COMMONWEALTH OF MASSACHUSETTS
ENERGY FACILITIES SITING BOARD

Petition of NSTAR Electric Company d/b/a Eversource Energy and New England Power Company d/b/a National Grid for Approval to Construct a New 345 kV Underground Transmission Line in Woburn, Winchester, Stoneham and Wakefield, Massachusetts Pursuant to G.L. c. 164, § 69J	)	EFSB 15-04
Petition of NSTAR Electric Company d/b/a Eversource Energy and New England Power Company d/b/a National Grid for Approval to Construct and Use a New 345 kV Underground Transmission Line in Woburn, Winchester, Stoneham, and Wakefield, Massachusetts Pursuant to G.L. c. 164, § 72	)	D.P.U. 15-140
Petition of NSTAR Electric Company d/b/a Eversource Energy and New England Power Company d/b/a National Grid for Individual and Comprehensive Zoning Exemptions From the Zoning Ordinance of the City of Woburn and the Zoning Bylaw of the Town of Wakefield Pursuant to G.L. c. 40A, § 3	)	D.P.U. 15-141

FINAL DECISION

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ABBREVIATIONS

AC	alternating current
ACEC	area of critical environmental concern
ACOE	U.S. Army Corps of Engineers
Berkshire Power	Berkshire Power Development, Inc., D.P.U. 96-104 (1997)
CELT	Capacity, Energy, Loads, and Transmission (report)
CMR	Code of Massachusetts Regulations
Companies	NSTAR Electric Company d/b/a Eversource Energy and New England Power Company d/b/a National Grid
CO_2	carbon dioxide
dBA	A-weighted decibels
Department	Massachusetts Department of Public Utilities
DCR	Massachusetts Department of Conservation and Recreation
DOMSB	Decisions and Orders of Massachusetts Energy Facilities Siting Board
DPW	Department of Public Works (municipal)
DR	demand response
East Eagle	NSTAR Electric Company, EFSB 14-04/ D.P.U. 14-153/14-154 (2017)
EE	energy efficiency
EFSB	Massachusetts Energy Facilities Siting Board
EJ	environmental justice
EMF	electric and magnetic fields
Eversource	NSTAR Electric Company d/b/a Eversource Energy

FCA	Forward Capacity Auction
GHG	greenhouse gas
GIS	geographic information system
G.L. c.	Massachusetts General Laws chapter
Green Street Variation	A noticed alternative to a section of the Primary Route extending north from Cross Street into Woburn along an inactive railroad ROW and then east on Green Street and Montvale Avenue, to rejoin the Primary Route at Washington Street
GSRP	NSTAR Electric Company, 18 DOMSB 7; EFSB 08-2/D.P.U. 08-105/08-106 (2010) (Greater Springfield Reliability Project)
Hampden County	New England Power Company d/b/a National Grid and Western Massachusetts Electric Company, 18 DOMSB 323, EFSB 10-1/D.P.U. 10-107/10-108 (2012)
HCA	host community agreement
HDD	horizontal directional drilling
HPFF-PTC	high pressure fluid-filled pipe-type cable
HVDC	high voltage direct current
HVED	high voltage extruded dielectric (cable)
ICNIRP	International Commission for Non-ionizing Radiation Protection
ISO-NE	ISO New England, Inc.
kV	kilovolts
LEI	London Economics International LLC
LTE	long-time emergency rating
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation

MBTA	Massachusetts Bay Transportation Authority
MCP	Massachusetts Contingency Plan
MEPA	Massachusetts Environmental Policy Act
mG	milligauss
MVA	megavolt-amperes
MW	megawatts
MWh	megawatt-hours
MVRP	New England Power Company, D.P.U. 15-44/15-45 (2016) (Merrimac Valley Reliability Project)
Mystic-Woburn	NSTAR Electric Company, EFSB 15-03/D.P.U. 15-64/15-65 (2017)
National Grid	New England Power Company d/b/a National Grid
NEMA	northeastern Massachusetts (load zone)
NERC	North American Electric Reliability Corporation
New Line	proposed underground transmission line between Woburn Substation and the Wakefield Junction Substation
New Salem Street Variation	A noticed variation to the Primary Route, which follows New Salem Street in Wakefield from the Wakefield railroad ROW to Salem Street instead of continuing on the railroad ROW
NHESP	National Heritage and Endangered Species Program
NHT	New Hampshire Transmission, LLC
NOI	Notice of Intent
NPCC	Northeast Power Coordinating Council
NRG	NRG Canal 3 Development LLC, EFSB 15-06/D.P.U. 15-180 (2017)
NTA	non-transmission alternative

NY Central Railroad	New York Central Railroad v. Department of Public Utilities, 347 Mass. 586 (1964)
ORW	Outstanding Resource Waters
P_{max}	maximum size of modeled non-transmission alternative resources
PV	photovoltaic
ROW	right-of-way
Russell Biomass/WMECO	Russell Biomass LLC/Western Massachusetts Electric Company, 17 DOMSB 1, EFSB 07-4/D.P.U. 07-35/07-36 (2009)
Salem Cables	New England Power Company d/b/a National Grid, 20 DOMSB 129, EFSB 13-2/D.P.U. 13-151/13-152 (2014)
Save the Bay	Save the Bay v. Department of Public Utilities, 366 Mass. 667 (1975)
Section 72 Petition	NSTAR Electric Company d/b/a Eversource Energy and New England Power Company d/b/a National Grid petitions pursuant to G.L. c. 164, § 72
SEMA/RI	southeastern Massachusetts/Rhode Island (load zone)
SF_6	sulfur hexafluoride
Siting Board	Massachusetts Energy Facilities Siting Board
STE	short-time emergency rating
Stoughton-Boston	Boston Edison Company d/b/a NSTAR Electric, 14 DOMSB 233, EFSB 04-1/ D.T.E. 04 5/04-7 (2005)
TMP	traffic management plan
USEPA	U.S. Environmental Protection Agency
Walpole-Holbrook	NSTAR Electric Company d/b/a Eversource Energy, EFSB 14-2/D.P.U. 14-73/14-74 (2017)
WHO	World Health Organization

WPA	Massachusetts Wetlands Protection Act
Woburn Substation	NSTAR Electric Company d/b/a Eversource Energy, D.P.U. 15-85 (2016)
Working Group	a group of ISO-NE staff and electric transmission company staff
XLPE	cross-linked polyethylene-insulated (cable)
Zoning Petition	NSTAR Electric Company d/b/a Eversource Energy and New England Power Company d/b/a National Grid joint petition pursuant to G.L. c. 40A, § 3

Pursuant to G.L. c. 164, § 69J, the Massachusetts Energy Facilities Siting Board ("Siting Board" or "Board") hereby APPROVES, subject to the conditions set forth below, the Petition of NSTAR Electric Company d/b/a Eversource Energy ("Eversource") and New England Power Company d/b/a National Grid ("National Grid") (collectively, "Companies") to construct a new approximately 8.5-mile-long 345 kilovolt ("kV") underground transmission line in Woburn, Winchester, Stoneham, and Wakefield, Massachusetts. Pursuant to G.L. c. 164, § 72, the Siting Board hereby APPROVES, subject to the conditions set forth below, the Petition of the Companies for a determination that the proposed 345 kV transmission line is necessary, serves the public convenience, and is consistent with the public interest. Pursuant to G.L. c. 40A, § 3, the Siting Board hereby APPROVES, subject to the conditions and limitations set forth below, the Petition of the Companies for individual and comprehensive zoning exemptions from the Zoning Ordinance of the City of Woburn and the Zoning Bylaw of the Town of Wakefield in connection with proposed modifications to Eversource's Woburn Substation (the "Woburn Substation") and National Grid's Wakefield Junction Substation (the "Wakefield Junction Substation").

I. INTRODUCTION

A. Description of the Proposed Project

The Companies propose to construct, operate, and maintain a new approximately 8.5-mile-long 345 kV underground transmission line (the "New Line") between the Woburn Substation and the Wakefield Junction Substation (together, the "Substations") (Exh. JP at 1).[1] To accommodate the New Line, the Companies would install new equipment at the Substations (id. at 3). Construction of the New Line and the installation of new equipment at the Substations are collectively referred to as the "Project."

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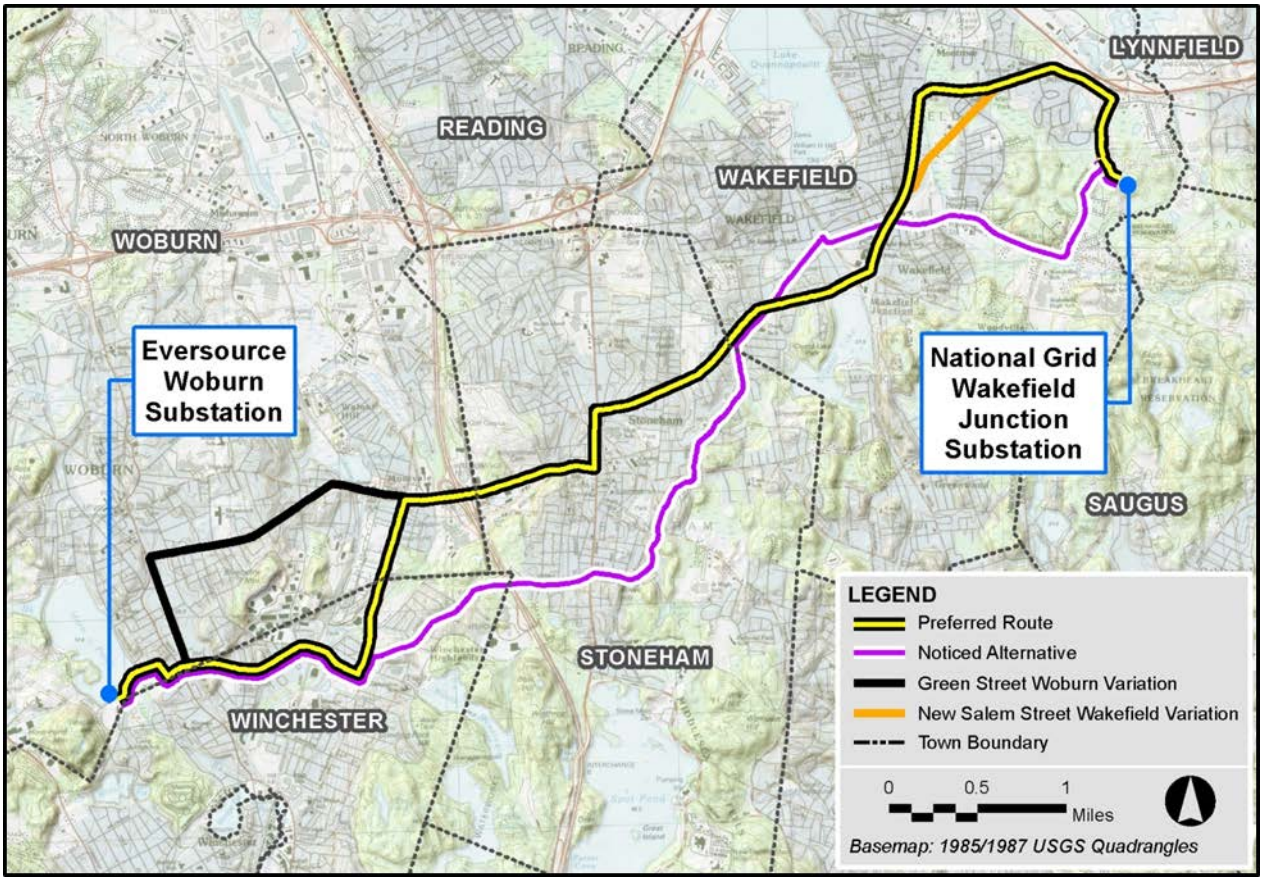
[1] Under the current plans, Eversource would construct the portion of the New Line located in Woburn, Winchester, and Stoneham, and National Grid would construct the transmission line in Wakefield (Exh. EFSB-G-10(R)). The exact demarcation point of the ownership and construction of the New Line is not yet finalized, but it is generally anticipated to be at or near the manhole closest to the Stoneham/Wakefield boundary (id.).

The Greater Boston Updated Transmission Needs Assessment ("2015 Needs Assessment"), issued by ISO-New England ("ISO-NE") in January 2015, identified the Project as the preferred solution to reliability-based transmission needs in the northeastern sub-region of Greater Boston (id. JP at 2). The Companies' most recent planning grade cost estimate (-25%/+25%) for the Project is $137.3 million, and construction is estimated to occur over a 22-month period (Exhs. JP-1, at 1-13; EFSB-C-1(S); Companies Brief at 27). This cost figure includes an estimated $96.2 million for the construction of the New Line and an estimated $41.1 million for the upgrades of the Substations (Exh. EFSB-C-1(S)).

The Companies noticed a Primary Route and an Alternative Route, both of which are mapped on Figure 1, below (Exh. JP-1, at 1-1 and fig. 1-1). Both routes would run through the communities of Woburn, Winchester, Stoneham, and Wakefield, Massachusetts (Exhs. JP at 3; JP-1 at fig. 1-1). The Companies also noticed two variations to the Primary Route: the Green Street Variation in Woburn and the New Salem Street Variation in Wakefield (Exh. JP-1, at 1-7, 1-8 and fig. 1-1).

Figure 1. Map of Primary Route with Variations and Noticed Alternative Route



Source: Exh. JP-1, fig. 1-1

B. Procedural History

On September 25, 2015, the Companies filed three petitions with the Siting Board and the Massachusetts Department of Public Utilities ("Department") relating to the Project. In these petitions, the Companies seek: (1) approval of the Project pursuant to G.L. c. 164, § 69J ("Siting Petition"); (2) approval of the Project pursuant to G.L. c. 164, § 72 ("Section 72 Petition"); and (3) individual and comprehensive exemptions from the Zoning Ordinance of the City of Woburn, and the Zoning Bylaw, Chapter 190, of the Code of the Town of Wakefield, for the Project pursuant to G.L. c. 40A, § 3 ("Zoning Petition") (together, "Petitions").

The Siting Petition was docketed as EFSB 15-04, the Section 72 Petition as D.P.U. 15-140, and the Zoning Petition as D.P.U. 15-141. Pursuant to the Companies' motion,

on December 2, 2015, the Chairman of the Department issued a Consolidation Order referring the Section 72 and Zoning Petitions to the Siting Board for review pursuant to G.L. c. 164, § 69H(2). The Siting Board conducted a single adjudicatory proceeding and developed a single evidentiary record for the consolidated Petitions, docketed as EFSB 15-04/D.P.U. 15-140/ 15-141.

Pursuant to the Presiding Officer's instructions, the Companies published the Notice of Public Hearing ("Notice") in *The Boston Globe*, the *Daily Times Chronicle* of Woburn, and the *Stoneham Independent* once a week for two consecutive weeks, the first publication was made "not less than fourteen days before the date" of the public hearing (Exh. CUR-1-3(a)(1)). G.L. c. 40A, § 11. Furthermore, on November 2 and 3, 2015, the Companies sent the Notice, with a one-page summary, by first class mail to: (1) the property owners abutting the Primary Route and the Noticed Alternative Route; (2) abutters to the abutters within 300 feet; (3) the city or town clerk's offices of Woburn, Winchester, Wakefield, and Stoneham with instructions to post the Notice in a conspicuous place for public viewing until after the intervention deadline (id.). On the same day, the Companies also mailed the Notice to the Planning Boards of Woburn, Winchester, Wakefield, and Stoneham and the Planning Boards of each abutting municipality, including Burlington, Reading, Saugus, Medford, Lexington, Arlington, Melrose, Lynnfield, Wilmington, and Malden (id.). Also on November 2, 2015, the Petitions were provided to the public libraries in Woburn, Winchester, Wakefield, and Stoneham for public viewing, along with the Notice for posting in a conspicuous place (id.).

The Project does not trigger the requirements for enhanced public participation or enhanced analysis of impacts and mitigation under either the "Environmental Justice Policy of the Executive Office of Energy and Environmental Affairs" issued on January 31, 2017, or the prior EJ Policy in effect at the time the Companies filed the Petitions (Exhs. JP-1, at 7-3; EFSB-CPC-2; TOW-RS-1; TOW-RS-13).[2] Further, consistent with established Siting Board practice

[2] While there may be populations within a mile of the Project that fall into the EJ Policy's definition of an EJ population because of income or minority status, the Project does not trigger other provisions of the EJ Policy. The Project does not require enhanced public participation because it does not exceed an Environmental Notification Form threshold under the Massachusetts Environmental Policy Act ("MEPA") for air, solid and

and language access considerations, the Siting Board staff examined the linguistic composition of the affected Project area, and determined that additional outreach, in languages other than English, was neither required, nor specifically requested by members of the public.

The Siting Board staff conducted a public hearing on the Petitions on Wednesday, November 18, 2015, at the Stoneham Town Hall. Speakers at the public meeting, and residents who subsequently sent comments to the Siting Board, raised a variety of issues including: the possible health effects that might result from electromagnetic fields that the Project would produce; traffic and noise caused by Project construction and the resulting impacts on residents and local businesses; and additional alternate routes for the New Line.

Timely-filed motions to intervene were submitted by the Town of Stoneham, Wakefield resident Richard Stewart, and Winchester resident Michael Curley. The Presiding Officer allowed all of these motions. Late-filed motions to intervene were submitted by the City of Woburn, the Town of Winchester, and ISO-New England ("ISO-NE"). The Presiding Officer also allowed all of these entities to intervene. The Presiding Officer also granted limited participant status to New Hampshire Transmission LLC, and Harvard Mills, LLC.

On April 11, 2016, the Companies filed a motion seeking to suspend the procedural schedule in order to allow additional time to provide notice of this proceeding to owners of property who should have, but did not, receive notice prior to the February 10, 2016, public comment hearing (Motion to Suspend the Procedural Schedule at 3, 4). The Companies state that these owners were omitted from certified abutter lists supplied to the Companies by the tax assessors of the Towns of Wakefield and Winchester ("Omitted Owners") (id. at 3, 8). Approximately 222 property owners did not receive notice (id. at 6). The Presiding Officer allowed the Motion to Suspend the Procedural Schedule on April 26, 2016, and ordered the Companies to give supplemental notice to all Omitted Owners (Ruling Re: Motion to Suspend

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hazardous waste, or wastewater and sewage. The Project does not require enhanced analysis of impacts and mitigation because it did not require a mandatory Environmental Impact Report under MEPA for air, solid and hazardous waste, or wastewater and sewage. See EJ Policy at 10-11.

the Procedural Schedule at 4). Furthermore, the Omitted Owners were given additional time – until May 16, 2016 – to move to intervene or to act as a limited participant (id.).

In response to the receipt of this supplemental notice, Winchester resident Robert J. Baum and Wakefield residents Michael and Denise Labieniec filed timely motions to intervene, both of which the Presiding Officer allowed. Similarly, Wakefield resident Keith Flanagan filed a timely motion to act as a limited participant, which the Presiding Officer also allowed. Woburn resident Brian Carpenter submitted a late-filed motion to intervene, which was denied, but Mr. Carpenter was given limited participant status (Ruling Re: Petition of Brian Carpenter for Leave to Intervene Out of Time at 4, 5). The Town of Wakefield submitted a late-filed motion to intervene, which the Presiding Officer allowed (Ruling Re: Petition of Town of Wakefield for Leave to Intervene Late at 8).

All of the parties, together, presented a total of 34 witnesses. The Companies presented the testimony of the following 16 witnesses in support of the Petitions: Beverly Schultz, project manager, Eversource; Demetrios Sakellaris, underground transmission engineer, Eversource; Kate McEneaney, siting analyst, Eversource; David Klinch, environmental consultant, Epsilon Associates; Elizabeth Leonard, senior engineer, Eversource; John W. Martin, consulting engineer, National Grid; Peter Valberg, principal, Gradient; Julia Frayer, managing director, London Economics International LLC; Michael Zylich, environmental engineer, Eversource; Bryan Hudock, project manager, National Grid; Venkatesh Minisandram, electrical engineer, National Grid; John Zicko, director of substation engineering, Eversource; Daniel McIntyre, civil engineer, National Grid; Robert O'Neal, noise engineer, Epsilon Associates; Stephen Farr, project manager, Nitsch Engineering; and Jeffrey Parenti, project manager, Nitsch Engineering. The Town of Winchester presented the testimony of the following ten witnesses: Peter Tirinzoni, senior engineer, Power Delivery Consultants;[3] Kenneth Cram, director of traffic engineering, Bayside Engineering; Gaye Ohanesian, director, gopower, Inc.;[4] James Gill,

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[3] Mr. Tirinzoni's testimony was submitted by both the Town of Winchester and the Town of Stoneham in support of their direct cases.

[4] Ms. Ohanesian's testimony was submitted by both the Town of Winchester and the Town of Stoneham in support of their direct cases.

director of public works, Town of Winchester; Beth Rudolph, Winchester town engineer; Richard Howard, Winchester town manager; Donald Haes, Jr., radiation safety officer, BAE Systems;[5] John Nash, Winchester fire chief; Peter McDonnell, Winchester police chief; and Michael Weiss, national sales manager, American U-Tel. The Town of Stoneham presented the testimony of the following five witnesses: Jeffrey Dirk, traffic engineer and principal, VHB; James McIntyre, Stoneham police chief; Michael Woronka, field paramedic and CEO, Action Ambulance Service; Matthew Grafton, Stoneham fire chief; and Robert Grover, Stoneham public works director and Town engineer. ISO-NE, an intervenor, presented the testimony of the following three witnesses: Pradip Vijayan, senior engineer, Transmission Planning, ISO-NE; Brent Oberlin, director of transmission planning, ISO-NE; and Andrew Kniska, lead engineer, Transmission Planning, ISO-NE.

The Siting Board staff conducted 13 days of evidentiary hearings beginning on September 21, 2016, and concluding on November 2, 2016. The Town of Wakefield filed its initial brief on January 6, 2017; the Companies and the Towns of Stoneham and Winchester filed initial briefs on January 16, 2017. The Companies and the Towns of Stoneham, Winchester, and Wakefield filed reply briefs on January 27, 2017. None of the limited participants filed a brief.

Siting Board staff prepared a Tentative Decision and distributed it to Siting Board members, and all parties and limited participants on Wednesday, February 14, 2018. The parties and the other recipients were given until Thursday, February 22, 2018, to file comments on the Tentative Decision. Written comments were received from: the Companies; Senator Jason Lewis, Senator Patricia Jehlen and Representative Michael Day, all of whom signed one joint comment letter; the towns of Wakefield, Winchester, and Stoneham; the City of Woburn; and Michael Curley, a Wakefield resident and intervenor . The Siting Board conducted a public meeting to consider and vote upon the Tentative Decision on February 27, 2018, at which parties and limited participants were invited to present oral comments to the Siting Board, as were members of the public, at the Chairman's discretion. After deliberation, the Board directed staff to draft a Final Decision APPROVING the Petitions subject to the conditions set forth below.

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[5] Mr. Haes's testimony was also submitted by both the Town of Winchester and the Town of Stoneham in support of their direct cases.

II. JURISDICTION AND STANDARD OF REVIEW UNDER G.L. C. 164, § 69J

G.L. c. 164, § 69J provides that the Siting Board should approve a petition to construct if the Siting Board determines that the petition meets certain requirements, including that the plans for the construction of the applicant's facilities are consistent with the policies stated in G.L. c. 164, § 69H to provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. Pursuant to G.L. c. 164, § 69J, a project applicant must obtain Siting Board approval for the construction of proposed energy facilities before a construction permit may be issued by another state agency.

G.L. c. 164, § 69G defines a "facility" to include "a new electric transmission line having a design rating of 115 kilovolts or more which is ten miles or more in length on an existing transmission corridor, except [for] reconductoring or rebuilding of transmission lines at the same voltage" or "a new electric transmission line having a design rating of 69 kilovolts or more and which is one mile or more in length on a new transmission corridor." A Section 69G transmission facility also includes "an ancillary structure which is an integral part of the operation of any transmission line which is a facility." The proposed 345 kV transmission line would be approximately 8.5 miles long and would run along a new transmission corridor. Therefore, the Project, including the New Line and the related upgrades at the Substations, is clearly a "facility" that is subject to Siting Board review with respect to Section 69J.

The Siting Board requires that an applicant demonstrate that its proposal meets the following requirements: (1) that additional energy resources are needed (see Section III, below); (2) that, on balance, the proposed project is superior to alternative approaches in terms of reliability, cost, and environmental impact, and in its ability to address the identified need (see Section IV, below); (3) that the applicant has considered a reasonable range of practical facility siting alternatives and that the proposed facilities are sited in locations that minimize costs and environmental impacts (see Section V below); (4) that environmental impacts of the project are minimized and the project achieves an appropriate balance among conflicting environmental concerns as well as among environmental impacts, cost, and reliability (see Section VI, below); and (5) that plans for construction of the proposed facilities are consistent

with the current health, environmental protection and resource use and development policies of the Commonwealth (see Section VII, below).

