is addressed in Section A-III, above.

existing record.[151]

Overall, the Siting Board concludes that the air quality benefits of the wind farm are significant, and important for Massachusetts and New England. Available evidence indicates the air quality benefits of the wind farm likely would outweigh its noise and avian impacts. Several other indirect benefits are likely to favor the wind farm, although they cannot be given any significant weight in light of the limitations of the record. Beyond these, the potential for significant visual impacts from the wind farm remains, and there is uncertainty regarding the nature and extent of direct impacts on fisheries. The Siting Board notes that, with further analysis clarifying uncertainties as to fisheries impacts and fully addressing visual impacts,[152] a finding that environmental benefits outweigh other environmental impacts might well be supportable. However, on this record, the Siting Board can reach no conclusion as to whether, overall, the environmental benefits of the wind farm outweigh its environmental impacts. The Siting Board therefore makes no finding with respect to the need for the energy from the wind farm for environmental purposes.

A-VI. Conclusion on Alternative Need Analysis

The Siting Board has found that there is a need for the power provided by the wind farm beginning in 2007 for reliability purposes. The Siting Board also has found that: (1) there is a need for additional renewable resources to meet the requirements of the Massachusetts RPS beginning in 2006; (2) there is a need for the full renewable output of the wind farm to meet the requirements of the Massachusetts RPS beginning in 2010; and (3) there is a need for the renewable resources provided by the wind farm to meet regional RPS beginning in 2006. The Siting Board further has found that there is a need for the power generated by the wind farm

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[151] In addition, certain impacts that would seem important to a broad-based environmental need analysis (e.g., indirect water use or water quality benefits) were not developed in this record. The absence of record evidence on these impacts and benefits hinders the analysis in this case.

[152] Such further analysis may be developed by other permitting agencies in their environmental analysis of the wind farm.

for economic purposes during the first five years of operation. Finally, the Siting Board has made no finding with respect to the need for the energy from the wind farm for environmental purposes. Based on the findings above, the Siting Board finds that 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.

In Section II.A.4, above, the Siting Board has found that the existing transmission system is inadequate to interconnect the wind farm. Accordingly, the Siting Board finds that additional energy resources are necessary to accommodate this new power plant.

The Company has established that: (1) the power from the non-jurisdictional wind farm is needed on reliability, economic, and other grounds; and (2) the existing transmission system is inadequate to interconnect the wind farm and, thus, that additional energy resources are necessary to accommodate this new power plant. Consequently, the Siting Board finds that the Company has established need for the proposed transmission line, consistent with our Turners Falls/MECo/ NEPCo precedent.

APPROVED by a majority of the Energy Facilities Siting Board at its meeting of May 10, 2005, by the members and designees present and voting. Voting for approval of the Tentative Decision, as amended: Paul G. Afonso (Chairman, DTE/EFSB), W. Robert Keating (Commissioner, DTE); David L. O'Connor, (Commissioner, Division of Energy Resources); James Stergios (for Ellen Roy Herzfelder, Secretary of Environmental Affairs) and Louis A. Mandarini, Jr., Public Member. Voting against the approval of the Tentative Decision, as amended: Judith F. Judson (Commissioner, DTE) and Deborah Shufrin (for Ranch Kimball, Secretary, of Economic Development).

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Paul G. Afonso, Chairman
Energy Facilities Siting Board

Dated this 10th day of May, 2005