III. NEED FOR THE PROPOSED PROJECT

A. Standard of Review

The Siting Board reviews the need for proposed transmission facilities to meet reliability, economic efficiency, or environmental objectives. G.L. c. 164, §§ 69H, 69J. When demonstrating the need for a proposed transmission facility based on reliability considerations, a petitioner applies its established planning criteria for construction, operation, and maintenance of its transmission and distribution system. Compliance with the applicable planning criteria can demonstrate a "reliable" system. NSTAR Electric Company, EFSB 14-04/D.P.U. 14-153/ 14-154, at 8, 9 (2017) ("East Eagle"); NSTAR Electric Company, EFSB 14-2/D.P.U. 14-73/ 14-74, at 7 (2017) ("Walpole-Holbrook"); New England Power Company and Western Massachusetts Electric Company, EFSB 10-1/D.P.U. 10-107/10-108, at 5 (2012) ("Hampden County").

Accordingly, to determine whether system improvements are needed, the Siting Board: (1) examines the reasonableness of the petitioner's system reliability planning criteria; (2) determines whether the petitioner uses reviewable and appropriate methods for assessing system reliability over time based on system modeling analyses or other valid reliability indicators; and (3) determines whether the relevant transmission and distribution system meets these reliability criteria over time under normal conditions and under certain contingencies, given existing and projected loads. NSTAR Electric Company, EFSB 15-03/D.P.U. 15-64/15-65, at 7 (2017) ("Mystic-Woburn"); New England Power Company, EFSB 13-2/ D.P.U. 13-151/13-152, at 6 (2014) ("Salem Cables"); Hampden County at 5.

When a petitioner's assessment of system reliability and facility requirements is, in whole or in part, driven by load projections, the Siting Board reviews the underlying load forecast. The Siting Board requires that forecasts be based on substantially accurate historical information and reasonable statistical projection methods that include an adequate consideration of conservation and load management. See G.L. c. 164, § 69J. To ensure that this standard has been met, the

Siting Board requires that forecasts be reviewable, appropriate, and reliable. A forecast is reviewable if it contains enough information to allow a full understanding of the forecast method. A forecast is appropriate if the method used to produce the forecast is technically suitable to the size and nature of the company to which it applies. A forecast is considered reliable if its data, assumptions, and judgments provide a measure of confidence in what is most likely to occur. Mystic-Woburn at 7; Salem Cables at 7; Hampden County at 6.

B. Description of the Companies' Demonstration of Need

The Companies' transmission planning activities are governed by the Regional System Planning Process administered by ISO-NE (Exhs. EFSB-N-1; JP-2, app. 2-1, at 2). In its role as the region's independent system operator, ISO-NE completes periodic assessments to identify regional transmission needs based on reliability standards and prepares solution studies to identify the most cost-effective transmission solutions to meet these needs (Exhs. EFSB-N-1; JP-2, app. 2-1, at 2). ISO-NE's 2015 Needs Assessment evaluated the ability of the Greater Boston Area transmission system to withstand contingency conditions given projections of peak load, and potential operating conditions such as generator availability, and regional power flows (Exh. JP-2, app. 2-1, at 1). Based on ISO-NE's 2015 Needs Assessment, the Companies assert that the Project is needed to meet applicable system planning criteria and standards (Exhs. JP-1, at 3-1; JP-3, app. 2-1).

1. Greater Boston Area Transmission Needs Assessment

The Greater Boston Area includes Boston and surrounding suburbs; the area includes Woburn, Winchester, Stoneham, and Wakefield (Exhs. JP-1, at 2-1; JP-2, app. 2-1, at 1, 12; EFSB-N-2). Beginning in 2008, ISO-NE led a group of stakeholders, including Eversource and National Grid, in studying the Greater Boston transmission system and identifying reliability-based transmission needs (Exh. JP-2, app. 2-1, at 2).

As transmission providers, the Companies stated that they must maintain their respective systems consistent with standards and criteria established by the North American Electric Reliability Corporation ("NERC"), Northeast Power Coordinating Council ("NPCC"),

New England Power Pool ("NEPOOL"), and ISO-NE (Exhs. JP-1, at 1-4, 2-6; EFSB-N-1). The criteria established by NERC, NPCC, NEPOOL, and ISO-NE ensure adequate transmission capacity exists to maintain the reliability of the regional electric power system (Exh. JP-1, at 3-1). Specifically, the standards and criteria established by these entities require transmission operators to design, test, and operate their systems to withstand system contingencies (id.). If a transmission operator's system does not have sufficient capability to serve forecasted load under the conditions specified in the reliability criteria, the operators are expected to plan and implement system additions and upgrades to address the identified inadequacies (id.). According to the Companies, the 2015 Needs Assessment identified elements in the Greater Boston Area transmission system that failed to meet thermal, voltage, and short-circuit criteria (together, "criteria violations") under projected 2018 and 2023 conditions (id. at 2-5 to 2-6; Exh. JP-2, app. 2-1, at 1).

A single contingency, known as an "N-1" contingency, is defined as a single event causing the loss of one or more system elements (including two transmission circuits on a double-circuit transmission tower or one single transmission circuit) (Exh. JP-1, at 2-6). The occurrence of two separate and unrelated contingencies occurring in a short period of time (i.e., 30 minutes) is known as an "N-1-1" contingency (id.). For the transmission system to meet the established reliability criteria, there cannot be any instances of a transmission element violating its thermal capability,[6] or unacceptably high or low voltage levels[7] following an N-1 or N-1-1 contingency (id. at 2-6 to 2-7).

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[6] The thermal capability of an element is a function of the element's heat-dissipation capability (Exh. JP-1, at 2-6 to 2-7). The normal rating is the continuous operating limit for the element (Exh. EFSB-N-3(1) at 10). The long-time emergency ("LTE") rating is the twelve-hour capability of an element, and the short-time emergency ("STE") rating is the 15-minute capability of an element (id.; Exh. EFSB-N-3). In order to meet applicable operating standards, an element can operate above the normal rating but below the LTE rating for no more than twelve hours, and can operate above the LTE rating but below the STE rating for no more than 15 minutes (Exhs. EFSB-N-3; EFSB-N-3(1) at 10; EFSB-N-36).

[7] According to the Companies, the voltages at all buses must be in the range of 0.95 to 1.05 per unit (i.e., fraction of nominal) with all lines in service (Exh. EFSB-N-3).

a. Load Forecast Methodology

The Companies stated that the 2015 Needs Assessment relied on ISO-NE's 2013 Capacity, Energy, Loads, and Transmission ("CELT") report, the most recent CELT report available during the development of the 2015 Needs Assessment, to project five-year (2018) and ten-year (2023) load levels for the Greater Boston Area (Exhs. JP-1, at 2-9; JP-2, app. 2-1, at 1, 3). The Companies stated that the CELT report is a ten-year econometric forecast of loads and resources for the New England region, and is the source of many assumptions used by ISO-NE in regional planning and reliability studies (Exh. EFSB-N-12). The Companies stated that the CELT report is the result of a rigorous stakeholder process, is updated annually, and is appropriate as the basis for peak load projections in the 2015 Needs Assessment (Exh. EFSB-N-10). The CELT report takes into consideration factors such as regional economic data, and customer adoption of behind-the-meter generation and passive demand response measures (id.; Exh. EFSB-N-15). The Companies stated that passive and active demand response ("DR") resources that had cleared Forward Capacity Auction ("FCA") 7, and energy efficiency ("EE") forecasted in the 2013 CELT report were modeled as load reductions (Exhs. JP-2, app. 2-1, at 4; EFSB-N-10).[8,9,10]

Voltages outside of this range represent criteria violations and must be addressed by the Companies (id.; Exh. JP-2, app. 2-1, at 135).

8 The Companies described changes to the 2015 Needs Assessment study assumptions including load forecasts in post-2013 CELT reports, transmission system topology, generation additions or retirements, and FCA results (Exhs. JP-1, at 2-9; EFSB-N-7; EFSB-N-10; EFSB-N-11; EFSB-N-14). The Companies concluded that these changes would not affect the need for the Project (Exhs. EFSB-N-7; EFSB-N-10; EFSB-N-14).

9 The Companies stated that projected growth in solar photovoltaics ("solar PV") was not considered in the forecast used in the 2015 Needs Assessment (Exh. EFSB-N-15). The "Final 2015 PV Forecast" was not available during the development of the 2015 Needs Assessment (id.). The Companies stated that the contribution from solar PV resources in the Boston area is forecasted to be less than one percent of Boston area load in 2018 and 2023, and contend that the inclusion of solar PV would not have a significant impact on the 2015 Needs Assessment or the need for the Project (id.).

The Companies indicated that ISO-NE forecasted an annual growth rate of 1.4 percent for New England summer peak load as part of its 2015 Needs Assessment (Exh. EFSB-N-17). The Companies stated that 1.4 percent is higher than the Greater Boston's historical annual load growth rate of 0.7 percent for the period of 2005 to 2015, which included the 2008 recession (Exh. EFSB-N-39). However, the Companies stated that the need for the Project existed before 2013 and is therefore not dependent on any assumed load growth (Exhs. EFSB-N-18; EFSB-N-19).

b. Base Cases Assessed

The Companies stated that for each of the two study years (2018 and 2023), the 2015 Needs Assessment examined 37 peak load base cases – 34 "Design Cases" and three "Retirement Sensitivity Cases," which together represent a wide range of possible generation dispatch and generator availability scenarios under peak summer conditions (Exhs. JP-1, at 2-9 to 2-10; JP-2, app. 2-1, at 4, 25). In addition, the 2015 Needs Assessment also included five light load dispatch scenarios – three minimum load and two summer off-peak load levels (Exh. JP-2, app. 2-1, at 4, 29).

The 37 peak load base cases were categorized by interface transfer levels across the Greater Boston Area: (1) high north-to-south flows (power flowing from northern New England into southern New England) with high flows out of the SEMA/RI zone (power flowing out of SEMA/RI to the north and west); (2) high north-to-south flows with low flows out of the SEMA/RI zone; and (3) low north-to-south flows with high flows out of the SEMA/RI zone (Exhs. JP-1, at 2-10; EFSB-N-4). Each of the Design Cases modeled one or two Boston area generation units (e.g., Mystic 7, 8, 9; Kendall Station; Footprint Power) out of service, and each of the Retirement Sensitivity Cases modeled two generation units out of service in addition to the retirement of the Mystic 7 unit (Exhs. JP-1, at 2-9 to 2-10; JP-2, app. 2-1, at 4 to 5). ISO-NE

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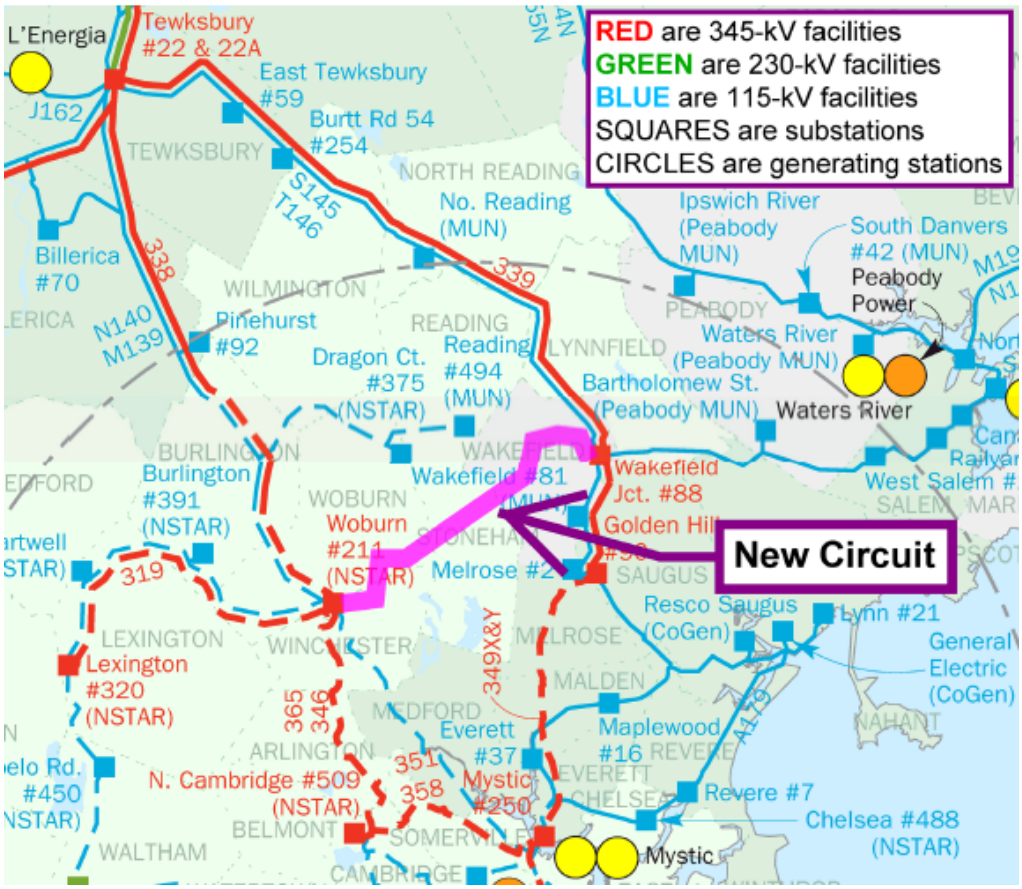
[10] ISO-NE defines DR resources as measures that can reduce the consumption of electricity (Exh. EFSB-N-10). Passive DR resources reduce energy demand during peak hours and are not dispatchable and include EE, distributed generation, and load management (id.). Active DR resources reduce load based on real-time system conditions or ISO-NE instructions and include real-time DR and real-time emergency generation (id.).

stated, in the 2015 Needs Assessment, that the development of the base cases created a comprehensive set of reliability assessment system conditions (Exh. JP-2, app 2-1, at 13, 35). ISO-NE further stated that if the results of the load flow analysis in the Design Cases indicate a criteria violation, a solution is required, whereas the Retirement Sensitivity Cases were primarily designed to evaluate the robustness of proposed solutions (Exhs. JP-1, at 2-10, 3-5; JP-2, app. 2-1, at 5).

c. Greater Boston Area Reliability Needs

The Companies stated that given the broad geographic area included in the 2015 Needs Assessment, the Working Group divided the Greater Boston Area into a number of sub-areas (Exh. JP-1, at 2-7). According to the Companies, the Project would address the needs on the existing 345 kV transmission system in Sub-Areas B and F, located in northeastern Massachusetts (id. at 2-7, 3-1). Sub-Area B is defined as the "Waltham, Woburn, and Lexington Area," and Sub-Area F is defined as the "Boston, Golden Hills, and Wakefield Junction Area" (id. at 3-1; Exh. EFSB-N-2). The Companies stated that Sub-Areas B and F contain a "loop" of seven interconnecting 345 kV transmission lines: (1) Lines 351/358, underground lines between Eversource's Mystic Substation and North Cambridge Substation; (2) Lines 346/365, underground lines between Eversource's North Cambridge Substation and Woburn Substation; (3) Line 338, an overhead line between Eversource's Woburn Substation and National Grid's Tewksbury 22A Substation; (4) Line 339, an overhead line between National Grid's Tewksbury 22A Substation and Wakefield Junction Substation; and (5) Line 349, an overhead and underground line between Wakefield Junction Substation and Mystic Substation (Exhs. JP-1, at 3-2; EFSB-N-2; EFSB-N-40). The existing 345 kV loop and the proposed New Line are shown in Figure 2, below.

Figure 2. Existing Northeastern Massachusetts Transmission System



Source: Exh. JP-1, at 3-3.

The Companies stated that this 345 kV loop serves as the transmission backbone for Sub-Areas B and F (Exh. EFSB-N-40). First, the loop acts as a path for bulk system power flows traveling south from northern New England into Boston (id.; Tr. 11, at 2132-2135). Second, the loop distributes power from northern New England generators and Boston-area generators (e.g., Mystic Station) to customers (Exh. EFSB-N-40). The Companies stated that the New Line would connect the sides of the existing loop, creating a parallel path to split the existing 345 kV loop into two smaller loops (id.; Tr. 11, at 2132-2135). Therefore, power would be able to sufficiently serve area substations following a contingency, or set of contingencies, that could disrupt power flows within the existing loop (Exh. EFSB-N-40; Tr. 11, at 2132-2135). As discussed in greater detail below, the Companies submit that reinforcement to the existing

transmission system is necessary to ensure the 345 kV loop continues to function reliably (Exh. JP-1, at 3-1, 3-7).

The 2015 Needs Assessment identified 58 unique N-1-1 contingency pairs that would lead to post-contingency thermal overloads in the 345 kV loop under Design Case conditions (Exhs. EFSB-N-23; EFSB-N-24).[11] The Companies stated that the thermal overloads were most severe on the underground lines between the Mystic, North Cambridge, and Woburn Substations (i.e., Lines 351/358 and Lines 346/365), and that the overloads are indicative of insufficient transmission capacity to reliably deliver power to customers (Exh. JP-1, at 3-5).

For each overloaded element and unique N-1-1 contingency pair, the Companies provided the contingencies, base case, and resulting thermal overload percentage value (Exh. EFSB-N-24). The Companies stated that a majority of the base cases that led to overloads would occur with power flowing from northern New England to southern New England (high north-to-south power flows) (Exh. EFSB-N-31). Table 1, below, presents the worst case post N-1-1 contingency overloads for transmission line components of the 345 kV loop.

Table 1. Worst-Case Post N-1-1 Contingency Design Case Results

	2018 Percent of LTE Rating	**2023 Percent of LTE Rating**
Lines 346 & 365	151 percent	151 percent
Line 351	118 percent	122 percent
Line 358	141 percent	146 percent
Line 349	No overload	105 percent

Sources**:** Exhs. JP-1, at 3-5; JP-2, app. 2-1, at 83-84.

[11] There were no criteria violations in the area under N-0 (all facilities in service) or N-1 conditions in the Design Cases, and no thermal overloads under the light load cases (Exhs. JP-1, at 3-4; EFSB-N-28).

The Companies stated that post-contingency thermal overloads modeled in the 2015 Needs Assessment could occur at 2013 summer peak conditions or earlier; therefore, there is an immediate need for the Project (Exh. JP-1, at 2-11).[12]

In addition to post-contingency thermal overloads on the 345 kV loop, the 2015 Needs Assessment identified numerous post-contingency voltage violations at area substations (Exhs. EFSB-N-22; EFSB-N-27). Specifically, voltages as low as 0.795 per unit were identified at the Woburn, Lexington, and North Cambridge Substations following an N-1-1 contingency under Design Case and Retirement Case conditions (Exh. EFSB-N-27). Voltages as high as 1.075 per unit were identified at the Wakefield Junction, Woburn, Lexington, and North Cambridge Substations under Design Case and light load conditions (id.). The Companies stated that the low voltage violations would be resolved by the installation of the New Line, and that high voltage violations would be resolved by the installation of 345 kV shunt reactors at the Wakefield Junction and Woburn Substations (id.).

C. Positions of the Parties

ISO-NE indicated its support for the Project as presented by the Companies (Tr. 5, at 934). No other parties provided comments on the identified need for the Project.

D. Analysis and Findings on Need

In the 2015 Needs Assessment, ISO-NE's Working Group identified numerous reliability needs within the Greater Boston Area, including deficiencies in Sub-Areas B and F. The 2015 Needs Assessment demonstrates that the existing transmission system would be insufficient to reliably supply customers in the Greater Boston Area under pre-existing and forecasted summer peak load conditions following certain N-1-1 contingencies. National and regional reliability standards require the Companies to eliminate the identified criteria violations in order to provide a reliable supply of electricity to their customers.

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[12] Specifically, the 2015 Needs Assessment projected potential thermal overloads for Lines 346/365 and 351/358 at pre-2013 load levels; for Line 349, the year of need was projected to be 2019 (Exhs. JP-1, at 3-7; JP-2, app. 2-1, at 10, 115; EFSB-N-5; EFSB-N-37).

The 2015 Needs Assessment relied on the summer peak load forecast from the 2013 CELT report, with adjustments for EE and DR forecasts and FCA results, to predict peak loads in 2018 and 2023. The 2013 CELT report relies on econometric modeling to produce a peak load energy forecast, and the Siting Board has relied on similar econometric modeling in past transmission project cases. The Companies have provided sufficient information to allow Siting Board staff to gain a general understanding of its load forecasting methodology. Accordingly, the Siting Board finds National Grid and Eversource's load forecast is reviewable, appropriate, and reliable for use in this proceeding to evaluate the Companies' assertion of need.

The 2015 Needs Assessment evaluated 37 peak load cases developed by the Working Group for the years of 2018 and 2023 for the Greater Boston Area, representing a comprehensive set of operating conditions in the area. For each of the base cases, ISO-NE simulated numerous contingencies to test the transmission system's capacity to meet a variety of operating conditions. The Siting Board finds that the Companies' use of an N-1-1 planning criterion is reasonable, reviewable, and appropriate for assessing system reliability, and that the Companies' existing transmission system does not currently meet this criterion. For these reasons, the Siting Board finds that additional energy resources are needed to maintain a reliable supply of electricity to the Greater Boston Area.

IV. ALTERNATIVE APPROACHES TO MEETING THE IDENTIFIED NEED

A. Standard of Review

G.L. c. 164, § 69J requires a project proponent to present alternatives to the proposed facility, which may include: (1) other methods of transmitting or storing energy; (2) other sources of electrical power; or (3) a reduction of requirements through load management.[13] In implementing its statutory mandate, the Siting Board requires a petitioner to show that, on balance, its proposed project is superior to such alternative approaches in terms of cost, environmental impact, and ability to meet the identified need. In addition, the Siting Board requires a petitioner to consider reliability of supply as part of its showing that the proposed

[13] G.L. c. 164, § 69J also requires an applicant to present "other site locations." This requirement is discussed in Section V.A, below.

project is superior to alternative project approaches. East Eagle at 29; Walpole-Holbrook at 17; NSTAR Electric Company, EFSB 10-2/D.P.U. 10-131/10-132, at 29 (2012) ("GSRP").[14]

B. Identification of Alternative Approaches for Analysis

On August 12, 2015, ISO-NE issued the Final Solutions Study for the Greater Boston Area ("2015 Solutions Study"), outlining the recommended transmission investments for addressing the reliability needs identified in the 2015 Needs Assessment (Exh. JP-2, app. 2-3). According to the Companies, ISO-NE recommended a set of approximately 40 individual transmission projects that, together, would bring the transmission system in the Greater Boston Area into compliance with applicable national and regional reliability standards (id., app. 2-3, at 12-13; Exh. JP-1, at 2-1). A new 345 kV transmission line between the Woburn and Wakefield Junction Substations using high-voltage extruded dielectric ("HVED") technology was one of the 40 projects (Exhs. JP-1, at 2-1, 2-14; JP-2, app. 2-3, at 12-13, 68; Tr. 12, at 2176-2177).

The Companies outlined the process of identifying approaches to meet the identified need (Exh. JP-1, at 4-1). Eversource and National Grid stated that they evaluated two transmission alternatives, the Project and a Three-Project Alternative (id.). The Companies also evaluated non-transmission alternatives ("NTAs") including EE, DR, energy storage, and energy generation (id.).[15] The Companies stated that the Project would be the best option to meet the identified need with a minimal impact on the environment and at the lowest possible cost (id.).

1. Transmission and Substation Alternatives

a. Proposed Project

As described above, the Project would consist of a new, underground, 8.5-mile 345 kV transmission line between Eversource's Woburn Substation and National Grid's Wakefield Junction Substation as well as interconnection facilities at each substation (Exh. JP-1, at 4-1).

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[14] GSRP stands for "Greater Springfield Reliability Project."

[15] Eversource and National Grid also explored a no-build approach. However, this approach did not address the identified reliability need (Exh. JP-1, at 4-1).

The Companies' planning grade (-25%/+25%) cost estimate for the Project is: (1) $96.2 million for the transmission line; (2) $20.9 million for the Woburn Substation upgrades; and (3) $20.2 million for the Wakefield Junction Substation upgrades; for a total of $137.3 million (Exhs. EFSB-C-1(S); EFSB-C-5). This estimate was prepared assuming the use of a HVED cable system for the New Line (Exh. JP-1, at 4-20). A summary of the process the Companies used to determine HVED construction was most appropriate for the Project is provided below.

i. Cable Technology Alternatives

The Companies considered two types of underground transmission line cable technologies for the Project: (1) an HVED cable system, and (2) a high-pressure fluid-filled pipe-type cable ("HPFF-PTC") system (Exh. JP-1, at 4-18). The Companies presented an analysis of the reliability, environmental impacts, and cost of the two cable technologies (id. at 4-18 to 4-20).

The Companies explained that an HPFF-PTC alternative would need to provide higher electrical capacity than an HVED solution because an HPFF-PTC transmission line has lower impedance, and would pull more current from the grid, than an HVED line (Exhs. COM-EL/JM-1; COM-DAS-1, at 4). The Companies stated that to meet the need, the minimum summer LTE of the Project would need to be 1,200 MVA for an HPFF-PTC system and 1,040 MVA for an HVED cable system (Exh. COM-DAS-1, at 4). Further, the Companies stated that they design transmission system solutions with a reasonable margin of capacity, rather than just meeting the minimum LTE value, to ensure the transmission system would meet current and future system needs, consistent with good engineering practice (id. at 6, 8).

Eversource and National Grid described the HVED system as consisting of three conductors, each individually insulated by an extruded plastic material, such as cross-linked polyethylene ("XLPE"), contained within a single concrete duct bank (Exhs. JP-1, at 4-19; EFSB-PA-4).[16] The Companies stated that a single-cable HVED system would be sufficient to

[16] The Companies stated that an HVED cable system would require terminal equipment at the Woburn and Wakefield Junction Substations, including line breakers, disconnect switches, voltage transformers, switchgear, and circuit breakers (Exh. EFSB-PA-8).

meet the identified need, and would provide a summer LTE rating of 1,249 MVA (Exhs. JP-1, at 4-19; EFSB-PA-4). Based on testing of soil along the route after filing the Petition, the Companies reduced their estimate of the capacity of the New Line under normal conditions; however, the Companies stated that the normal capacity of the New Line would still be sufficient (Exhs. EFSB-PA-4(R); TOW-RS-18). The Companies stated that the LTE rating of the New Line was unaffected (Exh. EFSB-PA-4(R)).

The Companies stated that a single-cable HPFF-PTC system would consist of three insulated conductors within a direct-buried steel pipe, filled with mineral oil dielectric fluid ("MODF") (Exh. JP-1, at 4-18).[17] To obtain the capacity required for the Project, the Companies stated that a two-cable HPFF-PTC system would be required and would provide a summer LTE rating of 1,348 MVA (id. at 4-19; Exh. EFSB-PA-4).[18]

The Companies described differences between the two cable technologies with respect to the construction footprint, ease of installation, environmental impacts, performance, and cost. The Companies stated that the HVED cables are larger in diameter and heavier than HPFF-PTC and therefore would be delivered in shorter lengths, requiring a greater number of manhole vaults for cable splicing (Exh. JP-1, at 4-19). However, the Companies stated that splices and terminations in the HVED manhole vaults are simpler to construct compared to HPFF-PTC

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17 The Companies stated that an HPFF-PTC system would require a fluid return line for cooling, pressurizing systems at the Woburn and Wakefield Junction Substations, chillers or heat exchangers to maintain thermal conditions, additional shunt reactor capacity, and a cathodic protection system (Exh. COM-DAS-1, at 4). The existing pressurization system at Woburn Substation includes back-up positions for pressurizing existing 115 and 345 kV lines (Exhs. TOS-PA-5; COM-DAS-1, at 19-21). The Companies stated that there is no room in the two substations for additional pressurization equipment (Exh. COM-DAS-1, at 9-10, 19-21).

18 The Companies stated that a single-cable HPFF-PTC system would provide a minimum summer LTE rating of 754 MVA without a fluid return line or a maximum summer LTE rating of 997 MVA with a fluid return line (Exhs. EFSB-PA-4; COM-DAS-1, at 4). The Companies acknowledged that the capacity of a single-cable HPFF-PTC system could be further enhanced using high-speed fluid circulation, but stated that such additions would add significant complexity; the Companies stated that adding heat exchanger equipment and a new pump plant would add approximately $20 million to project costs, not including cost of land acquisition (Exh. COM/DAS-1, at 9-10).

manholes vaults (id.). The distance between manholes, minimum number of manhole covers, inside length of manholes, and width of construction trench[19] for each cable technology is presented in Table 2.

Table 2. Comparison of Cable Technologies

	Distance Between Manholes (feet)	Number of Manholes	Inside Length of Manholes (feet)	Width of Construction Trench (inches)	Summer LTE Rating (MVA)
Single-cable HVED system	1,500 to 1,800	28	30	41	1,249
Two-cable HPFF-PTC system	2,000 to 3,000	23	22	48	1,348

Sources: Exhs. JP-1, at 6-8 to 6-10; EFSB-PA-6; EFSB-PA-9; Tr. 4, at 707-708.

With respect to the in-ground footprint of the duct banks, the Companies concluded that the width of the excavation would be similar for both cable technologies (Exh. TOW-C-1; Tr. 4, at 707, 711). The Companies stated that HVED systems may need to be buried more deeply than an HPFF-PTC system due to the HVED duct bank's size, especially in utility-congested areas (Exhs. JP-1, at 4-19; TOW-PA-1). The Companies stated that the typical burial depth would be five feet for both technologies; however, the HVED system could be buried at a depth varying from 3 to 20 feet (Exhs. EFSB-PA-7; TOS-ED-10). The cost of the HVED system could increase due to a need for deeper burial (Exh. JP-1, at 4-19). The steel pipe of the HPFF-PTC system can be installed between or around existing utilities, while maneuvering the concrete duct bank of the HVED system around existing infrastructure would be difficult (Exhs. JP-1, at 4-19; EFSB-PA-7).

Additionally, the Companies compared the environmental impacts of the cable technologies based on availability of land, construction duration, magnetic field levels, and use of MODF (Tr. 4, at 706). The Companies indicated they would encounter spacing constraints at

[19] The Companies defined the construction trench as the width of the pavement that would need to be cut in order to install the duct bank (Tr. 4, at 711).

the Woburn and Wakefield Junction Substations and along the transmission line route for the HPFF-PTC system's required ancillary equipment (e.g., shunt reactor, pumping plant, heat exchanger) (id. at 714-718; Exh. COM-DAS-1, at 4). The Companies stated that the construction period for the HPFF-PTC technology would be longer, due to factors that include the need to install two cables, and weld and test the steel pipes (Exh. EFSB-PA-9; Tr. 4, at 710, 718-720). Further, the Companies noted that HPFF-PTC system would require the use of MODF, which would present the potential for oil spills along the route and would require additional maintenance and monitoring (Tr. 4, at 714, 721).

With respect to costs, the Companies provided a conceptual grade (-25%/+50%) cost comparison and stated that although the civil construction and maintenance costs for the two technologies would be similar, material and installation costs would be higher for the two-cable HPFF-PTC system (Exhs. EFSB-PA-9; TOW-C-3). The Companies estimated that the two-cable HPFF-PTC system would cost between $34 million and $51 million more than a single-cable HVED system (Exhs. EFSB-PA-9; TOW-C-3). The Companies stated that the estimate does not include the cost associated with increased substation infrastructure for a two-cable system, which would further increase the cost disparity between the options (Exh. EFSB-PA-9).[20]

The Companies concluded that a single-cable HVED system, compared to a two-cable HPFF-PTC system, would minimize costs and environmental impacts and is the preferred technology for the Project (Exh. JP-1, at 4-20).

b. Three-Project Alternative

The Companies identified a transmission alternative referred to as the "Three-Project Alternative," that would consist of three distinct, new, 345 kV transmission line projects, totaling 39.8 miles (Exh. JP-1, at 4-1).[21] The components of the Three-Project Alternatives are:

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[20] As an example, the Companies stated that one heat exchanger would cost $1 million, and that multiple heat exchangers would be required (RR-TOS-7).

[21] The individual components of the Three-Project Alternative were identified as separate projects to mitigate thermal overloads on Lines 351/358 and 346/365 in work in advance

(1) a 12.9-mile overhead line between the Woburn Substation and the Tewksbury 22A Substation ("Project 1"); (2) a 7.4-mile underground line between the Woburn Substation and the North Cambridge Substation ("Project 2"); and (3) an 18.9-mile overhead line between National Grid's Ward Hill and Wakefield Junction Substations ("Project 3") (id. at 4-2). Each of the three projects would require ancillary facilities and/or upgrades to lines and protection equipment at each substation (id. at 4-4 to 4-8). The total cost of the Three-Project Alternative was estimated at $377.3 million, with a target accuracy of -50%/+200% (id. at 4-9).

Project 1 would be constructed in an existing overhead electric utility right-of-way ("ROW") in Woburn, Burlington, Billerica, and Tewksbury, and would require reconfiguration of existing lines within the ROW (i.e., removing existing structures, relocating and reconstructing on new structures) (Exh. JP-1, at 4-3 to 4-4). Project 2 would be constructed within streets in Woburn, Winchester, Arlington, Somerville, and Cambridge (id. at 4-6). Project 3 would be constructed within existing electric utility ROWs through Haverhill, Boxford, North Andover, Middleton, North Reading, and Wakefield (id. at 4-6 to 4-7).

c. Companies' Comparison of the Project and Three-Project Alternative

The Companies compared the cost, reliability, and environmental impacts of the Project and the Three-Project Alternative (Exh. JP-1, at 4-9 to 4-10). From a cost perspective, the Companies stated that the Three-Project Alternative would cost twice as much as the Project, and therefore was not preferred (id. at 4-9; Exh. EFSB-C-1(S)). From a reliability perspective, the Companies indicated that both transmission alternatives would meet the identified need and,

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of ISO-NE's Solutions Study (Exhs. JP-2, app. 2-3, at 68; EFSB-N-34; EFSB-PA-1; Tr. 12, at 2172-2173). When the Solutions Study was published in 2015, the amount of capacity needed for the Project had decreased due to a reduction in the load forecast, inclusion of the EE forecast, and new generation resources (Exh. JP-2, app. 2-3, at 68; Tr. 12, at 2171-2177). Therefore, the Companies evaluated the potential for an HVED cable between Woburn and Wakefield Junction Substations based on the decreased capacity (Tr. 12, at 2171-2177). The Companies presented the Three-Project Alternative as the transmission alternative for the Project because the three projects had previously been considered as solutions for the Project need (Tr. 12, at 2179-2180).

therefore, the Companies concluded that the transmission options are comparable with respect to reliability (Exh. JP-1, at 4-9).

The Companies analyzed several environmental factors in their comparison of the impacts of the transmission alternatives, including waterway, highway, railroad, bridge, and wetland crossings (id. at 4-9 to 4-10). The Companies noted that the underground components of each project are similar in scope and scale (id. at 4-9).[22] The Three-Project Alternative would require 31.8 miles of new overhead 345 kV lines in existing ROWs, which would require reconfiguration of some existing lines (id. at 4-9). The Companies completed an analysis of the environmental impacts of the two projects, and concluded that the Three-Project Alternative would have greater impact from nearly every project element evaluated (see Table 3 below), consistent with the larger scale of the Three-Project Alternative compared to the Project (id. at 4-9 to 4-10). Based on that analysis, the Companies stated that the Project is the preferred transmission alternative with respect to environmental impacts (id. at 4-9).

Table 3. Comparison of Project and Three-Project Alternative

Element	Project	Three-Project Alternative
Total length	8.5 miles	39.2 miles
Type	Underground	Overhead and underground
Waterway crossings	18	34
Wetland crossings	14	96
Tree clearing (approximate)	3.6 acres[23]	93 acres[24]
Total Cost (millions)	$107.3	$377.3

Sources: Exhs. JP-1, at 4-9 to 4-10; STEW-1-1.

[22] The Companies noted that the Project 2 would consist of an HPFF-PTC system, as it would be constructed alongside an existing HPFF-PTC system (Tr. 12, at 2186-2187).

[23] The Companies stated that the only portion of tree clearing for the Project would be along the one-mile, 30-foot-wide Wakefield railroad ROW (Exh. STEW-1-1).

[24] The Companies stated that approximately 93 acres of tree clearing would be required for Project 3 of the Three-Project Alternative (Exh. JP-1, at 4-6 to 4-7).

2. Non-Transmission Alternatives

The Companies engaged London Economics International LLC ("LEI") to conduct an assessment of the cost and feasibility of using NTAs to address the identified need (Exh. JP-1, at 4-11). LEI defined an NTA as a solution to an identified need that either does not require the construction of traditional electric transmission infrastructure, or delays the timing of the transmission investment (Exh. EFSB-PA-13(1) at 8). The Companies stated that they provided LEI with hypothetical injection locations[25] and capacity requirements that would be necessary to mitigate the potential for post-contingency thermal overloads, based on projected reliability needs for 2023 (Exh. JP-1, at 4-11 to 4-12).

LEI then modeled NTA resources at three different maximum sizes ("P_{max}") per injection point, a P_{max} of 15 MW, 250 MW, and 750 MW, in order to model different categories of resource types (Exh. JP-1, at 4-12). LEI's analysis considered the potential for installing multiple NTA technologies at each injection point; however, in determining the least-cost NTA solution, LEI selected one technology for each injection point, based on the lowest net levelized cost of entry ("LCOE") (Exh. EFSB-PA-11).[26]

LEI identified a broad range of demand side and supply side resources and analyzed whether each technology would be technically feasible (Exhs. JP-1, at 4-13; EFSB-PA-13(1) at 8).[27] LEI defined a technically feasible NTA resource as a technology that could be implemented based on planning criteria, technology specific operating profiles, and reliability needs of the Project, apart from cost considerations (Exh. EFSB-PA-13(1) at 2, 8). According to

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[25] An injection point is the location on the electric gird where a new resource would connect.

[26] The Companies stated that the gross LCOE is a dollars-per-kilowatt-year ($/kW-year) value that includes all investment and operating costs, and that net LCOE is derived by deducting any potential revenue streams (e.g., energy sales, capacity market revenues, etc.) from the gross LCOE (Exh. EFSB-PA-13(1) at 16).

[27] These resources included combined-cycle gas turbines, simple-cycle gas turbines, peaker frame units, dual-fuel jet engines, utility-scale solar with and without storage, distributed solar generation with and without storage, slow and fast discharge batteries, and active and passive demand response (Exhs. JP-1, at 4-13; EFSB-PA-13(1) at 9).

the Companies, LEI first considered the minimum and maximum size of each technology to determine whether a particular NTA option could provide the size of injection needed at a specific location (Exh. JP-1, at 4-13 to 4-14). Next, LEI considered whether a specific NTA technology has the operational characteristics necessary to respond to N-1-1 contingency conditions (id. at 4-14; Exhs. EFSB-PA-13(1) at 8, 12; EFSB-PA-14).[28] LEI stated that it then considered whether sufficient load reductions from active and/or passive demand response were technically feasible NTAs at that injection point (Exh. JP-1, at 4-14).[29]

Following the identification of technically feasible NTAs for each location, LEI calculated the gross and net LCOE for each technology to determine the least cost NTA (Exh. JP-1, at 4-15). First, LEI calculated a gross "all-in" LCOE based on the investment and operating costs of each technology (id.). However, LEI recognized that the total cost of NTAs could be reduced by market revenues or other income sources, and subsequently adjusted the net LCOE for each technology to account for the potential for offsetting revenues from energy markets (i.e., capacity markets, solar renewable energy certificates ("SRECs")) (id.; Exh. EFSB-PA-13(1) at 36, 38). To account for uncertainty in future market revenues, LEI evaluated four scenarios of capacity payments and SREC revenues; by accounting for such

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28 The Companies identified operational characteristics including the ability of an NTA to respond within 30 minutes following a contingency and to operate continuously for at least twelve hours (Exhs. JP-1, at 4-14; EFSB-PA-13(1) at 8). According to the Companies, a period of twelve hours would encompass the amount of required time for an NTA to continuously operate following the failure of a transmission system element until the element is repaired or loads decrease on a peak load summer day (Exh. EFSB-PA-14).

29 LEI assumed active and passive DR could reduce peak load by no more than 15 percent over and above DR reductions embedded in ISO-NE's load forecasts (Exh. JP-1, at 4-14). The Companies stated that achieving peak load reductions of 15 percent over and above levels achieved through state-mandated programs is an aggressive goal, which goes well beyond utility experiences to date targeting energy efficiency (Exh. EFSB-PA-13(1) at 25).

revenues, its estimate of LCOE provided a range of the predicted direct costs to ratepayers (Exh. JP-1, at 4-15 to 4-17).[30]

LEI concluded that the direct cost to ratepayers would be between $87.1 million annually (for the scenario based on high SREC revenues and high capacity payments and consisting of 11,666.7 MW of utility-scale solar PV) and $423.2 million annually (for the scenario based on low SREC revenues and no capacity payments and consisting of 2,058.8 MW of peaking simple-cycle natural gas generation) (Exhs. JP-1, at 4-15; EFSB-PA-13(1) at 3).[31] However, LEI further stated that the least-cost option would face significant barriers such as land use requirements and the low likelihood of high SREC revenues, which would likely make this option infeasible (Exh. JP-1, at 4-15 to 4-18).[32] According to LEI, the most likely scenario, consisting of gas-fueled combined-cycle generation, would be based on low SREC revenues and high capacity payments, and would cost ratepayers $128.1 million annually (id. at 4-17 to 4-18). In comparison, the Companies estimated that the annual revenue requirement for the Project is

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30 The key assumptions for developing the LCOE included the potential for revenues from SRECs and forward capacity market payments (Exh. EFSB-PA-13(1) at 18). SREC revenues were modeled at high and low values, with high SREC revenues scenarios assuming a price of $321/kilowatt-month ("kW-month") and low SREC revenue scenarios assuming a price of $88/kW-month (id.). Similarly, forward capacity payments revenues were modeled at high and low values, with the high revenue scenario assuming a facility would earn capacity payments for half of its life cycle, and the low revenue scenario assuming a facility would never earn capacity payments (Exh. EFSB-PA-13(1) at 18).

31 The direct cost is the aggregate value for all identified least cost technically feasible NTA technologies across all injection locations (Exh. EFSB-PA-10(1) at 34).

32 LEI's analysis did not include a quantitative analysis that would consider factors including land requirements, additional infrastructure, and implementation time (Exhs. EFSB-PA-13(1) at 50-52; EFSB-PA-33; EFSB-PA-34). According to the Companies, in order to include a quantitative analysis, LEI would need detailed project designs to assess specific technical, cost, timing, and commercialization factors (Exhs. EFSB-PA-33; EFSB-PA-34). The Companies stated that including this analysis would have likely led to higher costs for an NTA solution, further limiting the available technically feasible NTA technologies; and therefore, LEI stated that its analysis is conservative and understates the cost of an NTA solution (Exhs. EFSB-PA-33; EFSB-PA-34).

approximately $19.4 million (Exh. EFSB-PA-26(S)). The Companies concluded that an NTA solution would be costly, difficult to implement, less flexible and robust in operation than the Project (Exh. JP-1, at 4-18). Therefore, National Grid and Eversource stated that the Project would better meet the identified need (id.).

C. Position of the Parties

Winchester and Stoneham focused on cable technology selection aspects of the project alternatives, as described below. No intervenors addressed whether NTAs or the Three-Project Alternative would be preferable to the Project.

1. Intervenors

a. Winchester

Winchester asserts that a single-cable HPFF-PTC system would be able to meet the Project need (Winchester Brief at 4, 26; Winchester Reply Brief at 14, 19, citing Exhs. EFSB-TOW-3; EFSB-TOW-4; EFSB-TOW-5; COM-TOW-29(1); COM-TOW-29(2)). Winchester witness Mr. Tirinzoni presented a design that would consist of a single transmission line and a fluid circulation pipe or oil return line (Exh. TOW/TOS-PT-1, at 5-7). Winchester states that this design could provide a minimum summer LTE of 1,041 MVA (Winchester Brief at 26, citing Exhs. EFSB-TOW-3(R); COM-TOW-29; Tr. 5, at 826-827; Winchester Reply Brief at 14, 18). Winchester states that the minimum summer LTE rating of its design could be increased with the installation of air coolers or heat exchangers, but it did not provide a specific potential LTE for such a design (Winchester Reply Brief at 18-19). Winchester acknowledges that pressurization equipment would be needed for an HPFF-PTC system, but argues such equipment could be installed within the footprint of existing facilities at the Woburn Substation (Winchester Brief at 42-43, citing Exhs. TOS-PA-5; TOS-PA-6; Winchester Reply Brief at 17).

Winchester states that the HVED cable technology would result in long-term loss of available underground space within Winchester's public streets, and that the HVED system's concrete duct bank would require more space within the roadway and would make accessing other services difficult (Winchester Brief at 24; Winchester Reply Brief at 17). Winchester

requests that the transmission line, whether the Companies employ HPFF-PTC or HVED technology, be buried underneath existing infrastructure to avoid any relocation of existing services (Winchester Brief at 24; Winchester Reply Brief at 16-17).

Winchester argues that the HPFF-PTC technology could be installed at the same cost as HVED, while reducing environmental impact (Winchester Brief at 42-44; Winchester Reply Brief at 17). Winchester argues that the HPFF-PTC technology would produce significantly lower levels of magnetic fields than an HVED system and would limit potential magnetic field impact to the community (Winchester Brief at 29; Winchester Reply Brief at 21). Winchester indicated that it is more comfortable with quantifiable risks of leaking MODF from HPFF-PTC systems, relative to what it considers uncertainties in the strength of magnetic fields from an HVED cable system in combination with unknown risks of magnetic fields themselves (Winchester Reply Brief at 14, 18). Winchester states that a HPFF-PTC system would alleviate performance risks associated with the HVED cable system such as "hot spots," line derating, and line failures (id. at 15; Winchester Brief at 27-28, 42, citing Exh. EFSB-CM-2(1)).

Winchester states that HPFF-PTC technology has been used for underground transmission lines in Massachusetts since the 1940s, and claims that the Companies have little experience with 345 kV HVED technology (Winchester Reply Brief at 15, 18). Winchester asserts the Companies' experience with the HPFF-PTC technology would lead to reduced costs associated with repair, maintenance, and training (id. at 15). Winchester acknowledges that HPFF-PTC systems may require "slightly more" monitoring (id. at 18). However, Winchester asserts that the Companies do not have experience operating and maintaining HVED systems (id.).

Winchester calculated the total cost of a single-cable HPFF-PTC system at approximately $96.4 million (Exh. EFSB-TOW-5). Arguing that the Companies underestimated their cost for the HVED design due to the lack of information about the actual location and depth of existing underground utilities, Winchester estimated the cost of a single-cable HVED system at approximately $100.3 million (Exh. EFSB-TOW-5; Winchester Brief at 27, citing Tr. 5, at 829-830). Winchester argues that its calculations demonstrate that the cost of the two technologies is "essentially the same" (Winchester Brief at 27, citing Tr. 5, at 830-831).

b. Stoneham

Stoneham supports the use of an HPFF-PTC system for the New Line (Stoneham Brief at 29-30, 32; Stoneham Reply Brief at 13). Stoneham states that it adopts the arguments presented by the Town of Winchester regarding the type of cable technology that would be most appropriate for the Project, including magnetic field and reliability issues (Stoneham Reply Brief at 13).

Additionally, Stoneham argues that the concrete duct bank required for the HVED system would impact existing and future in-street infrastructure (Stoneham Brief at 30). Stoneham reports that the steel pipes of the HPFF-PTC system would be easier to install and to "thread through and around" existing utilities compared to the concrete duct bank of the HVED cable system (id., citing Exhs. JP-1, 4-18 to 4-19; TOW/TOS-PT-1, at 14; Tr. 5, at 843-844; Tr. 5, at 901-902; TOW-GO-1, at 7-13). Further, Stoneham argues that the HPFF-PTC system would occupy less space within town streets (Stoneham Brief at 30).

Stoneham asserts that the construction impact of the HPFF-PTC system would be less than those of the HVED cable system, specifically with respect to cable splicing and the number of manholes (id. at 31, citing Exhs. JP-1, at 4-19; TOW/TOS-PT-1, at 13). Stoneham argues that fewer manholes would reduce construction and traffic impacts (Stoneham Brief at 31).

2. Companies' Response

Based on their review of the cable technologies, the Companies argue that a single-cable HVED system is the most appropriate technology for the Project (Companies Brief at 49, citing Exh. JP-1, at 4-20). The Companies assert that a two-cable HPFF-PTC system would be needed to meet the necessary capacity, which would result in increased material and installation labor costs and environmental impacts (Companies Brief at 49-50).

The Companies argue that the single-cable design presented by Winchester (and adopted by Stoneham) would fail to meet the identified need for the Project and would not provide the required summer LTE capacity (Companies Brief at 52-54, citing Exh. COM-DAS-1, at 5-6, 12; Companies Reply Brief at 23). The Companies argue that Winchester's calculations failed to

take into account the lower impedance of HPFF-PTC on the required transmission capacity, leading to the incorrect conclusion that one HPFF-PTC system would be sufficient (Companies Reply Brief at 23-25, citing Tr. 5, at 875-876). Furthermore, the Companies state that an HPFF-PTC system, using either a one- or two-cable design, would require additional facilities including a new pressurization plant, heat exchangers, chillers, and a cathodic protection system (Companies Brief at 49, 50, 54, citing Exhs. EFSB-PA-6; EFSB-PA-9; CUR-2-4(a); TOW-C-3; COM-DAS-1, at 4; Tr. 4, at 673-674, 688, 697-700, 722; RR-TOW-7). The Companies argue that Winchester's cost estimates do not reflect the need for this additional equipment or cost elements such as overhead, development and permitting costs, construction maintenance costs, and real estate costs (Exh. COM-EL/JM-1; Companies Reply Brief at 24, 29, citing Tr. 5, at 890-894).

The Companies state that Winchester and Stoneham's request for the Companies to bury the transmission line under all existing utilities would increase reliability risks, costs, and construction impacts (Companies Reply Brief at 38, citing Exh. COM-BAS-1, at 9, 10). The Companies assert that if existing utilities need to be relocated, the Companies would pay for the cost of relocation (Companies Reply Brief at 38). Further, the Companies state that they would utilize their experience constructing and maintaining underground electric transmission lines to minimize impacts to existing in-street utilities (id.).

The Companies assert that the HVED design is a reliable cable technology (Companies Reply Brief at 30). According to the Companies, the installation of HPFF-PTC systems has diminished in recent years and the electric transmission industry has shifted towards the installation of HVED cable systems (Companies Brief at 52, citing Exh. COM-DAS-1, at 4; Tr. 4, at 702-703). The Companies state that due to the diminished use of HPFF-PTC systems in the United States, there is only one manufacturer and a limited number of experienced technicians remaining for HPFF-PTC systems (Companies Reply Brief at 31). The Companies state that Eversource successfully constructed an HVED cable system in Connecticut and, therefore, Eversource has experience operating an HVED cable system (id. at 30-31, citing Exhs. TOW-PA-2; TOW-PA-3; TOS-CM-25(R); Tr. 4, at 726).

The Companies acknowledged that magnetic fields from a HPFF-PTC system would be lower, but stated that the magnetic fields from an HVED system are also low (Tr. 4, at 707). The Companies assert that the single-cable HPFF-PTC design fails to meet the identified need, requires more equipment and land acquisition, results in higher overall life-cycle and maintenance costs, and leads to higher environmental impact (Companies Brief at 50, 51, 55). The Companies conclude that the single-cable HPFF-PTC design, like the two-cable design, is inferior to the proposed HVED cable system (id. at 52, 55).

D. Analysis and Findings on Alternative Approaches

The evidence described above shows that the Three-Project Alternative would result in greater environmental impact and would have a significantly higher cost compared to the Project. Regarding NTAs, the Companies showed that each NTA would be significantly more costly than the Project, and given the scale of the required resource additions, would likely encounter significant implementation obstacles.[33]

The Companies proposed the installation of a single-cable HVED system for the Project. The record shows that a single-cable HPFF-PTC would need fluid recirculation, pressurization, and chillers, as well as shunt reactors, to increase capacity and control voltage, and with such equipment, the cost would increase by approximately $20 million, not including land costs for expanded above-ground facilities. The Companies' engineering demonstrated that in order to meet the identified need, a two-cable HPFF-PTC system would be required, and the record shows that such a design would result in greater environmental impact and would have a higher cost compared to the single-cable HVED system.

The towns of Winchester and Stoneham state that they prefer the use of HPFF-PTC technology to reduce construction impact and magnetic field levels. The record shows that the single-cable HPFF-PTC system proposed by Winchester and Stoneham would not have

[33] The Siting Board continues to expect that Eversource and National Grid will strongly encourage their customers, both existing and new, to take full advantage of EE programs. The Companies should also continue to explore creative ways to use NTAs (individually or in combination) to avoid or delay the need for new transmission infrastructure.

sufficient capacity to meet the identified need. Therefore, the appropriate comparison here is between a single-cable HVED system and a two-cable HPFF-PTC system. The record shows that a two-cable HPFF-PTC system would cost more than the proposed HVED system, would require a wider trench, and would require the use of MODF, with its potential for spills and leaks which have environmental and reliability implications. While the industry still utilizes HPFF-PTC systems for some projects, the record shows that the industry is moving toward HVED as a standard technology for underground transmission systems. The record does not show a clear reliability advantage or disadvantage between HVED and HPFF-PTC. The record also shows that a two-cable HPFF-PTC system would require fewer and smaller manhole vaults, and would result in lower magnetic fields than the HVED system. The Siting Board addresses Winchester and Stoneham's comments regarding utility density and magnetic fields in Sections VI.C.1 and VI.C.6, below. While the Companies' soil testing reduced the expected normal rating of the New Line, the LTE rating was unaffected, and the normal rating remains sufficient to meet the Project need. The Siting Board finds that the HVED system would provide the necessary capacity with lower environmental impact, and a lower cost than an HPFF-PTC system.

The record shows that an HVED cable system is superior to an HPFF-PTC system for the Project based on capacity, cost, potential environmental impacts, and reliability. Therefore, the Siting Board finds that on balance the Project is superior to the other alternatives identified with respect to providing a reliable energy supply for the Commonwealth with minimum impact on the environment at the lowest possible cost.

V. ROUTE SELECTION

A. Standard of Review

G.L. c. 164, § 69J requires a petition to construct to include a description of alternatives to the facility, including "other site locations." Thus, the Siting Board requires an applicant to demonstrate that it has considered a reasonable range of practical siting alternatives and that its proposed facilities are sited in locations that minimize cost and environmental impacts while ensuring a reliable supply. To do so, an applicant must 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 routes in a manner that ensures that it has not overlooked or eliminated any routes that, on balance, are clearly superior to the proposed route. Second, the applicant generally must establish that it identified at least two noticed sites or routes with some measure of geographic diversity. East Eagle at 63; Walpole-Holbrook at 32; Boston Edison Company, EFSB 04-1/D.T.E. 04-5/D.T.E. 04-7, at 32-33 (2005) ("Stoughton-Boston"). But see Colonial Gas Company, EFSB 16-01, at 28 (2016), where the Siting Board found the company's decision not to notice an alternative route to be reasonable.

B. The Companies' Approach to Route Selection

1. Introduction

The Siting Board's Route Selection review, below, reflects the three-step route selection process used by the Companies in this proceeding. In step one, the Companies developed, and in step two, applied, an approach to choosing and scoring routes for the Project. Section B.2 discusses the approach developed by the Companies; Section B.3 discusses the Companies' use of this approach to identify initial candidate routes. Thereafter (step three, Section B.4), the Companies examined the results of their initial route selection analysis in conjunction with consideration of three additional routes proposed by Intervenors during the proceeding. Besides a discussion of step three, Section V.B.4 includes a map and descriptions of routes proposed by the Intervenors and provides information about the Companies' initial candidate routes. Table 7 in Section V.B.4 provides the Companies' summary comparison of the Intervenors' routes and the Companies' initial route options on the basis of updated scores, ranking and costs.

Section V.C.1 presents the results of the Companies' analysis of the environmental impact, cost, and reliability of route options for the Project as evaluated in step three of the Companies' route selection process; Section V.C.2 addresses the geographic diversity of the Primary and Noticed Alternative Routes identified by the Companies in Section V.C.1. Section V.D includes the Intervenors' opinions of the Companies' route selection process and the Companies' reply to the Intervenors. Finally, Section V.E provides the Siting Board's analysis and findings on Route Selection.

The Siting Board notes that Route Selection has been an area of active Intervenor participation in this proceeding. Intervenors proposed several routes for the Project in addition to those identified by the Companies. The introduction of these additional proposed routes occurred in the course of the proceeding, after the Companies completed their initial route selection assessment and after the Project was noticed. To address the addition of the Intervenors' routes, the Companies conducted a supplemental round of route selection analysis.

2. Companies' Route Selection Process: Step One

The Companies delineated a study area to locate the Project between the Woburn Substation and the Wakefield Junction Substation (Exh. JP-1, at 5-1 to 5-4). The Companies established criteria for developing potential routes within the Project study area that included various environmental and engineering factors, described below (id. at 5-1). Based on these criteria, the Companies gave preference to direct routes over circuitous routes; opted for established ROWs, including roadways, to the extent possible, while avoiding use of private property; and minimized Project costs by avoiding routes with complex engineering and construction characteristics (id.). Using this approach, the Companies: (1) identified existing linear corridors between the two substations in the study area along with the associated constraints; (2) undertook engineering review and municipal consultations to refine the Companies' choice of candidate routes and route variations; and (3) scored the candidate routes, shown in Figure 3, below, based on 16 environmental and constructability criteria (id. at 5-2 to 5-27).[34]

[34] The Companies categorized the linear corridors as northern, central or southern based on their relative location within the study area (Exh. JP-1, at 5-2 to 5-27).

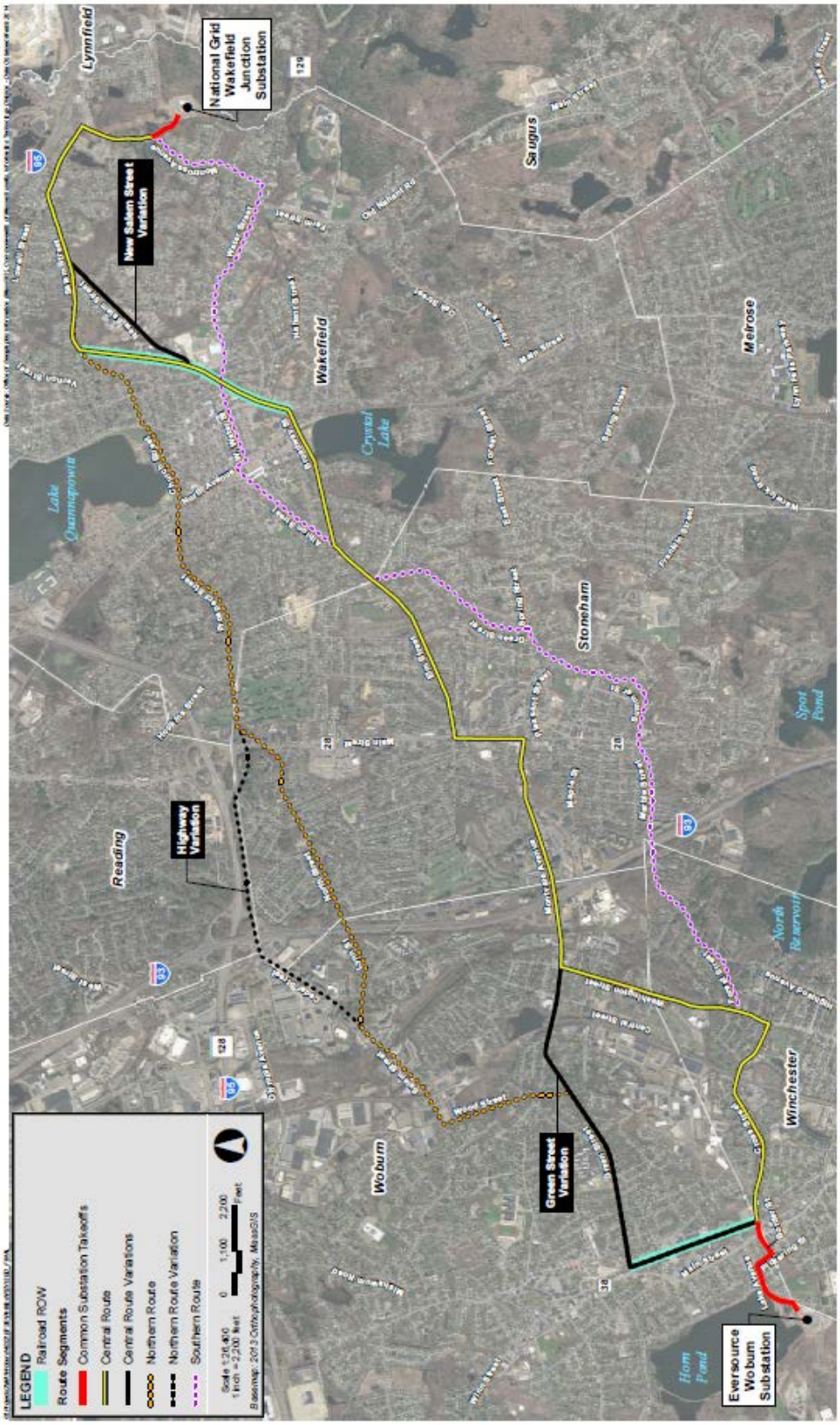

Figure 3. Companies' Evaluated Candidate Routes, Preliminary Analysis

Source: Exh. JP-1, at 5-29, fig. 5-5.

The Companies' 16 evaluation criteria fell into three categories: (1) impacts to the human environment (seven criteria); (2) impacts to the natural environment (four criteria); and (3) engineering and technical impacts (five criteria) (Exh. JP-1, at 5-34 to 5-35). Within the human environment category, the criteria included impacts to residential land uses, commercial/industrial land uses, sensitive receptor land uses, public transit facilities, historic resources, and traffic congestion, as well as the number of high-impact crossings[35] (id. at 5-34). Criteria in the natural environment category included the length of wetland buffer zone crossings, impacts to public shade trees, Areas of Critical Environmental Concern ("ACEC") and Outstanding Resource Waters ("ORWs"), and areas of likely subsurface contamination (id. at 5-34 to 5-35). Engineering and technical category criteria included route length, utility density, the number of route bends/turns greater than 30 degrees (based on road centerlines), street width, and the number of trenchless crossings (id. at 5-35).

The Companies developed a route evaluation scoring technique for each of the 16 route selection criteria that assigned "1" to the route with the highest potential for a particular impact; other routes received a ratio score between "0" and "1" indicating their comparative potential for the particular impact (Exhs. JP-1, at 5-35; EFSB-RS-18).[36] The Companies added scores for each criterion to get a total raw score for each candidate route (Exh. JP-1, at 5-41). The Companies then developed weights (1, 2, or 3) for each scoring criterion to reflect the relative importance of the criterion (id. at 5-41, 5-46 to 5-47). The Companies assigned a triple weight to residential land use, commercial/industrial land use, high-impact crossings, and potential for traffic congestion; a double weight to sensitive receptors, ACEC/ORW crossings, subsurface

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35 A high-impact crossing is defined by the Companies as a complex, multi-month drilling or bridge construction project likely to result in high levels of disturbance to the environment, traffic, sensitive receptors, and residential neighborhoods (Exh. JP-1, at 5-34, 5-43).

36 For example, if a hypothetical Route X with ten proximate residential units has the highest potential residential unit impact, then the residential unit impact score of Route X is 10 units/10 units or "1" (Exhs. JP-1, at 5-35; EFSB-RS-18). A hypothetical Route Y with five proximate residential units has a residential unit impact score of 5 units/10 units or "0.5" (Exhs. JP-1, at 5-35; EFSB-RS-18).

utility density, and street width; and a single weight to the remaining eight criteria (Exh. JP-1, at 5-46). For each candidate route, the Companies then multiplied raw ratio scores for each criterion by the assigned weighting factor, yielding weighted scores for each criterion (Exhs. EFSB-RS-18; EFSB-RS-18(1)). Finally, for each candidate route, the Companies added the weighted scores for each criterion to determine a total weighted ratio score (Exhs. EFSB-RS-18; EFSB-RS-18(1)). Accordingly, the lower the total weighted ratio score for a candidate route, the lower its impact, and the better it compares with other routes.

3. Companies' Route Selection Process: Step Two

The Companies identified six initial candidate routes, each connecting the Woburn and Wakefield Junction Substations (Exhs. JP-1, at 5-7, 5-51 to 56; JP-6; A; Tr. 1, at 10-15, 44-46). Two of the initial candidate routes crossed the northern portion of the study area, three crossed through the central portion of the study area, and one passed along the southern portion of the study area (Exh. JP-1, at 5-28 to 5-48). In addition to environmental impacts and constructability, the Companies developed high-level cost estimates for the routes and compared their reliability benefits (id. at 5-53).[37] Because the central and southern routes included a common segment on Albion Street in Wakefield, the Companies also explored combinations of these routes east and west of Albion Street "to ensure that they had not overlooked a superior route" (id. at 5-53 to 5-56).

Table 4 provides weighted ratio scores and cost estimates along with the corresponding weighted ratio and high level cost rankings for the Companies' six initial candidate routes (Exh. JP-1, at 5-48, 5-50 to 5-51). See Section V.B.4, below, for updated cost estimates.

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[37] The Companies based estimated costs for initial candidate routes from the cost estimates for the Primary Route, deriving a per-linear-foot-cost for trenching in-street and trenching in the railroad ROW, plus per-unit cost adders for trenchless crossings (Exh. EFSB-RS-23). The Companies' cost estimates for the Primary Route were at the conceptual grade (-25% /+50%) (Exhs. EFSB-RS-6, at 10; EFSB-RS-23). The Companies developed individual cost estimates for HDD crossings and for the bridge crossing of the MBTA Lowell Line on the Primary Route with the Green Street Variation (Exhs. JP-1, at 5-50; RR-EFSB-10; RR-EFSB-34).

Table 4. Companies' Initial Candidate Routes and Variations [38]

Candidate Route	Weighted Ratio Score	Weighted Ratio Ranking	Cost Estimate (Millions)	Cost Ranking
Northern Route	23.2	6	$74.5	4
Northern Route with Highway Variation	21.8	5	$77.6	6
Central Route (Primary Route)	18.9	1	$72.6	3
Central Route with Green Street Variation	21.5	4	$76.7	5
Central Route with New Salem Street Variation	19.5	2	$69.8	1
Southern Route (Noticed Alternative Route)	19.7	3	$72.0	2

Source: Exh. JP-1, at 5-48, 5-50 to 5-51.

The Companies eliminated the Northern Route options as inferior to other route alternatives with respect to potential environmental impacts, constructability, and cost (Exh. JP-1, at 5-53). At an initial level of analysis, the Companies estimated that the Central Route with the New Salem Street Variation and the Southern Route would each cost less (the Southern Route only nominally less) to construct than the Central Route (id.; RR-EFSB-10; RR-EFSB-33). The Companies anticipated, however, that construction costs listed for the New Salem Street Variation would likely increase for two reasons: (1) the location of a portion of New Salem Street within the Mill River watershed left it subject to flooding; and (2) the

[38] The Siting Board notes that the Central Route of the Companies' initial process is later identified by the Companies as their Primary Route; the Southern Route of the Companies' initial process is later identified by the Companies as their Noticed Alternative Route (Exh. JP-1, at 5-54 to 5-56). The Siting Board also notes that the Companies distinguish between a "workaround" to a route and a route "variation," but use the same term (variation) in naming route options (id. at 5-56; Exh. A(R) n.1). For example, the New Salem Street Variation is a workaround plan the Companies would use only if unable to build along the northern part of the Wakefield railroad ROW along the Primary Route (Exh. JP-1, at 5-56). In contrast, the Green Street Variation was not offered as a workaround but rather was presented as a route segment alternative for comparison based on its relative merits (Exh. A(R) n.1).

instability of soils along New Salem Street might require the design of a reinforced duct bank system (Exh. JP-1, at 5-55).

The Companies' analysis indicated that although the Southern Route would likely be slightly less expensive than the Central Route, it is inferior to the Central Route from constructability and environmental impact perspectives (id. at 5-51 to 5-56). The Companies explained that they therefore chose the Central Route as the Primary Route for their Project and identified the Southern Route as the Noticed Alternative Route (id. at 5-56).

The Companies compared the candidate routes with regard to the reliability of the proposed New Line, but identified no meaningful differences in the operating characteristics of the Project for the routes under consideration (id. at 5-51).

In addition to noticing the Primary Route (as well as the New Salem Street Variation, a workaround for possible construction issues along the northern part of the Wakefield railroad ROW) and the Noticed Alternative Route, the Companies also noticed the Green Street Variation, a route segment the Companies examined as a potential alternative to part of the Primary Route (Exhs. JP-1, at 5-22 to 5-23; A; JP-6; Tr. 1, at 10-15). According to the Companies, the Green Street Variation to the Primary Route is inferior to the Primary Route; the Companies stated, however, that they analyzed and ultimately noticed the Green Street Variation to ensure consideration of geographically diverse routes to the greatest degree practical (Exh. JP-1, at 5-56). The Companies indicated that they intend to use the New Salem Street Variation only in the event of difficulty acquiring rights to the MBTA ROW along the Companies' Primary Route in Wakefield (Exh. A; Tr. 1, at 13).

4. Intervenor-Submitted Routes: Step Three

The Companies considered three additional routes proffered during the proceedings by Mr. Curley and the Towns of Winchester and Stoneham: the Overhead/ Underground Route, the Holton Street Variation, and the Main Street Hybrid Route (Exhs. A; JP-6; Tr. 1, at 19-24, 26-30, 36-59). The Companies evaluated the Overhead/Underground Route and the Holton Street Variation but did not score or notice these two routes because the Companies considered them to have "fatal flaws" (Exhs. A; JP-6; TOW-G-3; TOW-G-3(S); Tr. 1, at 61-70;

RR-EFSB-10, at 2).[39] The Companies scored, but did not notice, the Main Street Hybrid Route (Exh. COM-DCK-1(R) at 4-6). Tables 5 and 6 provide a description, and Figure 4 a map, of the above-mentioned candidate routes and the route variations proposed by the Companies or Intervenors (Exh. A; RR-EFSB-21(1)(R)).[40]

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39 The Companies stated that the Overhead/Underground Route is not viable given that: (1) existing overhead transmission circuits on the ROWs for the route would require rebuilding or redesign to accommodate a new 345 kV circuit; and (2) the Companies would potentially need to acquire additional rights to use properties owned by the Reading Municipal Light Department (Exh. TOW-G-3, at 2). The Companies stated that the Holton Street Variation is not viable because its construction would require the Companies to acquire easement rights from the City of Woburn to use the Tri-Community Greenway, and Woburn had indicated its opposition (RR-EFSB-10, at 2).

40 These are the candidate routes listed in Table 4, above, minus the Northern Routes, already eliminated from additional analysis by the Companies (see Section V.B.3).

Table 5. Companies' Noticed Route Options

Route	Description
Primary Route; Primary Route with New Salem Street Variation	The Primary Route (8.5 miles) is an underground route that starts at the Woburn Substation, crossing the northeastern portion of the substation property to enter Lake Ave, heading generally northeast. The route then turns south onto Pickering St before turning east onto Border St where it crosses Main St (Route 38) and enters Cross St at the border of Woburn and Winchester. It continues on Cross St (traversing under an elevated section of the MBTA Lowell Line) east into Winchester until its intersection with Washington St. The route then follows Washington St north and crosses into Woburn, then east along Montvale Ave, and under Interstate Route 93 ("I-93") into Stoneham. The route continues east along Montvale Ave to its intersection with Main St. The route then continues north on Main St until its intersection with Elm St, and then heads east on Elm St to the Wakefield town line. The route follows Albion St east/northeast to Broadway and following that roadway north, then crossing the MBTA Haverhill Line railroad tracks at grade and continuing along Broadway to its intersection with an inactive railroad ROW owned by the MBTA in Wakefield. The route continues north in Wakefield on the MBTA Railroad ROW for approximately one mile to its intersection with Salem St. The route turns east on Salem St, south onto Montrose Ave, and finally southeast onto the Wakefield Junction Substation driveway. The Companies indicated that the Primary Route with New Salem St Variation (8.4 miles), a noticed workaround to the Primary Route, would be identical to the Central (Primary) Route to the point where the Wakefield railroad ROW intersects New Salem St in Wakefield. At this point, the New Salem St Variation would continue northeast along New Salem St to rejoin the Central Route on Salem St.
Primary Route with Green Street Variation	The Green St Variation of the Primary Route (8.7 miles) is an underground route which begins at the intersection of Cross St at the border between Woburn and Winchester. It then extends north along an inactive railroad ROW before turning east onto Green St and from Green St continuing east on Montvale Ave. The route follows Montvale Ave over the MBTA's Lowell Line (via a bridge that is part of Montvale Ave) to join the Primary Route at the intersection in Woburn of Washington St and Montvale Ave.
Noticed Alternative Route	The Noticed Alternative Route (8.0 miles) is an underground route that follows the Primary Route until Washington St in Winchester. The route then turns north on Washington St for several blocks then heads east/northeast on Forest St and under I-93 and into Stoneham. The route continues along Marble St in Stoneham, continuing across Main St (Route 28). The route turns north on Summer St, then follows Summer St to Spring St. At Spring St, the route goes east, turning north on Green St, then follows Green St to the intersection of Elm St and Albion St at the Stoneham/Wakefield town line. The route continues northeast on Albion St, travels underneath the MBTA Haverhill Line, turns south on North Ave, then bears east along West Water St and southeast along Water St. The route then turns north onto Montrose Ave to reach the junction of Montrose Ave and the driveway at the Wakefield Junction Substation entrance.

Sources: Exh. A(R); RR-EFSB-21(1)(R).

Table 6. Intervenors' Proposed Route Options (Not Noticed)

Route	Description
Main Street Hybrid Route (Proposed by Stoneham)	The Main St Hybrid Route (8.8 miles) is an underground route that follows the Primary Route until the intersection of Main St and Elm St in Stoneham. The route then continues north on Main St to the intersection with North St. The route turns east onto North St, and continues on North St to its intersection with Prospect St in Wakefield. The route follows Prospect St to Church St, turning north onto Salem St. The route then turns east on Salem St, then south onto Montrose Ave, and southeast onto the Wakefield Junction Substation driveway (this portion is the same as the Primary Route).
Holton Street Variation (Proposed by Winchester)	The Holton St Variation (8.4 miles) would follow the Primary Route from the Woburn Substation to Cross St in Winchester. Instead of continuing east on Cross St under the railroad crossing to Washington St, this alternative turns north on Holton St in Winchester ahead of the railroad underpass. From there, the route travels north on Holton St into Woburn, and then turns east on Nashua St, crossing Tremont St. The proposed route then travels under the railroad tracks. Once on the east side of the tracks, the proposed route follows the existing, abandoned railroad ROW in Woburn to the intersection with Washington St. Depending on the alternative preferred by the Town of Stoneham, the proposed route could continue along the railroad ROW through Stoneham, following the route of the Tri-Community Greenway, or it could turn north on Washington St to connect with the remainder of the Primary Route, which uses Washington St and Montvale Ave into Stoneham.
Overhead/ Under-ground Route (Proposed by Winchester)	The Overhead/Underground Route (14.2 miles) is a route with overhead portions along an existing Eversource transmission ROW from the Woburn Substation traveling north along the Woburn-Tewksbury ROW and then east to the Reading Substation. The route would then travel underground for 3.75 miles through Reading and Lynnfield along Route 129/Lowell St to Bay State Road. The route would transition back to overhead at the Route 95/Route 129 exit and travel southeast along an existing ROW to the Wakefield Junction Substation.

Sources: Exh. A(R); RR-EFSB-21(1)(R).

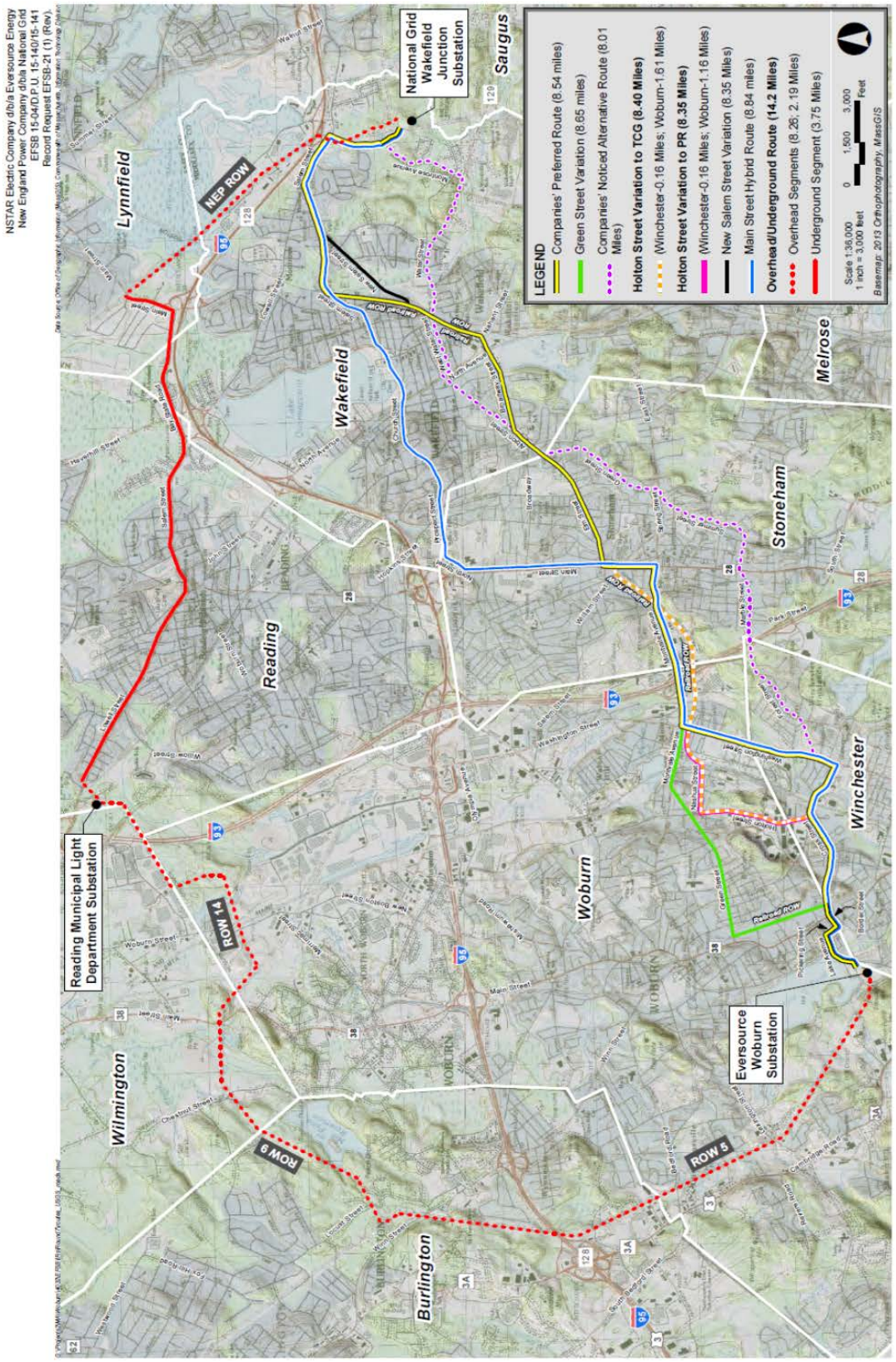

Figure 4. Intervenors' Proposed and Companies' Noticed Route Options

Source: Exh. JP-6

The Companies submitted an updated cost comparison on the routes/route variations proposed for further route selection evaluation by the Companies or Intervenors (RR-EFSB-10; RR-EFSB-33).[41] The Companies derived a per-linear-foot cost from the planning grade cost estimate of $91.6 million for the Primary Route and used this figure to develop a consistent cost comparison basis across all route alternatives evaluated (Exhs. EFSB-RS-23; EFSB-C-1(S); RR-EFSB-10). (See Section VI.D for a discussion of costs for route comparisons versus Project costs).

The Companies indicated that most of the route options are between eight and nine miles long, with the exception of the 14.2-mile-long Overhead/Underground Alternatives Route (Exh. JP-6). Cost estimates for most of the route options ranged between $87.7 million (the estimate for the Noticed Alternative Route) and $95.9 million (the estimate for the Central (Primary) Route with Green Street Variation); the Overhead/Underground Alternative Route is more expensive, with anticipated costs of $101.9 million, or $6 million more than the next most expensive option (Exhs. EFSB-RS-23; EFSB-C-1(S); RR-EFSB-10; RR-EFSB-33; RR-EFSB-34; Companies Brief at 73, n.54). The Companies provided summary weighted scores for built and natural resource and design/construction characteristics for the Companies' noticed routes and noticed route variations (Exhs. JP-6; COM-DCK-1(R) Att. A at 3; Tr. 1, at 19-24, 26-30, 36-59, 61-70).

With respect to routes proposed by Intervenors, the Companies scored two versions of the Main Street Hybrid Route: with and without the Green Street Variation; the Companies did not

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41 The Companies stated that to facilitate an apples-to-apples comparison across alternative routes, they derived, and applied to all routes, updated linear foot costs from the -25%/+25% cost estimate for the Project (Exh. EFSB-RS-23: RR-EFSB-10; RR-EFSB-33). They also applied loaders, including overhead costs (e.g., Allowance for Funds Used During Construction, and permitting and development costs), across the board, consistent with the methodology for Project costs (RR-EFSB-10). The Companies included a separate adder, as applicable across routes, for trenchless crossings (RR-EFSB-23). The Companies estimated costs for major horizontal directional drillings ("HDDs") separately; they used a more generic cost for "more routine" jack-and-bore crossings (Exh. EFSB-RS-23). The cost estimates did not include certain route-specific costs such as rock removal, night work, and easement acquisition (RR-EFSB-33; Exh. JP-1, at 5-50).

score the Holton Street Variation and the Overhead/Underground Alternative Route due to perceived "fatal flaws" (Exhs. TOW-G-3; TOW-G-3(S); RR-EFSB-10). Table 7, below, provides the Companies' summary weighted scores and updated costs for the Main Street Hybrid Routes as well as for the Companies' noticed route options.

Table 7. Updated Scores, Ranking, and Costs:
Selected Intervenor-Proposed Routes and Companies' Noticed Route Options

Route	Noticed (Y/N)	Built and Natural Resource and Design/Construction		Cost (millions)
		Weighted Ratio Score	Rank	
Central Route (Primary Route)	Y	17.5	1	$91.6
Central Route with New Salem Street Variation	Y	18.1	2	$89.2
Central Route with Green Street Variation	Y	20.0	5	$95.9
Southern Route (Noticed Alternative)	Y	18.5	3	$87.7
Main Street Hybrid Route	N	19.0	4	$91.9
Main Street Hybrid Route with Green Street Variation	N	21.8	6	N/A[42]

Sources: Exhs. A; JP-6; COM-DCK-1(R) Att. A at 3; RR-EFSB-10; RR-EFSB-33; RR-EFSB-34; Tr. 1, at 46-49).

C. Selection of the Primary and Noticed Alternative Routes

1. Environmental Impact, Cost, and Reliability

The Companies reaffirmed their earlier choice of the Central Route (with and without the New Salem Street Variation) as the Primary Route because it ranked better than all of the other routes with respect to environmental impacts and ease of construction (RR-EFSB-33). Similarly,

[42] Although the Companies did not estimate the cost for the Main Street Hybrid Route with Green Street Variation, both the Green Street Variation and the Main Street Hybrid segments each increased costs of the Central Route when added as a variation, and logically, the inclusion of both variations would further increase costs (Exh. JP-1, at 5-54; RR-EFSB-10, at 3).

the Companies reaffirmed their earlier choice of the Southern Route as the Notice Alternative Route given its relatively low weighted ratio score, and lowest cost estimate of all route options evaluated (id.)

The Companies further evaluated their Primary Route and their Noticed Alternative Route against intervenor-submitted routes and route variations (Exhs. COM-DCK-1(R); COM-DCK-1(R)(A); JP-6; TOS-RS-30). The Companies indicated that they applied a second layer of more specific route characteristics (e.g., avoidance of sharp turns, town centers, and difficult highway crossings) (Exh. JP-1, at 5-6, 5-34 to 5-35, 5-54 to 5-56; EFSB-RS-18; EFSB-RS-30). The Companies maintained that their reliance on their routing guidelines and specific route characteristics resulted in consistent evaluation of potential Project routes (Exhs. JP-1, at 5-56 to 5-57; EFSB-RS-30).

The Companies concluded that the Primary Route would achieve the best balance among cost, environmental impact, and reliability in accordance with Siting Board precedent (Exhs. JP-1, at 5-57; COM-DCK-1(R); COM-DCK-1(R)(A).[43] The Companies asserted that no intervenor-submitted route proved clearly superior to the Primary Route (Exhs. COM-DCK-1(R); TOW-G-3; RR-EFSB-1; RR-EFSB-3; RR-EFSB-7(1)). The Companies indicated that, based on environmental and constructability scoring, the Noticed Alternative Route is also preferable to the intervenor-submitted route options (Tr. 2, at 310-311). The Companies estimated that the cost of the Noticed Alternative Route would be slightly lower relative to other route options considered, including the Primary Route, but argued that the Noticed Alternative Route is nonetheless inferior to the Primary Route due to its environmental impacts (RR-EFSB-33; Companies Brief at 73-74). The Companies included the New Salem Street Variation in their subsequent analyses (given uncertainties about acquiring railroad ROW easements in Wakefield) and the Green Street Variation (for the sake of more robust geographic diversity) (Exh. JP-1, at 56; Tr. 6, at 1149-1150).[44]

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43 As noted in Section V.B.3, above, the Companies identified no meaningful differences in the operating characteristics of considered routes with regard to Project reliability.

44 See Section VI.C.8 for a discussion of the New Salem Street Variation.

2. Geographic Diversity

The Companies indicated that they had selected a Noticed Alternative Route with an appropriate measure of geographic diversity, given its path primarily along the southern corridor in contrast to the location of the Primary Route principally along the central route corridor (Exh. JP-1, at 5-51 to 5-57 & fig. 5-5). In addition, the Companies stated that their analysis of the noticed Green Street Variation to the Primary Route along with the Noticed Alternative Route, ensured the Companies noticed and analyzed geographically diverse route options to the greatest degree practical (id.).

D. Positions of the Parties

1. Intervenors

a. Winchester

The Town of Winchester asserts that the Companies' Primary Route with the Green Street Variation is superior to the Primary Route, because it would eliminate the use of portions of Cross and Washington Streets in Winchester, while using a 3,400-foot-length of unused railroad ROW in Woburn (Exh. COM-TOW-18; Winchester Reply Brief at 11).[45] Winchester's testimony from outside consultants and town officials (including its fire chief, police chief, and public works director) contends that the Project, if constructed along Cross Street and Washington Street, would have significant negative impacts on the community (Exhs. TOW-JG-1, at 2-4; TOW-JN-1; TOW-PM-1; TOW-BR-1; TOW-2; TOW-5). These impacts include: (1) construction-related impacts to Winchester-owned utilities; (2) permanent loss of corridor in the public ROW for future utility replacement or improvement projects; (3) increased costs of repair for existing Winchester-owned utilities; (4) construction-related traffic impacts, including increases in emergency response times, commuting delays, inconvenience to residential and commercial abutters, and disruption of pedestrian and vehicular

[45] Winchester originally proposed two additional routes, the Holton Street Route and the Overhead/Underground Route, but did not request Siting Board approval for these options in its Brief (Exhs. TOW-G-2; TOW-G-3; Tr. 1, at 14-44; Winchester Brief at 45).

school routes; and (5) greater burden to Winchester environmental justice populations (Exhs. TOW-JG-1, 2-4; TOW-JN-1; TOW-PM-1; TOW-BR-1; TOW-2; TOW-5).

Winchester also argues that the Primary Route would strain Town of Winchester resources, including police, fire, public works, and engineering staff resources, and would compound the impact to Winchester of other planned and on-going construction projects, including the Eversource 115 kV Mystic-to-Woburn transmission project (Tr. 9, at 1669-1708).[46] Winchester expresses concern that work along Cross Street or Washington Street, especially for jack-and-bore operations, would require road closures (Exh. TOW-BR-1, at 15). Winchester asserts that such road closures would complicate emergency vehicle operations and create traffic gridlock (Exh. TOW-KC-1, at 2-5).

Winchester maintains that the Companies' route selection method of scoring candidate routes in their entirety obscures the comparison between the geographically diverse segments of the competing routes (Winchester Brief at 10-11).[47] According to Winchester, the Companies' model methodology "is a broad brush evaluation for many routes over a large area," but, "when making a decision between two segments, the imprecision in this comparison model…for the entire route and many routes become[s] evident" (id. at 11). In addition, Winchester contends that the Companies' weighting system is subjective, and scores should be weighted on a town-by-town basis to reflect each community's preferences (id. at 15).

Winchester finds other flaws in the Companies' route scoring method, and suggests various changes. For example, Winchester notes that the location of existing utilities and their

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46 The Siting Board approved the Mystic-to-Woburn underground transmission project on March 13, 2017. NSTAR Electric Company, EFSB 15-03/D.P.U. 15-64/15-65 (2017).

47 Winchester asserts that the Companies' methodology applied in a given category "distorts or masks the characteristics in binary comparisons, especially if the other segments or routes have no bearing on the discrete comparison" (Winchester Brief at 10-11). Winchester contends that in the Companies' methodology, the denominator (the divisor of each category) is the largest number of that category for all the routes being compared (id. at 10). Any introduction of a new route, elimination of a route, or even a segment of a route, has the potential to change any of the divisors in one, multiple, all, or none of the categories; this results in a change in calculation of the score of all the routes (id.).

alignment within a road is a very important impact consideration, yet it argues that the Companies' scoring methodology for utility density is based on a count of surficial features (such as manhole locations) and does not rely on a full survey of all route alternatives (Winchester Reply Brief at 10). Winchester advocates the use of certain additional criteria to the scoring and routing analysis, including "street length for excavation," "EMF street length," and "Environmental Justice" street length (id. at 18-19).

Winchester provided its own segment-to-segment scoring comparison of the Green Street Variation versus the portion of the Primary Route that it would replace, which includes Cross Street in Winchester and Washington Street in Winchester and Woburn (Exhs. COM-TOW-18; COM-TOW-18(1-5). Despite its reservations regarding the Companies' scoring methodology, Winchester contends that its scoring analysis consistently used the same criteria, weightings, and methodology as did the Companies, and it also used the same raw data "except where indicated in the notes documenting adjustments to omissions or errors" (Winchester Brief at 12, citing Exhs. COM-TOW-18; COM-TOW-18(1-9).[48] Based on its scoring, Winchester asserts that the Green Street Variation has a score of 20.08 while the Cross Street and Washington Street segment of the Primary Route has a score of 24.76 (Winchester Brief at 16, citing Exh. COM-TOW-18(1)).[49] Therefore, Winchester asserts, the Green Street Variation is clearly

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48 Winchester acknowledged that it made certain adjustments and updates to the raw data used by the Companies in their scoring. Winchester contends that "errors and omissions to the [Companies'] raw data were adjusted and updated where Town data from the Town, Google Earth and MAGIS and MADEP were not included [by the Companies]; however not all changes were made" (Winchester Brief at 13).

49 Winchester also provided a simple, unweighted comparison of the two route segments using each of the 16 categories in the Companies' scoring methodology. Winchester's comparison gave the Green Street Variation a lower score in 11 of the 16 categories, a tie in one, and a higher score in four categories (Winchester Brief at 18). Winchester contends that this analysis also supports its view that the Green Street Variation is clearly superior to the Cross Street and Washington Street segment of the Primary Route (id. at 16-19, citing COM-TOW-18(1)). The inclusion of additional comparison categories recommended by Winchester (Street Length for Excavation; Environmental Justice Street Length; and EMF Street Length) would, Winchester argues, make the Green Street Variation score even better than the Primary Route segment (Winchester Brief at 18-19).

superior to the Cross Street and Washington Street segment of the Primary Route (Winchester Brief at 16-19).

Winchester indicated that additional data modifications in its scoring were warranted, but not made by the Companies. For example, Winchester contends that the Companies incorrectly counted two separate borings as one on the Primary Route because they occur sequentially at the same location (Winchester Brief at 18). In addition, based on the assumed use of a pre-fabricated truss bridge that could be attached to the Montvale Avenue bridge over the Lowell commuter rail line, Winchester contends that the Green Street Variation, in fact, has no high impact crossings (id. at 13).

Winchester asserts that the Companies under-estimated the cost of the Primary Route and over-estimated the cost of the Green Street Variation, and that a proper accounting of both routes shows the costs to be equal (Winchester Brief at 19-23). The most significant cost disparity asserted by Winchester for the Green Street Variation concerns the use of a truss bridge on Montvale Avenue where it crosses over the Lowell Commuter Rail line (id. at 19). While the Companies estimated that such a bridge would take over three months to complete, at a cost of $3 million, Winchester asserts that a pre-fabricated bridge, as proposed by its consultant, "can be installed in 2 to 3 hours just impacting traffic during one night" and would cost $400,000 (id. at 13, 19). Winchester contends that the brief amount of time required to install the truss bridge would also reduce police detail costs, and other traffic-related costs by $576,000 (id. at 23). Finally, Winchester anticipates additional costs of $1.125 million for the Primary Route for gas line replacements, and the higher-end estimates for jack-and-bore construction (id.).

Winchester notes that it has been meeting with Eversource to discuss the Project since October 2014, but that once the town indicated its intent to intervene in the Siting Board proceeding, the Companies' approach has "been largely adversarial in nature and calculated to secure acceptance by the Siting Board of the Companies' Preferred Route" (Winchester Brief at 39-40). Winchester contends that throughout these proceedings, the Companies have implied that Winchester's efforts have been intended to shift the burdens caused by the line to other communities; however, Winchester points to testimony of its town manager, Mr. Howard, who

stated that the town sees route selection as a regional equity issue and that the Green Street Variation is the better choice (id. at 39, citing Tr. 9, at 1726).

b. Stoneham

The Town of Stoneham asserts that the Primary Route will have significant negative impact on Stoneham, both during construction, and over the estimated 40-year useful life of the line (Stoneham Brief at 2). The town notes that the Primary Route goes directly through the center of Stoneham, but does not go through the center of any other town (id.). The town notes that the Primary Route would occupy Montvale Avenue, Main Street, and Elm Street, which it contends are at the heart of Stoneham's business district and also adjacent to residential neighborhoods (id.). Stoneham asserts that it has demonstrated in this proceeding that it accepts the portion of the Primary Route through the center of town (Main Street between Montvale Avenue and Elm Street) (Stoneham Reply Brief at 2-3). However, Stoneham takes strong exception to the Companies' routing decision to go east on Elm Street rather than continuing north on Main Street, which it contends "is among the widest streets in Stoneham and is straight for almost its entire length," and "should have made the Main Street Hybrid an obvious route to formally evaluate" (Stoneham Brief at 3, 18).

The Town of Stoneham argues that construction of the Elm Street portion of the Primary Route would have both short- and long-term negative effects on Stoneham residents and businesses and should not be included in the Project route (Exhs. TOS-RG-1, Att. A at 14; TOS-RM-1, at 5-7). Stoneham contends that there are already traffic delays and congestion at the transition from Montvale Avenue to Elm Street along the Primary Route, particularly at the intersections of Montvale Avenue with Main Street and of Main Street with Elm Street (Exh. TOS-JM-1, at 4-5; Stoneham Brief at 2). Stoneham asserts its businesses would be particularly vulnerable to the added congestion because these businesses, unlike national chains, tend to be small, independent shops without the resources to survive a period of construction-related disruption (Exh. TOS-RM-1, at 5). Stoneham states that Project construction would jeopardize efforts to revitalize existing commerce and draw new businesses to areas near the Montvale Avenue and Main Street intersection such as Stoneham Square (id. at 6).

Stoneham also expresses concern that the relatively narrow width (30 feet) of roadway on Elm Street would reduce vehicular passage to one lane or alternating lanes during construction, with resulting inconvenience to abutting businesses and residents (Exh. TOS-JD-1, at 13). In addition, Stoneham opines that using Elm Street for Project construction is problematic because Elm Street is an important access route for emergency vehicles and also for local residents to Stoneham's senior center, cemetery, and housing authority, as well as a common means of access from Wakefield to Stoneham's central business district (Exhs. TOS-JM-1, at 3-6; TOS-RG-1, at 4).

The Town of Stoneham supports the Main Street Hybrid Route described in Table 6, above (Exhs. TOS-GO-1; TOS-GO-1(1); TOS-GO-1(1)(S); Stoneham Brief at 14-25; Stoneham Reply Brief at 1-5). The Main Street Hybrid Route would avoid Elm Street, as recommended by Stoneham's traffic expert (Exh. TOS-JD-1, Att. B at 2). Additional witnesses sponsored by Stoneham, including its police and fire department chiefs, the director of its public works department, and the director of a local medical emergency service provided testimony consistent with the testimony of Stoneham's traffic expert supporting the Main Street Hybrid Route and avoiding use of Elm Street (Exhs. TOS-JM-1; TOS-MG-1; TOS-RG-1; TOS-MW-1).

Stoneham asserts that construction of Main Street Hybrid Route segments would be less disruptive and potentially faster than construction on Elm Street (Tr. 11, at 2091-2092). Stoneham maintains that relative to Elm Street, Main Street is straighter and wider (id.). Furthermore, Stoneham states that utility density is lower and ledge and rock less prevalent on Main Street than on Elm Street (Exh. TOS-GO-1, at 5). Stoneham claims that the predominance of commercial parcels along Main Street would make nighttime construction easier along Main Street than along Elm Street (Tr. 10, at 1926-1927). Stoneham also anticipates cost savings from construction along Main Street rather than along the Primary Route (Tr. 9, at 1561). Given the above, the Town of Stoneham argues that the Main Street Hybrid Route is superior to the Companies' Primary Route (Exh. TOS-GO-1(1)(S); Tr. 11, at 2107-2117).

The Town of Stoneham provided its own scoring analysis of the Stoneham and Wakefield portions of the Main Street Hybrid Route and the Primary Route. Stoneham contends that its witness performed the route scoring analysis of these competing route segments "using

the Companies' scoring methodology and the raw data that was available in the record" (Stoneham Brief at 19, citing Exhs. TOS-GO-1, TOS-GO-1(1)). Stoneham revised its scoring analysis with additional raw data from the Companies and corrections of certain errors pointed out by the Companies in their rebuttal testimony (Exh. TOS-GO-1(1)(S); Stoneham Brief at 19).[50] Based on its analysis, the Town of Stoneham contends that the Main Street Hybrid Route scores better than the Primary Route in Wakefield (19.73 for the Main Street Hybrid Route vs. 19.88 for the Primary Route) and in Stoneham (14.70 for the Main Street Hybrid Route vs. 15.47 for the Primary Route) (Exh. TOS-GO-1(1)(S); RR-TOS-9).

Stoneham asserts that the Companies' scoring is deficient (Tr. 11, at 2080-2081, 2088, 2093, 2097; Tr. 13, at 2415; Stoneham Brief at 20). Stoneham maintains that the Companies acknowledge that their scoring methodology does not always reflect the distinct aspects of a particular segment of an overall route, that there may be qualitative factors relevant to selecting a route segment that may not be adequately identified in a total route scoring analysis, and, in addition, that their scoring methodology is, to some extent, subjective (Stoneham Brief at 20-21, citing Tr. 10, at 1915; Tr. 13, at 2414). Stoneham contends that when scoring the routes from the Woburn to Wakefield Junction substations, the Companies' scoring methodology divides by the largest number for each scoring category, and thereby dampens the sensitivity of the analysis (Tr. 11, at 2080-2081, 2088, 2093, 2097; Tr. 13, at 2415; Stoneham Brief at 20). Stoneham argues that, in contrast, comparing specific segments of the Main Street Hybrid Route and the Primary Route highlights the differences that distinguish those two segments and produces better route selection results (Tr. 11, at 2088, 2094, 2096).[51]

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50 Stoneham's scoring analysis begins at the intersection of Main Street and Elm Street in Stoneham for each route, and continues along the respective routes in Stoneham and Wakefield, with both routes terminating at the Wakefield Junction Substation (Tr. 11, at 2066, 2077). Stoneham calculated separate scores for the Stoneham and Wakefield portions of the respective routes (Exh. TOS-GO-1(1)(S).

51 Stoneham also contends that its use of the Companies' own data and scoring methods was confirmed by the Companies' witness in RR-TOS-9, and further, that if the Companies' data used was corrected, often simply to match its own data, the Main Street Hybrid Route would score even better (Stoneham Reply Brief at 4, citing Exh.TOS-GO-1(1) (S) and its footnotes). According to Stoneham, the scoring data corrections should include:

Stoneham asserts that the Companies' failure to score the Main Street Hybrid Route in its initial analysis submitted with the Petitions was a "glaring miss," and that the Main Street Hybrid Route was an "obvious route to formally evaluate" (Stoneham Brief at 18). As a result, Stoneham asserts, the Companies do not have as much information for the Main Street Hybrid Route as they do for the routes noticed in the Petitions and therefore may have an "unintended bias" against the Main Street Hybrid Route (id.; Tr. 10, at 1863). Stoneham recommends that the Siting Board notice the Main Street Hybrid Route so that it may be considered on an equal footing as the Primary Route variations that have been noticed (Stoneham Reply Brief at 11-13).

Stoneham argues that the Companies have not met their burden of demonstrating that they have "not overlooked or eliminated a clearly superior route" as required by Siting Board precedent established under G.L. c. 164, § 69J (Stoneham Brief at 24-25, citing EFSB 13-2/D.P.U. 13-151/152 at 5, 34-35). The town asserts that in their initial analysis of the Proposed Line, the Companies "failed to analyze the Main Street Hybrid Route, although it had the obvious advantages of using one of the Town's widest and straightest streets…" (Stoneham Brief at 25). Stoneham further maintains that the town has presented substantial evidence in this proceeding indicating that the Main Street Hybrid Route is superior to the segment of the Primary Route in Stoneham and Wakefield (id.). Nevertheless, Stoneham argues that it is "not an intervenor's burden to prove that there is no superior alternative to the [Primary] Route[t]hat burden remains with the applicant" (id.).

Finally, Stoneham faults the Companies for failing to establish an approach and/or methodology under which candidate routes could have been jointly reviewed by Woburn, Wakefield, Winchester and Stoneham (Stoneham Brief at 21-22). Stoneham contends that the lack of coordinated review by the four municipalities resulted in a fragmented and disjointed Project "which failed to identify a clearly superior route" (id.). Moreover, Stoneham contends that the Companies "followed the wishes of Wakefield" in selecting the Primary Route so that an inactive railroad ROW in Wakefield could be used for the transmission line, and made suitable for future use as a recreational path (Stoneham Reply Brief at 4). As a result, Stoneham

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(i) sensitive receptors; (ii) angles greater than 30 degrees; (iii) trenchless crossings; and (iv) traffic worksheets and ranking (id.).

contends the Companies failed to seriously consider any route through Stoneham that did not connect with Albion Street in Wakefield (id. citing Tr. 9, at 1648; Exhs. JP-1, fig. 5-2c; TOS-TB-1). Stoneham further suggests that the Primary Route was chosen by the Companies based on "prior relationships and/or commitments arising from the presence of electric transmission and substation facilities in some municipalities" rather than "a fair, logical, equitable, and consistent process" (Stoneham Brief at 3).

c. Wakefield

The Town of Wakefield favors the Primary Route and argues against use of the Main Street Hybrid Route for several reasons. Wakefield contends that congestion along Main Street and North Street and at the Main Street-North Street intersection results from the proximity of I-93 and I-95 and motorists' attempts to access or find alternatives to the interstates when highway traffic is slow (Wakefield Reply Brief at 2). Wakefield argues that pedestrian safety during construction is also a reason to use the Primary Route rather than the Main Street Hybrid Route (Wakefield Reply Brief at 2). According to Wakefield, sidewalks are more common, and, therefore, provide greater pedestrian safety, along Elm Street and the Primary Route than along North Street and the Main Street Hybrid Route (Wakefield Reply Brief at 2).

Wakefield also asserts that Project construction on Prospect Street, North Street, and the north end of Main Street would likely slow its response time to calls from the Stoneham Fire Department for mutual aid on Main Street north of Elm Street (Wakefield Reply Brief at 2). Wakefield contends that fire responder assistance on Main Street north of Elm Street is a particular concern given the prevalence of multi-family residences and commercial buildings (Wakefield Reply Brief at 2-3). Wakefield further asserts that potential sensitive receptors on North Street such as the Bear Hill Nursing Home are as much a concern as the presence on Elm Street of the Stoneham Senior Center (Tr. 13, at 2406; RR-WAK-5).

The Town of Wakefield asserts that it would have objected to the Main Street Hybrid Route more quickly and aggressively if Stoneham had proposed the route earlier in the proceeding or if the route had been properly noticed (Tr. 1, at 47-48). In addition to opposing the Main Street Hybrid Route, Wakefield argues against approval of the Primary Route with the

New Salem Street Variation as a workaround on a contingency basis (Wakefield Brief at 15). According to the Town of Wakefield, Project construction along the New Salem Street Variation would not take advantage of the unused railroad ROW along the Primary Route; furthermore, it would introduce construction challenges avoided by the Primary Route (id. at 15).

d. Woburn

The City of Woburn supports the Primary Route based on Woburn's understanding that the Project is needed for all Eversource customers (Tr. 1, at 33-34). Woburn does not endorse the Green Street Variation or any other alternative to the Primary Route introduced by the Town of Winchester (id.).

2. Companies' Response

The Companies note that none of the intervenors contests the need for the Project, nor that a new transmission line between Woburn Substation and Wakefield Junction Substation is the best alternative to meet the identified Project need (Companies Reply Brief at 2). The Companies also note that the disputes by Stoneham and Winchester in this case are primarily limited to how the Companies can best route a transmission cable between these substations (id.). The Companies assert that no other route, including the Main Street Hybrid Route or the Primary Route with Green Street Variation (or both in combination), is clearly superior to the Primary Route (id. at 3-23).

With regard to the Siting Board's route selection standard of review, the Companies claim that Stoneham has erred in stating that the Companies' process "failed to identify a clearly superior route" (Companies Reply Brief at 4, citing Stoneham Initial Brief at 21). The Companies maintain that this is not the Siting Board's standard: "it is not the Companies' obligation to prove that their chosen route is clearly superior . . . Rather, in accordance with Siting Board pertinent standards, the Companies must show that they have not overlooked a clearly superior route" (Companies Reply Brief at 4).

The Companies contend that their route selection process fully addresses the applicable Siting Board standards (Exh. JP-1, at 5-56 to 5-57; Companies Brief at 84). The Companies

argue that they identified and evaluated a wide array of potential routes as alternatives to satisfy the Project need, and that the Companies designed their process to ensure that no clearly superior route was overlooked (Exh. JP-1, at 5-56 to 5-57; Companies Brief at 84). The Companies recount over 50 meetings with municipal officials, boards, stakeholders and others that provided the Companies with additional understanding of the community concerns and brought new route ideas to light (Companies Reply Brief at 5, citing Exhs. JP-1, at 1-16 to 1-18, 5-6; EFSB-RS-1; EFSB-RS-2; EFSB-RS-32; TOS-RS-19.).

The Companies assert that they fully evaluated over two dozen routes for the Project, and twelve route variations in Stoneham alone, to ensure that no route clearly superior to the Primary Route was overlooked (Exh. COM-DCK-1, at 3). Although the additional intervenor-proposed routes were not initially included in the Petition to the Siting Board, the Companies maintain that these options were all considered in the early route screening procedures, but not carried through for further analysis (Companies Reply Brief at 5-8). The Companies maintain that they investigated and analyzed over a dozen routes that avoided Elm Street in Stoneham altogether (Companies Reply Brief at 6, citing Exhs. JP-1, at figs. 5-2a, 2b, 2c, 2d; JP-6; EFSB-RS-6(1); EFSB-RS-15; EFSB-RS-16; EFSB-RS-29; TOW-G-3; CUR-1-1(e); RR-EFSB-1; RR-EFSB-1(1)). Further, the Companies assert that they were specifically dissuaded in the early stages of the route selection process from further evaluation of the northern part of the Main Street based direct input from municipal officials in Stoneham, including the Town Manager (Companies Reply Brief at 6, citing Exhs. COM-BAS-1, at 15; EFSB-RS-15; TOS-RS-30). The Companies maintain that the Primary Route is the best route evaluated based on environmental and constructability criteria, and will enable the Companies to achieve the best balance among cost, environmental impact, and reliability in accordance with Siting Board precedent (Exh. JP-1, at 5-57; Companies Brief at 85).

The Companies argue that competing routes are best evaluated in their entirety from end to end – that is from Woburn Substation to Wakefield Junction Substation – using consistent data sources (Companies Reply Brief at 9, n.10; Exh. COM-DCK-1(R) at 4-5; Tr. 1, at 124). The Companies contend that they used consistent data sources to inform their scoring, including MassGIS data, USGS topographic maps, aerial photography, the Massachusetts Department of

Environmental Protection ("MassDEP") Massachusetts Contingency Plan ("MCP") database and field reconnaissance (Companies Brief at 62, citing Exh. JP-1, at 5-41). The Companies' presented such comparisons in their initial Petition, with subsequent revisions during the proceeding to include intervenor-proposed routes, such as the Main Street Hybrid Route (Companies Brief at 69-77). The Companies contend that the end-to-end route comparisons they performed demonstrate that the Primary Route is superior to the other routing options (Companies Reply Brief at 3).

In response to concerns expressed by Winchester and Stoneham, the Companies also provided a more granular scoring analysis of the Green Street Variation and the Main Street Hybrid, as compared to the portions of the Primary Route where these route variations diverge from the Primary Route (Companies Brief at 69-77). In making such comparisons, the Companies argue that it is imperative that the respective route segments being compared have common beginning and end points (aka "nodes") so as to provide meaningful comparative information (Companies Reply Brief at 9 n.9, 10; Exh. COM-DCK-1(R) at 4-5). The Companies argue that comparing competing route segments that are delineated solely by municipal boundaries and not connected by common nodes does not yield useful data (Companies Reply Brief at 9 n.9, 10; Exh. COM-DCK-1(R) at 4-5; Tr. 1, at 87-89).

With respect to the Main Street Hybrid Route, the Companies disagree with Stoneham's assertion that the Main Street Hybrid Route is superior to the Primary Route and that it scored more favorably than the Primary Route (Exhs. COM-DCK-1(R); RR-EFSB-1; RR-EFSB-1(1); RR-TOS-9). The Companies assert that Stoneham's scoring methodology is flawed, in part, because it segments the Main Street Hybrid Route and the Primary Route into Stoneham and Wakefield portions (Companies Reply Brief at 9; RR-TOS-9, at 1). The Companies contend that it is not possible to make a proper comparison of route segments with disjointed endpoints at municipal boundaries as Stoneham does in advocating for the Main Street Hybrid Route (Companies Reply Brief at 9, n.9, 10; Exh. COM-DCK-1(R) at 4-5; Tr. 1, at 89-90).

The Companies contend that between the intersection of Main and Elm Streets in Stoneham and the Wakefield Junction Substation the Primary Route outscores the Main Street Hybrid Route (Tr. 10, 1864-1866; RR-EFSB-1(1)). The Companies provided such a node-to-

node comparison, evaluating the same 16 characteristics they used to score the entire routes in the Initial Petitions (Tr. 13, at 2371-2380). The Companies concluded that the Primary Route scores better on both a raw score basis and a weighted basis (Companies Brief at 78; RR-EFSB-1; RR-EFSB-1(1)). The Companies computed a weighted score for the Main Street Hybrid Route segment of 21.30 as compared to a weighted score of 19.98 for the Primary Route segment, indicating that the Primary Route is preferred (RR-EFSB-1(1)).[52]

The Companies contend that the Town of Stoneham's scoring method is inconsistent with the method of route scoring used by the Companies and isolates routes by political boundaries and is not a valid method of comparison (Companies Reply Brief at 9 n.9; Tr. 13, at 2357-2358; Exh. COM-DCK-1(R) at 4-5). The Companies also assert that there are numerous errors and omission that would significantly affect the scores presented (Exh. COM-DCK-1(R) at 6). In particular, the Companies point to their consistent use of data from MassGIS, MassDEP, and MassDOT across all of its scoring analyses, while Stoneham has supplemented these sources with disparate data from Google Earth and Stoneham-provided sources in the town's scoring methodology (id. at 8; Company Brief at 62).

Scoring aside, the Companies argue that Stoneham's assertion of "obvious advantage" for the Main Street Hybrid Route does not withstand scrutiny (Companies Reply Brief at 9-13; Exh.TOS-GO-1(S)(1). The Companies note that there are over 800 more residential units along the Main Street Hybrid Route than the Primary Route (Companies Brief at 78, citing Exhs. COM-DCK-1 (R) at 5; RR-EFSB-1(1); Tr. 1, at 95). They further note that Main Street has the highest traffic volumes in Stoneham, with over 30,000 average trips per day according to MassDOT (Companies Brief at 78, citing Exh. TOS-RS-30). Also, the Companies point out, the northern section of Main Street has a hard median over most of its length, making traffic

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52 Disparities in the scoring of the Stoneham and Wakefield segments of the Main Street Hybrid Route and the Primary Route by the Companies in their response to RR-EFSB-1 and the Town of Stoneham's scoring in Exh. TOS-GO-1(1)(S) reflect the use of differing raw data. Raw data disparities between the Companies scoring and Stoneham's scoring are evident in the following categories: sensitive receptors; street width; potential for traffic congestion; public shade trees; existing utility density; potential for subsurface contamination; trenchless crossings; and route bends.

management more complicated relative to roadway without a median. In addition the Companies contend the Main Street Hybrid Route involves a potential conflict with a major MWRA project anticipated in the vicinity of North Street and Prospect Street. Because the design for the 48-inch width MWRA project is not yet complete, the Companies argue that it is not yet known whether there is room in the relatively narrow Prospect Street for both the MWRA infrastructure and the Project's conduit (Companies Brief at 79, citing Exh. JP-1, at 5-32; TOS-RS-19; Tr. 1, at 111-112, 126). Based on these concerns, as well as its scoring analyses, the Companies concludes that the Main Street Hybrid is not clearly superior to the Primary Route, and that, in fact, it is inferior (Companies Brief at 79, Companies Reply Brief at 3).

The Companies contend that Winchester's claim that the Primary Route with Green Street Variation is superior to the Primary Route is also not compelling (Companies Reply Brief at 16). The Companies assert that Winchester's scoring contained errors including collection of inconsistent data, use of clearly incorrect data, and significant math errors in scoring (Exh. COM-DCK-1(R) at 7-10; Companies Reply Brief at 17).[53] The Companies contend that Winchester's additional analysis of the relative raw scores in the 16 data categories used by the Companies is also inappropriate because Winchester did not use weighting (Companies Reply Brief at 17-18). The Companies maintain that assignment of weights to individual criteria is essential because it ensures that the scoring process accounts for the relative importance of each criterion (Exh. JP-1, at 5-46).[54] The Companies offer similar criticisms of the data sources used by Winchester that, like Stoneham's, rely, in part, on GoogleEarth and town-supplied data that

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53 The Companies cite, as one such error, the Town of Winchester's count of 107 residential units along the Green Street Variation and 141 along the Primary Route for the Winchester Cross Street/Washington Street segment (Exh. COM-DCK-1(R) at 8). According to the Companies, the correct count is 179 residences along the Green Street Variation and 172 along the Primary Route (id.).

54 In addition, the Companies take issue with Winchester's suggestion of using additional categories for analysis (e.g., street length for excavation), arguing that these categories are essentially redundant to factors that the Companies already identified and analyzed (Exh. COM-DCK-1(R) at 11-12; Tr. 2, at 218-219).

are not consistent with the MassGIS, MassDEP and MassDOT data sources that the Companies used across all segments and all routes (Exh. COM-DCK-1(R) at 7-11, Att. A at 5).[55]

The Companies also performed a more focused scoring evaluation of the Cross Street/Washington Street segment of the Primary Route in comparison with the Green Street Variation, using common nodes where the Green Street Variation diverges from the Primary Route. Based on the Companies' data and scoring, the Primary Route fares better than the Primary Route with the Green Street Variation (Exh. COM-DCK-1(R), Att. A at 5). The Companies computed a weighted score of 18.04 for the Cross Street/Washington Street segment of the Primary Route, versus a weighted score of 23.02 for the Green Street Variation (id.).

Finally, the Companies take issue with Winchester's assessment of the bridge required on Montvale Avenue to cross over the Lowell commuter railroad. The Companies stated that the Green Street Variation would require construction of a separate truss bridge to bring the Project transmission line across an active railroad crossing of Montvale Avenue (Tr. 2, at 216-217). The Companies explained that the grade difference between the road on either side of that crossing and the tracks below is quite large and limits the possibility of using a jack-and-bore and another type of crossing at that location (id.). The result, according to the Companies, is to add to construction complexity and the cost associated with that crossing (id. at 217). The Companies dismiss the testimony of Winchester's witness who opined that a pre-fabricated truss bridge could be installed in "a few hours" and would cost $400,000 rather than the $3 million figure estimated by the Companies (Companies Reply Brief at 20). The Companies emphasize that Winchester's witness acknowledged that he is not a professional engineer and does not have expertise with respect to the design, construction, and cost for the truss bridge (Companies Reply

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55 Disparities in their respective scoring of the Green Street Variation and the Primary Route segments by the Companies (in Exh. COM-DCK-1(R)(A)) and the Town of Winchester (in Exh. COM-TOW-18(5)) reflect the use of differing raw data. Raw data disparities between the Companies' scoring and Winchester's scoring are evident in the following categories: residential land use; commercial or industrial land use; sensitive receptors; public transit facilities; potential for traffic congestion; public shade trees; wetlands; potential for subsurface contamination; street width; utility density; angles greater than 30 degrees; and trenchless crossings.

Brief at 20-22, citing Tr. 11, at 1962-1997). The Companies characterized Winchester's cost and timing information for the truss bridge as lacking any requisite detail and analysis, citing the absence of information on acquisition of easements, including easements on private property, the location of construction relative to the railroad ROW, the location, management, and timing of construction staging, the type of foundation and number of abutments the bridge would require, and the incorporation of safety measures protective of the public and suitable for future troubleshooting and maintenance of utilities (Companies Reply Brief at 20-22, citing Tr. 11, at 1962-1997). The Companies maintain that Winchester's evidence in this regard is highly tenuous, poorly documented, and does not represent "substantial evidence" on which the Siting Board should rely (Companies Reply Brief at 20-21).

The Companies reiterate that their analysis has produced: (1) a Primary Route that is the highest ranked route evaluated based on environmental and constructability criteria, a route that will enable the Companies to achieve the best balance between cost, environmental impact, and reliability at the lowest possible cost in accordance with Siting Board precedent; and (2) a Noticed Alternative Route with an appropriate measure of geographic diversity (Exh. JP-1, at 5-56 to 5-57; Companies Brief at 84-85). The Companies also argue for carrying the New Salem Street Variation forward to the Environmental Impacts Comparison of the Primary and Noticed Alternative Routes (Exh. JP-1, at 5-56, 5-57; Companies Brief at 71, 85). The Companies specifically request that the Siting Board approve the New Salem Street Variation, in addition to the Primary Route, to provide the Companies "with the necessary flexibility to construct the Project in a timely manner" (Tr. 2, at 284-286; Companies Brief at 71).

The Companies aver that they have analyzed and addressed the environmental and construction-related concerns of Stoneham and Winchester in particular and will continue to work cooperatively with these municipalities throughout the Project (Companies Reply Brief at 3). The Companies assert that, based on the weight of the evidence and consistent with Siting Board standards, the Siting Board should reject Stoneham's and Winchester's route selection proposals (Companies Brief at 85; Companies Reply Brief at 3).

E. Analysis and Findings on Route Selection

The Siting Board requires that applicants consider a reasonable range of practical siting alternatives and that proposed facilities are sited in locations that minimize cost and environmental impacts. In past decisions, the Siting Board has found various criteria to be appropriate for identifying and evaluating route options for transmission lines and related facilities. These criteria include natural resource impacts, land use impacts, community impacts, cost and reliability. East Eagle at 74; Walpole-Holbrook at 37; Stoughton-Boston at 43-44. The Siting Board has also found the specific design of scoring and weighting methods for chosen criteria to be an important part of an appropriate route selection process. East Eagle at 74; Walpole-Holbrook at 37; Boston Edison Company, EFSC 89-12A, at 34-38 (1989).

Given the uncontested Project need for a 345 kV interconnection between the Woburn and Wakefield Junction Substations, and the advantages of using existing ROWs and corridors, the Companies appropriately identified a broad study area that would encompass a reasonable range of routing options. Within the study area, using several initial screening criteria, the Companies identified and advanced for further evaluation three general route corridors: northern, central, and southern. After initially screening dozens of potential routes within these three corridors, and conducting extensive outreach to municipal officials, residents, businesses, and other stakeholders, the Companies narrowed down the range of routing possibilities to a total of six candidate routes. The criteria types and the outreach process relied upon by the Companies generally encompass those that the Siting Board has previously found acceptable in its reviews of route selection processes.

The Companies then developed and applied a quantitative system for ranking the Companies' six candidate routes as well as one of the three intervenor-submitted routes, with the objective of selecting the best route, which they identified as the Primary Route, based on a compilation of weighted scores across environmental and constructability criteria, as well as on cost and reliability. In conjunction with their identification of the Primary Route, the Companies identified two noticed variations to the Primary Route, a route incorporating a workaround for possible construction issues along the northern part of the Wakefield railroad ROW (the New Salem Street Variation), and a route with an alternative segment to the Cross Street and

Washington Street portion of the Primary Route (the Green Street Variation). The Companies also reviewed several intervenor-submitted routes, eliminated those deemed infeasible (such as the Holton Street Variation) and scored and evaluated the remaining Main Street Hybrid Route.

Although routing possibilities are nearly infinite, even in a defined study area like that between the Woburn and Wakefield Junction substations, the Companies used a logical, methodical, and appropriate process to identify the six initial candidate routes for closer evaluation. When presented with additional routes of particular interest to Stoneham and Winchester later in the proceeding, the Companies undertook an appropriate review of these routes as well to ensure that they did not overlook or eliminate any clearly superior route alternatives. Contrary to Stoneham's contention that the absence of the Main Street Hybrid Route in the initial group of candidate routes in the Petitions was a "glaring miss," the Siting Board notes that the Companies were, in fact, dissuaded by Stoneham officials early in the route selection process from considering the use of the northern portion of Main Street in Stoneham, which is a critical component of the Main Street Hybrid Route. The Siting Board also finds unpersuasive Stoneham's assertion that the later inclusion of the Main Street Hybrid in the Companies' route selection comparison group constituted an "unintended bias" against a fair and objective comparison. The record shows that the Companies performed the expanded route selection analysis in a diligent and generally consistent manner with the earlier-identified candidate routes.

At the outset, the Siting Board notes that, of the four municipalities involved in this proceeding, there are also four distinct recommendations on routing,[56] some mutually exclusive, that did not provide the Companies an obvious or easy consensus choice. It is also evident that several of the towns – citing overlooked community preferences, intolerable local traffic or utility infrastructure construction impacts, and other local considerations – supported routes that

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[56] While both Woburn and Wakefield support the Primary Route, Wakefield is opposed to the inclusion of the New Salem Street Variation. As noted above, Stoneham advocates use of the Main Street Hybrid Route (opposed by Wakefield), while Winchester prefers the Green Street Variation (opposed by Woburn). Winchester's reported attempts to enlist the support of Woburn and Stoneham for the Holton Street Variation were similarly unsuccessful.

would shift significant lengths of the Project line to neighboring or more distant communities. The reasonable self-interests of each affected community make this both an unsurprising circumstance and one that well illustrates the importance of the Siting Board's reliance on an objective, data-driven route selection process to ensure that, on an overall project-wide basis, proposed facilities are sited in locations that minimize environmental impacts and costs and ensure reliability.

With regarding to route scoring, there are three general issues on the record to be resolved, including: (1) the selection of appropriate impact categories, ratio scores, and weightings; (2) the accuracy and consistency of data sources; and (3) the use of end-to-end route comparisons vs. segment-to-segment route comparisons.

While accepting the 16 scoring categories used by the Companies, Winchester suggests inclusion of additional criteria regarding EMF, environmental justice populations, and street excavation length, although it did not include these categories in its weighted score of the Green Street Variation and competing segment of the Primary Route. The Siting Board concurs with the Companies' assessment that all of these additional categories are already reflected in the Companies' overall analysis of the environmental impacts of the Project. For example, "street length for excavation" is essentially redundant to the Companies' traffic criteria and analysis. Environmental justice considerations are already addressed in this proceeding by the objective of minimizing the Project's impacts to all populations, including EJ populations.[57] "EMF street length" is already considered implicitly through the scoring of the density of residences and sensitive receptors, and the fact that magnetic fields in proximity of the underground line itself would be roughly equivalent, regardless of route taken. Accordingly, the Siting Board declines to include these additional categories in the route scoring analysis in this proceeding.

With regard to the use of ratio scores, both Stoneham and Winchester contend that this methodological approach dampens the sensitivity of the comparison, and obscures important

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[57] The Project does not include any specific thresholds referenced in the Executive Office of Energy and Environmental Affair's Environmental Justice Policy that would trigger either enhanced public participation requirements or enhanced impact reviews. See Section I.B.

differences between route segments. The Siting Board does not agree with these concerns. The use of ratio scores is well-established in previously accepted scoring analyses and this effect has not been observed. We also note that concerns expressed about ratio scores seem to actually relate to the question addressed below, on end-to-end scoring vs. segment-to-segment scoring.

Following the Companies' approach, the intervenors used the same weightings in their respective scoring categories. However, Winchester argues that each community should be able to establish its own weightings for the impacts within its borders, consistent with individual local preferences. While it is certainly true that communities may have differing perceptions as to which impacts are most important for route scoring purposes, such an approach could be easily manipulated by towns seeking to avoid inclusion in a proposed route, and in any case, would not achieve the consistency of analysis across all routes that is central to the Siting Board's focus on minimizing overall project impacts.

The second general area of dispute concerns the sources and consistency of data used in the respective scoring analyses. This issue is the fundamental reason that the Companies and the intervenors have reached different numerical outcomes in their respective route scoring, and differing conclusions regarding route superiority. As noted above, the Companies adhere to the premise that data sources and methods must be consistently used for each route, from end to end, while the intervenors have supplemented the data used for routes segments of particular interest using Google Earth or town-provided data. While the towns defend their supplemental (or substitute) data as providing greater precision reflecting local knowledge, the Companies correctly point out that selective data use for only certain routes, in only certain communities, introduces a significant bias into the route comparisons. Were each and every town to introduce its own preferred data sources, the scores of every route studied would be affected, and potentially change the rankings in unknowable ways. More importantly, the Companies have shown a number of inaccuracies and flaws in both Winchester's and Stoneham's data collection methods and results that make use of such data, and the scoring conclusions they rest upon, untenable.

The final area of dispute relates to whether routes should be evaluated on an end-to-end basis, or on a segment-to-segment basis. Although the Companies emphasize the importance of

end-to-end route scoring, and this has indeed been the usual approved practice of the Siting Board, the Companies acknowledge that segment-to-segment comparison also has potential value.[58] Unlike the intervenors, the Companies insist that such segment comparisons must have common starting and ending point, or nodes, and not be based on municipal borders. The Siting Board agrees that segment-to-segment analysis can be useful, if performed correctly, with common nodes that facilitate an "apples-to-apples" comparison of route segments. Stoneham's bifurcation of route scoring between Stoneham and Wakefield portions of the Main Street Hybrid Route and the Primary Route, does not achieve a nodal comparison that can facilitate an applicant's decision to "mix and match" route segments into a better overall scoring primary route.[59]

Based on the above findings, the Siting Board finds that the Companies have adequately demonstrated that their route scoring results, both for end-to-end and segment-to-segment comparisons, are consistent, based on appropriate data sources and methods, and reliable. These results confirm that the Primary Route in its entirety scores better than any of the other routes evaluated. Furthermore, in comparison with the Green Street Variation and the Main Street Hybrid Route, the competing segments of the Primary Route also score better (lower). Accordingly, the Siting Board finds that the scoring analyses performed by the Companies is consistent with applicable standards and the facts in this case, and demonstrates that the Primary Route scores better than alternative routes.

Turning to cost comparisons between the competing routes, the Siting Board notes that the revised cost estimates provided by the Companies for the various routes are relatively close. The Primary Route costs approximately $3.9 million more than the Noticed Alternative Route, but it is $300,000 and $4.4 million less expensive than the Main Street Hybrid Route and the

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58 The Siting Board notes that only the Companies performed and provided end-to-end route scoring. The intervenors performed scoring of only particular route segments.

59 The Siting Board recognizes that the Stoneham and Wakefield segments together comprise comparable nodes for the Main Street Hybrid Route and the Primary Route. However, by performing the scoring calculation in a bifurcated manner based on municipal boundaries, instead of a single node-to-node comparison (as scored by the Companies), Stoneham's route scoring is likely to produce inaccurate results.

Green Street Variation, respectively. The Town of Winchester contests several aspects of the Companies' cost estimates, and claims that the Green Street Variation has almost identical costs to the Primary Route. In particular, Winchester disputes the Companies' estimate of $3 million for the truss bridge to carry the cable aside the Montvale Avenue overpass of the commuter rail line, and it further claims that the cost should be $400,000 (and the time to install a prefabricated truss bridge only a few hours). The testimony and analysis provided by the Town of Winchester regarding this cost estimate lacks requisite detail and is insubstantial. Accordingly, we accept the Companies' high-level cost comparisons as acceptable for use in their route selection analysis.

Bolstering the Companies' route scoring and costing analysis in support of the Primary Route are other important features of the competing routes not fully captured by scoring or cost comparisons. Of note, the convergence of the MWRA pipeline project, a 48-inch-wide pipe to be installed in North and Prospect Streets, poses a potential conflict with installing the New Line using the Main Street Hybrid Route. Main Street is also the busiest roadway in Stoneham, with 30,000 average daily trips, and features a hard median, which would make traffic management challenging. As noted above, the needed bridge crossing for the Green Street Variation is likely to cost $3 million and require over three months of work on the bridge, creating significant traffic concerns.

The Companies identified a Noticed Alternative Route which uses a significantly different set of roadways to connect the substation end points in Woburn and Wakefield. The Siting Board concludes from this information that the Primary Route and the Noticed Alternative Route encompass a measure of geographic diversity.

The Siting Board notes that the Primary Route with Green Street Variation would result in greater environmental impact and would be more expensive to construct than either the Primary Route or the Noticed Alternative Route. The Siting Board concludes, therefore, that the Primary Route with Green Street Variation offers no compelling advantage for the Project that warrants its continued inclusion in the analysis in Section VI, below. The Siting Board notes that the Green Street Variation is not required as a workaround to avoid significant construction

impediments. The New Salem Street Variation is considered further in Section VI in conjunction with analysis of the Primary Route because of its status as a potential workaround.

The Siting Board recognizes that the Companies have expended considerable effort in reaching out to affected municipalities, government officials, community groups and the general public in vetting their route selection approach. Nevertheless, the Siting Board agrees with Stoneham that, in the future, where a transmission line project involves multiple communities, it may be beneficial for applicants to consult jointly with all potentially affected communities in the earliest stages of the project design process. The Companies have offered several insights as to why a collaborative approach might not have changed the outcome of the present proceeding, but the Siting Board believes that a good faith effort at fostering collaboration among affected municipalities would be advisable.

Based on the route selection process described above, the Siting Board finds that the Companies have: (1) developed and applied a reasonable set of criteria for identifying and evaluating alternative routes in a manner that ensures that they have not overlooked or eliminated any routes that are clearly superior to the proposed project; and (2) identified a range of practical transmission line routes with some measure of geographic diversity. Therefore, the Siting Board finds that the Companies have demonstrated that they examined a reasonable range of practical siting alternatives and that the proposed facilities are sited in locations that minimize cost and environmental impacts.

VI. ANALYSIS OF PRIMARY AND NOTICED ALTERNATIVE ROUTES

In this section, the Siting Board analyzes the Primary Route and the Noticed Alternative Route, based on environmental impacts, cost, and reliability. Based on the evidence and findings presented below, the Siting Board concludes that the Primary Route is superior to the Noticed 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.

A. Standard of Review

In implementing its statutory mandate under G.L. c. 164, §§ 69H, 69J, 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 route for the facility is superior to the alternative route on the basis of balancing environmental impact, cost, and reliability of supply. East Eagle at 76-77; Walpole-Holbrook at 38-39; Stoughton-Boston at 32-33.

The Siting Board first determines whether 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 examines the environmental impacts of the proposed facilities along the Primary and Noticed Alternative Routes and determines: (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. Finally, the Siting Board compares the Primary Route and the Noticed Alternative Route 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. East Eagle at 77; Walpole-Holbrook at 39.

B. Description of the Primary and Noticed Alternative Routes

1. Primary Route and Primary Route with New Salem Street Variation

The Companies stated that the Primary Route starts at the Woburn Substation, crosses the northeastern portion of the substation property, and enters Lake Avenue just south of the Cove Street intersection, heading northeast (Exh. JP-1, at 6-1). The route then turns south onto Pickering Street for approximately 500 feet before turning east onto Border Street for another 500 feet at which point it crosses Main Street (Route 38) and enters Cross Street (id.). The route continues on Cross Street at the border of Woburn and Winchester and continues east into Winchester (id.). In Winchester, the route continues on Cross Street, under the elevated active railroad tracks (the MBTA Lowell Line) and crossing the Aberjona River, which flows under a bridge at this location (id.). The route continues along Cross Street until its intersection with

Washington Street (id.). The route follows Washington Street north until it reaches Montvale Avenue, and includes a second crossing of the Aberjona River in Winchester on Washington Street, and a third crossing in Woburn on Montvale Avenue (id.). The route travels east along Montvale Avenue under I-93, continues into Stoneham, crossing over Sweetwater Brook, and continuing to Main Street (id.). The route turns north on Main Street, then east on Elm Street, crossing over Sweetwater Brook for a second time, and continues onto Albion Street in Wakefield (id.). From this point, the route continues northeast to Broadway, crossing another set of active railroad tracks (the MBTA Haverhill Line) at grade and continues for approximately one mile on an inactive MBTA railroad ROW that extends north from Wakefield Center (the Wakefield railroad ROW) (id.).[60] The route continues north on the Wakefield railroad ROW to its intersection with Salem Street (id.).[61] The Primary Route then turns east, crossing immediately under the Mill River and continuing east on Salem Street and then south onto Montrose Avenue, reaching the driveway of and continuing into the Wakefield Junction Substation (id.). The total length of the Primary Route is 8.5 miles, including approximately 7.5 miles of in-road construction and approximately 1.0 miles of construction within an inactive railroad ROW (id. at 6-3).

As discussed in Section V, above, the New Salem Street Variation is a three-quarter-mile potential variation to the Primary Route, providing an in-street alternative to the use of the northern portion of the Wakefield railroad ROW (Exh. JP-1, at 5-22, 5-37, fig. 5-7). The New Salem Street Variation of the Primary Route would avoid parts of both the Wakefield railroad ROW and New Salem Street by diverging from the Primary Route at a point where the Wakefield railroad ROW intersects New Salem Street (id. at 5-22, fig. 1-1). The New Salem

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60 The Wakefield railroad ROW section is about one mile long, is generally heavily wooded, and is elevated above surrounding land; the Companies noted that there are numerous encroachments on the Wakefield railroad ROW, and that it is located a few feet from the edge of the Mill River at its northern end (Exhs. JP-1, at 5-22, 6-1; JP-2, app. 6-2, at 18-20).

61 The Companies stated that the Town of Wakefield intends to develop this ROW for recreation use; project design is currently 25 percent complete (Exh. JP-1, at 5-4). Further, the Companies stated that the ROW has been inactive for many years, is overgrown, and contains rails and ties intermittently along most of its length (id.).

Street Variation then continues on New Salem Street to Salem Street, where it rejoins the Primary Route (id. at 5-22). As noted in Section V, the Companies are requesting the Siting Board authorize use of the New Salem Street Variation along with the Primary Route, to afford flexibility in the event that the use of the Wakefield railroad ROW proves infeasible (id.).[62] The total length of the Primary Route with the New Salem Street Variation is 8.4 miles (RR-EFSB-21).

2. Noticed Alternative Route

The Companies stated that the first 1.7 miles of the Noticed Alternative Route overlap with the Primary Route along Lake Avenue, Pickering Street, Border Street, Cross Street, and Washington Street, described above (Exh. JP-1, at 6-3). This stretch includes one railroad crossing and one river crossing (id.). The Noticed Alternative Route diverges from the Primary Route at the intersection of Forest Street and Washington Street in Winchester, at which point the Noticed Alternative Route heads northeast on Forest Street (id.). The route crosses under I-93 and continues on Marble Street in Stoneham, continuing across Main Street (Route 28); the route turns north on Summer Street and continues to Spring Street in Stoneham, where it advances east for approximately 250 feet before turning north on Green Street (id.). Continuing north on Green Street to the Stoneham/Wakefield town line, the route turns onto Albion Street in Wakefield and continues northeast, crossing the active MBTA Haverhill Line, to turn south on North Avenue for approximately 300 feet, then east along West Water Street and Water Street (id.). The route crosses under the Mill River and turns north onto Montrose Avenue to reach the Wakefield Junction Substation driveway, which it follows to the substation (id.).

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62 The Companies stated that although an appraisal of easement rights for the portion of the Wakefield railroad ROW has been completed, the MBTA will not formally consider granting easement rights to National Grid until engineering is further advanced (RR-EFSB-8). However, the Companies stated that, based on their discussions with the MBTA, they are confident that they will be allowed to construct the Project along the Wakefield railroad ROW (Tr. 2, at 285-286).

3. General Description of Project Construction

This section describes the Companies' plans for: (a) the general method of construction of the Project in town streets and restoration of these streets; (b) individual crossings of railroad lines, rivers/streams, and highways; (c) modifications at the terminal substations; and (d) the Project construction schedule.

a. Typical Construction and Restoration Methods

Construction methods for the Project within streets would generally be similar for the Primary Route and the Noticed Alternative Route, and would be completed in the following four principal phases: (1) manhole installation; (2) trenching and duct bank installation; (3) cable pulling, splicing, and testing; and (4) final pavement restoration (Exh. JP-1, at 6-5 to 6-8). According to the Companies, these phases would be conducted in sequence at each location so that several phases of construction may be ongoing simultaneously in different sections of the route (id. at 6-8).

In order to facilitate cable splicing and to allow access for maintenance and future repairs, the Companies would install manhole vaults at spacing intervals of approximately 1,500 to 1,800 linear feet, for a total of 28 vaults along the Primary Route (Exhs. JP-1, at 6-8; EFSB-NO-9). Each precast concrete manhole vault would typically be approximately 12 feet wide by 10 feet high and 32 feet long, and would likely take five to ten days to install (RR-EFSB-14; Tr. 7, at 1235). The Companies stated that some existing utility mains and services may need to be relocated to create space for the manholes (Exh. JP-1, at 6-8). The Companies also stated that they would work with local communities and utility companies regarding these relocations on a case-by-case basis as manhole locations are finalized (id.). At manhole locations where existing utilities cannot be relocated or are extremely close to the proposed manhole, the Companies stated they would consider a pour-in-place manhole (Tr. 12, at 2237 to 2238).

The Companies stated that trench construction is generally a linear progression, with tasks occurring concurrently or in progressive sequence (Exh. EFSB-CM-6).[63,64] For a typical 100-to-200 foot trench segment, the Companies provided the durations for various phases of construction (id.). Depending on field conditions; survey and layout would typically require one day, pavement cutting would require one day, trench excavation would require two to five days, conduit installation would require one to three days, duct bank concrete placement/curing/shoring removal typically would require three to five days, and backfill/temporary pavement placement typically would require two to three days (id.). To permit the passage of traffic during non-working hours, the Companies would sheet and shore the trench as required by soil conditions, U.S. Occupational Safety and Health Administration ("OSHA") safety rules, and local safety regulations, and would cover it with steel plates (Exh. JP-1, at 6-8 to 6-11). According to the Companies, in some areas excavation may be done by hand to avoid disturbing existing utility lines and/or service connections (id.). Typical duct bank trench would be four feet wide and five feet deep (id. at 6-5). Once a portion of the trench is prepared, the Companies would assemble the conduits and would lower them into the trench and then would fill the area under the conduits with high-strength thermal concrete (id. at 6-11). After the concrete is placed in the trench, the Companies would back-fill the trench with fluidized thermal backfill or native soil depending on local conditions, and a temporary pavement patch would be installed (id.).

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63 The Companies stated that the proposed underground transmission line would consist of three 3,500 thousand circular mil ("kcmil") cables each insulated with XLPE and placed individually within high density polyethylene ("HDPE") conduits within a concrete duct bank (Exh. JP-1, at 6-5). The duct bank would consist of four approximately 8-inch-diameter HDPE conduits, two 4-inch-diameter polyvinyl chloride ("PVC") conduits, and two 2-inch-diameter PVC conduits to carry communications lines and ground continuity conductors (Exh. JP-1, at 6-5).

64 The Companies stated that installation of manhole vaults and construction of trenchless crossings would commence early in the construction process, followed closely by the mainline and intersection trenching (RR-EFSB-25). According to the Companies, cable pulling and splicing work would start after approximately 80 percent of the conduit is installed and about a year after the start of construction, because the activity advances at a faster rate than conduit installations (RR-EFSB-25).

To install each cable section, the Companies would pull each of the three cables through the new conduits from one pull-in manhole to an adjacent pull-out manhole using a cable reel, a hydraulic pulling winch and tensioner (Exh. JP-1, at 6-11 to 6-12). This process would be repeated until all cables have been installed (id. at 6-12). After adjacent cable sections are installed, they will be spliced together inside the manholes (id.). The Companies stated that splicing high voltage solid-dielectric transmission cable is a time-consuming, complex operation that typically requires 40 to 60 hours to complete all three cables at each manhole (id.). The Companies indicated that cable splicing is a twelve-hour-per-day activity that would be completed by specialized contractors (Exh. EFSB-CM-5).

Following cable installation and splicing, the Companies would test the cable electrically, temporarily patch and later permanently restore pavements in accordance with the Department street restoration standards detailed in D.T.E. 98-22, as well as pursuant to any agreement made with the applicable municipality or agency (Exhs. JP-1, at 6-12; EFSB-CM-31). The Companies stated that, pursuant to Section 9.16 of D.T.E. 98-22, the municipality "shall have jurisdiction to determine the pavement repair method to be utilized on all pavements which have been installed for less than five years" (Exh. EFSB-CM-31).[65] In addition to cable installations, different types of equipment would be installed at the Woburn and Wakefield Junction Substations in order to support the proposed new underground 345 kV transmission line (see Section VI.B.3.c, below).

b. Wetlands, Railroads, and Highway Crossings

i. Primary Route

As described above, the Primary Route crosses waterbodies, railroad ROWs, and I-93.[66] The Primary Route would involve seven stream crossings: the Horn Pond outfall crossing in Woburn; two Aberjona River crossings in Winchester; the Aberjona River crossing on Montvale

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65 Sections of Montvale Avenue and Washington Street in Woburn, Pickering Street in Winchester, and Montrose Avenue in Wakefield were repaved between 2012 and 2014 (Exh. EFSB-T-14).

66 The Companies proposed one additional trenchless crossing during the proceeding, which is to avoid existing utilities on Elm Street in Stoneham (RR-EFSB-19).

Avenue in Woburn; two crossings of the Sweetwater Brook in Stoneham; and the Mill Street culvert crossing in Wakefield (Exh. JP-1, at 6-2). The Companies stated that they would use a trenchless method (i.e., jack-and-bore, pipe-jacking, or HDD) for crossing these waterbodies (id.; RR-EFSB-19; Tr. 6, at 1111).[67] The Companies further stated that, although their construction consultant recommended the use of pipe-jacking in certain areas along the Project route, the Companies would select the installation method for each waterbody crossing after test pits and geotechnical borings are complete (Tr. 12, at 2249; RR-EFSB-19). According to the Companies, pipe-jacking and jack-and-bore methods have similar footprints and similar noise impacts, but pipe-jacking takes about two to three months, which is typically 20 to 30 percent longer than a jack-and-bore method; in comparison, HDD has a larger footprint than either but may be less noisy (Exh. EFSB-NO-16; Tr. 12, at 2263-2264, 2270-2271).[68] Impacts of stream crossings on wetlands and water resources are discussed in Section VI.C.2, below.

The Primary Route crosses two active sets of railroad tracks, crossing under the elevated MBTA Lowell Line railroad bridge on Cross Street in Winchester, and crossing at grade the MBTA Haverhill Line on Broadway in Wakefield (Exh. JP-1, at 6-1, 6-2). For crossing under the MBTA railroad bridge on Cross Street, the Companies originally proposed a trenchless method because of the high utility density in the street and the narrowness of the roadway

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67 According to the Companies, a jack-and-bore technique is typically used to accomplish crossings that are less than 200 feet, including crossings of railroads, streams, and crossings under shallower existing underground facilities; jack-and-bore installation is accomplished by digging a bore pit on one side of a feature to be crossed and pushing the pipe in the bore hole as it is being drilled to the receiving pit (Exh. JP-1, at 6-13). In pipe-jacking, a jack pushes a larger-diameter pipe through to the receiving pit, and a miner goes inside the pipe to remove excess soil (Tr. 12, at 2260-2261). In contrast, HDD is typically used for comparatively deep and long crossings such as those under major highways and some waterbodies (Exh. JP-1, at 6-13). HDD is accomplished by drilling a curved hole between surface locations on either side of the feature to be crossed, and then pulling pipe back through the bore hole (id.).

68 The Companies indicated that they provided duration for pipe-jacking and jack-and-bore operation in a range considering the potential for delays associated with hitting rock during pipe-jacking or jack-and-bore operations (Tr. 12, at 2263).

(Exh. EFSB-CM-26; RR-EFSB-19; Tr. 12, at 2249).[69] However, the Companies later stated that they are considering an open-cut trench method for this MBTA crossing to minimize the number of trenchless crossings on Cross Street and to minimize disruptions to the community (Tr. 6, at 1109-1110; Tr. 12, at 2248-2249).[70] The Companies would either employ a jack-and-bore or pipe-jacking method for crossing the MBTA Haverhill Line in Wakefield on Broadway west of North Avenue (Exh. JP-1, at 6-2; Tr. 12, at 2249, 2259-2260).[71,72]

The New Line on the Primary Route would cross I-93 in Woburn by extending the open-cut trenching of Montvale Avenue through the I-93 underpass (Exhs. JP-1, at 6-2; EFSB-CM-19).

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69 The Companies stated that the MBTA railroad crossing and the Aberjona River culvert crossing are about 200 feet apart on Cross Street (Tr. 6, at 1058). In deciding whether to accomplish both crossings in a single construction effort, the Companies stated they would factor in Winchester's choice of whether to limit or to close traffic flow on Cross Street (id. at 1058-1059). If the Companies select a trenchless method, they would use a common middle jacking pit to accomplish both the MBTA Railroad ROW and the Aberjona River crossings on Cross Street (RR-EFSB-19).

70 If the Companies select an open-cut method, they commit to using vacuum trucks for excavation to protect town utilities (Tr. 6, at 1060).

71 The Companies stated that the MBTA does not allow the use of HDD crossing under its railroad tracks, in order to preserve the structural integrity of its facilities (Tr. 12, at 2259).

72 The Companies would use the open-cut trench method for installing the New Line in the Wakefield railroad ROW (Exh. EFSB-CM-25). Prior to installing the New Line in this inactive railroad ROW, the Companies would have to prepare the ground surface which would require the removal of railroad ties and rails, removal of vegetation, and land grading to support Project construction and maintenance (id.). The Companies stated they would construct an access road within the existing ROW; the Town of Wakefield has advanced the design of a recreation path on this ROW and the Companies anticipate that the access road would serve as the foundation for a future bike path (Exh. JP-1, at 6-1 to 6-2).

ii. Noticed Alternative Route

Like the Primary Route, the Noticed Alternative Route crosses waterbodies, railroad ROWs, and I-93 (Exh. JP-1, at 6-4). The Noticed Alternative Route has five stream crossings: the Horn Pond culvert in Woburn; the Aberjona River bridge on Cross Street in Winchester; an unnamed intermittent stream culvert on Forest Street in Stoneham; the Mill River bridge on Water Street in Wakefield, and another unnamed intermittent stream culvert on Montrose Avenue in Wakefield (id.). The Horn Pond culvert and the Aberjona River bridge crossings are the same as the Primary Route, and the crossing method would be the same as described above (id.). For crossing the other three stream crossings along the Noticed Alternative Route, the Companies would use a jack-and-bore method (id.).

The Companies stated that there would be two railroad crossings along the Noticed Alternative Route – the MBTA Haverhill Line at West Water Street in Wakefield and the MBTA railroad bridge on Cross Street in Winchester (id.; RR-EFSB-19; Tr. 12, at 2248-2249). The Companies would use a jack-and-bore method for crossing the Haverhill Line (Exh. JP-1, at 6-4). The Cross Street MBTA crossing on the Noticed Alternative Route is the same as on the Primary Route, as described above.

For the Noticed Alternative Route, the Companies would use HDD to cross under I-93 at the Winchester/Stoneham town line (Exh. JP-1, at 6-4).[73] According to the Companies, MassDOT would require that HDD entry and exit pits be placed away from the bridge so that traffic flow during HDD construction can be maintained (Exh. EFSB-CM-19). In addition, MassDOT indicated that the drilling must be made at sufficient depth so that it will not affect I-93 highway stability (id.). To keep the Forest Street/Marble Street bridge available for traffic, the Companies stated that they would stage the HDD: (1) from the west either from Forest Street or from adjacent private property to the north, and (2) from the east from adjacent private property to the north (Exh. JP-1, at 6-3). The Companies concluded that the HDD crossing at

[73] Eversource proposed HDD crossing at this location in order to avoid placing the New Line on a bridge that is expected to be replaced after the year 2020 (Exh. EFSB-CM-19). Also, the Companies stated that MassDOT would not allow transmission line placement on a bridge when a surface road option is available (id.).

this location would be a complex and uncertain three-to-four month drilling process requiring either a mid-sized or maximum-sized drilling rig, as well as a potential work area located in the parking lot of the Cliffside-Hillside Community Apartment Complex (id. at 6-4, 6-41; Exhs. EFSB-NO-28; EFSB-CM-19).[74]

c. Substation Upgrades

The Project would require upgrades at the Woburn Substation and Wakefield Junction Substation, regardless of which route is chosen (Exh. JP-1, at 6-43 to 6-48). To accommodate the new underground 345 kV transmission line, the Project would include the installation of the following equipment at the Woburn Substation: (1) 345 kV breakers; (2) a 345 kV shunt reactor with oil containment and a three sided wall; (3) 345 kV bus work with support structures; (4) 345 kV surge arresters; (5) a shielding mast; and (6) 345 kV cable termination structures (id. at 6-43; RR-EFSB-13). Furthermore, to accommodate the New Line, the Project would include the installation of the following equipment at the Wakefield Junction Substation: (1) 345 kV breakers; (2) a 345 kV shunt reactor with oil containment and a fire wall ; (3) 345 kV transformers; (4) 345 kV bus work with support structures; (5) 345 kV surge arresters; (6) a lightning protection structure; (7) cable termination structures; and (8) a 15-foot sound wall (Exhs. JP-1, at 6-48; EFSB-G-11; RR-EFSB-13). The Companies stated that these modifications would not require expansion of the fenceline at either of these substations (Exh. JP-1, at 6-44 to 6-49). The Companies are requesting zoning exemptions for the upgrades to the Woburn and Wakefield Junction Substations (see Section VIII).

d. Construction Schedule

The Companies stated that construction of the Project is anticipated to occur over a 22-month period (Exh. JP-1, at 6-14). In addition, the Companies stated that substation

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[74] The Companies indicated that the closest structure to the HDD entry would be located 109 feet away while the closest structure to the exit drill would be about 97 feet away (Exh. EFSB-NO-28(1)). Further discussion on potential noise impacts of this crossing is discussed in Section VI.C.4.

improvements at Woburn and Wakefield Junction Substations would be timed to coincide with the energization of the New Line (id.). According to the Companies, this Project schedule assumes that in-street construction would likely cease during winter moratorium months (Exh. EFSB-CM-21).[75]

C. Environmental Impacts

This section compares environmental impacts of the Project along the Primary Route and the Noticed Alternative Route. Environmental impacts of the Project along the New Salem Street Variation of the Primary Route are also discussed below in Section VI.C.9.

1. Land Use

a. Companies' Description

The Companies stated that the dominant land use adjacent to both the Primary Route and the Noticed Alternative Route is medium-density residential development (Exh. JP-1, at 6-19). Other common land uses proximate to both routes include high density residential, commercial, and multi-family residences, and forestland (id.).[76] Land use along the Primary Route and the Noticed Alternative Route is summarized in Table 8, below.

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75 The Companies indicated that the Town of Winchester and the City of Woburn maintain a moratorium on street opening activities between November 15 and April 15, while in the Town of Wakefield, the winter moratorium is in effect between November 15 and April 1 (Exh. EFSB-CM-44). According to the Companies, the Town of Stoneham does not have a specific moratorium bylaw, but the practice is for a moratorium to be in effect between December 1 and April 1 (id.). The Companies stated that depending on the weather, Wakefield may allow construction during the moratorium period, and as a result, construction along the Wakefield railroad ROW may continue into the winter months (Exh. EFSB-CM-21). The Companies noted that cable splicing is typically allowed by municipalities during winter moratorium periods (Exh. EFSB-CM-44).

76 The Companies used MassGIS data to identify land use along Project routes (Exh. JP-1, at 6-17; Tr. 6, at 1025 to 1026).

Table 8. Summary of Land Use within 300 feet of Pavement/ROW Edge

Distance from Pavement/ ROW Edge	Primary Route (8.5 miles)			Noticed Alternative Route (8.0 miles)		
	Residential Units	Commercial /Industrial	Other [77]	Residential Units	Commercial /Industrial	Other[75]
0'-25'	56	16	1	528	38	3
25'-50'	401	42	1	350	22	1
50'-100'	489	54	2	331	24	2
100'-200'	359	61	4	602	36	0
200'-300'	379	72	8	562	35	6
Total	**1,684**	**245**	**16**	**2,373**	**155**	**11**

Source: Exh. EFSB-LU-1.

The Companies characterized potential land use impacts as physical land disturbances of roadways and infrastructure associated with Project construction (Tr. 6, at 1022-1023). According to the Companies, land use impacts would be temporary and Project construction would not result in permanent changes to land uses along either route (Exh. JP-1, at 6-19). Temporary impacts to residences, businesses, and other sensitive receptors may include traffic disruption, access constraints associated with road closure, noise, and/or dust (id.). The Companies noted that at certain locations along the Project route such as railroad and waterbody crossings, as well as at locations where there is a high density of existing utilities, Project construction would occur for relatively extended periods of time (id. at 6-13; RR-EFSB-19; Tr. 12, at 2263-2264). As discussed in Section VI.B.3.b, above, the Companies will make a final decision on which method would be used for the MBTA railroad bridge crossing on Cross Street and for each waterbody crossing along the Project route upon the completion of the test pit and geotechnical boring program (RR-EFSB-19; Tr. 12, at 2249).

In addition to work along the Primary or Noticed Alternative Routes, the Project would involve work at the Woburn and Wakefield Junction Substations. The Woburn Substation is

[77] Other land uses include schools, hospitals, police/fire stations, elder care facilities, nursing homes, daycare facilities, and courthouses, place of worship, parks, funeral homes, and cemeteries (Exh. JP-1, at 6-19).

located near Horn Pond in Woburn, and is bordered by Pond Street to the east, Cove Street to the north, and Woburn Parkway to the west and south (Exh. JP-1, at 6-43). Adjacent land uses are primarily residential to the east and south, while Horn Pond and associated recreational facilities are located to the north and west (id.).

The other line termination point for the Project, the Wakefield Junction Substation, is located along an existing overhead transmission ROW that extends to the north and the south (Exh. JP-1, at 6-47). Land immediately east of the Wakefield Junction Substation is within the Breakheart Reservation, managed by the Massachusetts Department of Conservation and Recreation ("DCR"), and a residential development is located approximately 400 feet to the northeast (id.). Land immediately east and west of Wakefield Junction Substation is forested; there are residential areas approximately 300 to 400 feet from the substation to the northeast, northwest, and southwest (id. at 6-47, 6-48; Exh. JP-3, at 17-LU). The Companies stated that there would be no changes to land use as a result of Project work at the Woburn and Wakefield Junction Substations, as all work would be performed within the fencelines of the existing substations (id. at 6-44, 6-49).

The Companies stated that the Project is subject to review by the Massachusetts Historical Commission ("MHC") (Exh. JP-1, at 6-20). According to the Companies, the Primary Route and the Noticed Alternative Route each pass properties listed as historic, eligible for inclusion in the State and National Registers of Historic Places, or currently included in the Inventory of Historic and Archaeological Assets of the Commonwealth, as well as archaeological sites and the Middlesex Canal Historic and Archaeological District (id.). The Primary Route passes adjacent to 45 registered or eligible historic properties and archaeological sites, while the Noticed Alternative Route passes 92 (id.). The Companies concluded that, although both routes pass numerous historic properties and archaeological sites, no adverse impacts are expected to these properties and sites located on either route (id.; Exh. EFSB-LU-4). In addition, the Companies stated that there are no Article 97 lands, National Heritage and Endangered Species Program ("NHESP") habitat, or known habitat of federally protected species along either the Primary Route or the Noticed Alternative Route (Exh. JP-1, at 6-17).

The Companies stated that they would identify and safeguard existing utilities (e.g., water, sewer, gas, electric, or cable) during Project construction (Exhs. CUR-1-1(j); EFSB-CM-11; EFSB-S-2). Should existing utilities be affected, the Companies asserted they would notify the affected facilities' owners, and would resolve issues and obtain necessary owner approvals (Companies Brief at 97). The Companies stated they would determine utility density along roads for underground transmission projects by: requesting subsurface utility maps from municipalities and other utility owners; performing field verification to locate catch basins, hand holes, and manholes; measuring depths where manhole access is allowed; creating base plans for engineers to design the proposed line route; and performing test pitting to further confirm available space for manholes (Exhs. TOS-ED-4; EFSB-CM-11). Further, the Companies stated they would provide draft plans to the towns and meet with them to verify locations of identified existing utilities (Exhs. TOS-ED-4; EFSB-CM-11; Tr. 1, at 115-119). The Companies indicated that based on collected survey data and review of available as-built records, there is higher utility density along the Noticed Alternative Route than along the Primary Route (Exhs. CUR-1-1(j); COM-DCK-1(A)).

The Companies stated that they do not anticipate any disruptions to utility service (Exh. EFSB-CM-20). In response to Stoneham's and Winchester's requests that the Companies fund an independent "field engineer" to inspect and oversee Project construction and to report to the towns (see below), the Companies stated that the issue of the field engineer would be an element of each Host Community Agreement ("HCA") to be negotiated with the municipalities (Exh. TOW-BR-1 at 14-15; Tr. 6, at 1188; see Stoneham Brief at 13).

The Companies concluded that land use along both the Primary Route and the Noticed Alternative Route is predominantly residential, and Project's land use impacts along both routes are comparable (Exh. JP-1, at 6-19 to 6-20). Potential Project traffic, noise, and air impacts are discussed in Sections VI.C.3, VI.C.4, and VI.C.7, below.

b. Position of the Parties

i. Intervenors

(A) Winchester

The Town of Winchester stated that land use impacts associated with the Project in Winchester include: (1) construction-related impacts to town-owned utilities; (2) permanent loss of space under pavement in the public ROW for future utility replacement or improvement projects, which the town described as "loss of corridor"; (3) extra future costs and time required to work around the proposed 41-inch by 32-inch duct bank and the splice vaults when repairing town-owned utilities; (4) construction-related disruptions to abutting residences and businesses, and the commuting public; (5) significant strain on town resources, including impacts to police, fire, departments of public works ("DPW") and engineering staff levels; and (6) compounded impact of other construction projects in Winchester including Eversource's 115 kV Mystic-Woburn project, and other town infrastructure and building projects planned or on-going (Exhs. TOW-BR-1, at 4-18; TOW-GO-1, at 8; TOW-JG-1, at 3; Winchester Brief at 5).

Winchester asserts that the Companies have not provided meaningful assurance that they would construct the Project in a manner that would protect utility services of the town and its residents, both during and after construction (Winchester Brief at 9).[78] Further, Winchester argues that the Project would have greater impact on environmental justice neighborhoods in the town (id. at 5).

Winchester recommends that, should the Siting Board approve the Project along the Primary Route, the Siting Board require the Companies to implement the following mitigation measures: (1) install the proposed Project duct bank four feet away from any town-owned utilities (water, sewer, and drain); (2) perform a pre-existing condition survey that includes a video recording of surface conditions along the full extent of the route, within the public way and

[78] Winchester stated that at the time the town filed its brief many aspects of the design and proposed construction along the Primary Route appear to be in the preliminary stages, including: (1) lack of updated and 90 percent complete construction plan and TMP; (2) incomplete and incorrect information for town-owned water, sewer, and drain utilities, and gas mains; and (3) lack of information on how town-owned utilities and private water and sewer laterals will be protected, relocated, or adjusted to make room for the 345 kV line in the ROW (Winchester Brief at 40).

along the abutting private properties, to document the basis for final surface restoration methods;[79] (3) install the proposed duck bank under all existing sanitary sewer and domestic water services, including provisions to replace all non-copper water services and all non-PVC sewer services; (4) hire a company to trace the water main and provide a more accurate location on the existing conditions plan; (5) fund a full-time inspection service that would report to the Winchester during construction; (6) include a final pavement restoration plan that includes a curb-to-curb overlay;[80] (7) coordinate with Winchester to identify specific locations where permanent water system improvements would be required prior to the start of construction such as the cut-in of new water gates to maintain or provide adequate controls to side street service mains to mitigate extent and duration of service interruptions; (8) coordinate with MWRA to protect its utilities during Project construction in Winchester (e.g., Cross Street); and (9) use HPFF-PTC technology rather than HVED cable technology because of its smaller footprint and lower EMF impact (Exhs. TOW-BR-1 at 6-8; TOW-RH-1, at 4).

(B) Stoneham

The Town of Stoneham opposes the Project on the Primary Route because of, among other things, its potential impacts on town utilities and infrastructure (Stoneham Brief at 11). Stoneham is concerned that existing utilities may be damaged by Project construction, and that the presence of the proposed line will limit the future availability of space for facilities in those rights of way for at least 40 years (id. at 12). Stoneham stated that the installation of the New Line would cause utility congestion and, because of the need to work around this proposed line, the town would incur extra cost and time in the future to repair its existing utilities (id.).

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79 Winchester stated that the existing water, sewer, and drain utilities along the Primary Route are of an age and made of materials (e.g., vitrified clay pipe sewers) that make them susceptible to potential damage and/or failure due to differential settlement of disturbed trenches or undermining of the sub-grade during installation of the proposed duct bank (Exh. TOW-BR-1, at 6).

80 Winchester requested that the pavement restoration measures include a minimum four-inch temporary trench pavement with 14-inches of compacted gravel sub-base, installed weekly to follow progress of work, and two-inch curb-to-curb milling, four-inch permanent trench pavement, and two-inch curb-to-curb overlay (Exh. TOW-BR-1, at 7).

To mitigate the impact of the Project, Stoneham recommended the use of the Main Street Hybrid Route rather than the Elm Street segment of the Primary Route (id. at 11).

Stoneham's director of public works stated that Montvale Avenue, Main Street, and Elm Street in Stoneham already contain a large number of existing utility facilities, many of which were installed years ago (Exh. TOS-RG-1, at 5). The director also stated that the existing utilities, such as clay pipe sewers, would be exposed to potential damage as a result of construction of the New Line (id. at 7). Stoneham argues that should the Siting Board approve the Primary Route, the Board should require the Companies to make a preconstruction video recording to document existing utilities and surface conditions in order to determine the need for any restoration and repairs (Exh. TOS-RG-1, at 7; Stoneham Brief at 12).

In addition, Stoneham requests that the Siting Board require the Companies to implement the following mitigation measures: (1) use HPFF-PTC technology rather than the HVED cable technology because of its smaller footprint and lower electromagnetic field impact, as described in Section IV.B.1, above; (2) install the proposed duct bank beneath all existing utilities; (3) provide six feet of cover where possible, but at least provide a minimum of 2.5 feet of cover over the proposed duct bank to protect water and other existing services from damage due to roadway construction and freezing; (4) fund an independent Project construction inspector to help Stoneham monitor, coordinate, and oversee the construction; and (5) work with Stoneham to execute a host community agreement (Stoneham Brief at 12, 27-34; Tr. 9, at 1616-1617).[81]

ii. Companies' Response

The Companies assert that they are committed to continuing to work with the towns of Winchester and Stoneham to develop construction plan sets and HCAs (as well as TMPs, see Section VI.C.3) (Companies Reply Brief at 32-34). Responding to the towns' criticism that initial construction plans were inaccurate, the Companies represent that they have corrected mislabeled utility information, using the towns' institutional knowledge (Companies Reply Brief

[81] The Town of Wakefield strongly endorsed the Primary Route in comparison to the Noticed Alternative Route or the New Salem Street Variation of the Primary Route (Exh. EFSB-CM-22(1)).

at 34). The Companies commit to further revising the construction plan set based on the results of the geotechnical borings and test pits and follow-up discussions with each municipality (id.; Exh. COM-BAS-1, at 4).

In response to Winchester's and Stoneham's concerns regarding disruption of existing utilities, the Companies commit to supporting Stoneham and Winchester in locating their water and sewer facilities with utility locating services (electronic locating equipment) during the test pit program (Exh. COM-BAS-1, at 5; Companies Reply Brief at 35). The Companies concur with Stoneham's request that they place at least a 2.5 feet of cover over the duct bank, stating that such an installation is common and consistent with Department regulations (see 220 CMR 125.30(2)) (Companies Reply Brief at 37, 38). The Companies note that for approximately 65 percent of the route, the duct bank will be more than five feet deep (Exhs. TOS-ED-10; COM-BAS-1, at 10). The Companies promise to consult with the towns regarding particular locations where the towns may have specific concerns about freezing and other considerations (Exh. COM-BAS-1, at 10)

With respect to Winchester's request to allow four feet of clearance between the proposed duct bank and existing utilities, the Companies assert that doing so would likely require moving some of the existing utilities, which would add to the duration of Project construction (Tr. 6, at 1080-1082). National Grid has been planning to replace existing natural gas lines in the Project area and the Companies have stated that National Grid will, prior to the construction of the Project, replace gas lines along the Primary Route in Woburn, Winchester, and Stoneham and, where applicable, change the location of these lines in order to provide four feet of separation from the proposed duct bank location of the Project (id. at 1080-1082). Finally, the Companies aver that if town-owned facilities need to be moved the relocation would be performed at the Companies' expense (Companies Reply Brief at 38).

With respect to Winchester's and Stoneham's request for a pre-construction video, the Companies represent that it is a standard practice, and that they would conduct interior video inspection of existing sewer lines (Exh. COM-BAS-1, at 8). However, the Companies indicated that interior video inspection of underground water pipes and other existing utilities is

impractical (id.). The Companies stated they will also videotape existing roadway conditions prior to construction (id.).

The Companies respond that they would not agree to a blanket installation of the duct bank beneath all existing utilities, as has been requested in by Winchester and Stoneham, because the deeper installation would require more extensive structures to support existing utilities during construction, would increase construction duration, and also would reduce the capacity of the New Line (Tr. 6, at 1094-1095; Companies Reply Brief at 38). The Companies contend that installing the New Line under all existing utilities would result in increased reliability risks, costs and construction impacts (Companies Reply Brief at 38). However, the Companies committed to consulting Winchester and Stoneham regarding particular locations where they may have specific concerns (id., citing Exh. COM-BAS-1, at 10, 20).

Regarding Stoneham's and Winchester's concerns that the presence of the duct bank proposed for the Project would impose future costs on each town and would limit the future availability of space for facilities in town streets, the Companies commit to working with both towns to establish a design that would minimize the use of existing space in the street and at the same time protect existing utilities (Companies Reply Brief at 38, citing Exh. COM-BAS-1, at 7). The Companies assert that, on balance, compared to the use of an HPFF-PTC system, the choice of the HVED system for the Project minimizes cost and environmental impact while ensuring transmission system reliability (Companies Brief at 52; Companies Reply Brief at 26-29). Further discussion of choice of cable type for the proposed Project is discussed in Section IV.B.1, above.

The Companies represent that, based on their experiences constructing complex projects in urban environments, projects of this magnitude require construction management and oversight and these tasks are shared and coordinated between the Companies and their contractors (RR-EFSB-23).[82] The Companies contend that, typically, the Companies' managers

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[82] The Companies stated that they have not yet determined precisely how responsibilities for construction management, coordination, communication, quality assurance and inspection will be allocated between the Companies and their contractors for this Project, and that these details will be resolved after the contractor is hired (RR-EFSB-23).

and supervisors are responsible both for making sure the project is constructed in accordance with the agreements, plans, and specifications that the municipalities have reviewed, and for communicating routinely with town officials (id.). The Companies note that on occasion, for major projects, municipalities sometimes hire an outside contractor to serve as a field engineer to protect the municipality's interests (id.). To assist municipalities in retaining such consulting assistance, the Companies represent that they sometimes fund an independent field engineer position for a particular project (id.). The Companies indicate that their minimum requirement for consideration of funding would be that the field engineer has the authority to approve changes in the field to make sure construction proceeds in an efficient and expeditious manner (id.).[83] The Companies note that they don't have an estimate of the cost associated with an outside field engineer for the Project (RR-EFSB-32).[84]

c. Analysis and Findings

The record shows that temporary land use impacts of the Project would include physical land disturbances of roadways and infrastructure.[85] Dominant land use adjacent to both the Primary Route and the Noticed Alternative Route is medium density residential development. Compared to the Primary Route, there are 689 more residential units adjacent to the Noticed Alternative Route and 90 fewer commercial/businesses. The Noticed Alternative Route also

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83 The Companies noted that each municipality would hire its own field engineer (RR-EFSB-23).

84 The Companies noted that in the Salem Cables case, involving construction of two 1.63-mile XLPE lines through downtown Salem, reimbursement of a field engineer was a condition in the Siting Board Final Decision and a stipulation of a HCA between National Grid and the City of Salem where the HCA required National Grid to reimburse the City of Salem up to $130,000 for its engineering oversight of Project construction (RR-EFSB-32; see New England Power Company, EFSB 13-2/D.P.U. 13-151/13-152, at 4 (2014)). In addition, the Companies indicated that Eversource paid for an inspector for the City of Cambridge for a three-mile-long oil-return pipeline project (Tr. 6, at 1188).

85 The Siting Board addresses traffic impacts including emergency vehicle access in Section VI.C.3, below.

passes a higher number of historical properties and archaeological sites (92 versus 45). There are no Article 97 lands, NHESP habitat, or known habitat of federally protected species along either the Primary Route or the Noticed Alternative Route. Therefore, on balance, the Primary Route is preferable to the Noticed Alternative Route with respect to land use impacts.

The record shows that the Companies have considered several methods for crossing waterbodies and the elevated railroad ROW on Cross Street. The record also shows that the Companies will make a final decision on what method would be used for each crossing upon the completion of the ongoing test pit and geotechnical boring program. The Siting Board notes that different crossing methods have different construction impacts and construction duration requirements, and therefore it directs the Companies to report to the Siting Board, at least 60 days before starting construction at each location: (1) the crossing method proposed for each railroad and waterbody crossing; (2) the rationale for selecting the crossing method; and (3) the Companies' mitigation of impacts. Mitigation of impact on water resources is addressed in Section VI.C.2, below.

In order to address concerns expressed by Winchester and Stoneham regarding the loss of underground space, which the towns described as "permanent loss of corridor" in their public ROWs due to construction of the Project, the Companies committed to working with the individual municipalities to identify the most efficient use of underground space to allow future utility development or repair in these towns. The Siting Board notes that the Companies will provide construction plans to host municipalities in conjunction with applying for street opening permits.

To mitigate Project impacts on existing town utilities, the Companies agreed with Stoneham's proposal to provide a minimum of 2.5 feet cover over the proposed duct bank stating that it is a requirement that is common and consistent with 220 CMR 125.30(2), the Department's regulations governing the installation and maintenance of underground electric utilities. The record shows that for about 65 percent of the route the proposed duct bank will be more than five feet deep; the Companies committed to consulting with the towns regarding particular locations where they may have specific concerns about freezing and other considerations.

The record shows that providing the four feet of clearance between the proposed duct bank and all existing utilities, as requested by Winchester, would require moving some of the existing utilities and would likely add significant time to the duration of the Project and expense. Nevertheless, National Grid has committed to selectively re-route some local gas distribution pipelines that are being replaced as part of the gas pipeline replacement Project, where necessary, to create more space and provide four feet of clearance between the proposed duct bank location prior to Project construction. However, the Siting Board declines to require the categorical utility line relocations sought by Winchester as both unwarranted and as a source of added costs and delay to the Project.

With respect to Stoneham's and Winchester's requests that the Companies fund a field engineer who would inspect and oversee Project construction and report to the towns, the record shows that although not a standard practice, the Companies have reimbursed municipalities for the costs of a field engineer on at least a few occasions. The Companies further stated that the funding of a field engineer would be an element of the HCA that is being negotiated with the towns. Given the extensive nature of the Project, the sensitivity and density of existing utilities in these town streets, and the limitations of the towns' capacities to deploy regular engineering oversight, the Siting Board directs the Companies to fund reasonable and appropriately documented costs for independent field engineers to assist the municipalities of Woburn, Winchester, Stoneham, and Wakefield solely in furtherance of the Project. Pursuant to this condition, each field engineer is to be afforded all necessary municipal authority to approve changes in the field and to make sure Project construction proceeds in an efficient, safe, and expeditious manner.[86] In addition, to document the existing condition of town underground utilities and determine the need for restoration and repairs, the Siting Board directs the Companies to perform a pre-construction interior video recording of existing sewer facilities and a video recording of existing roadway conditions prior to commencing construction.

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[86] Pursuant to the project change provision in Section XII of this Decision, authority of the field engineers to approve changes in the field does not extend to authority over what would be considered a project change in the context of the Siting Board's approval of the Project.

While Winchester and Stoneham request that the Companies use an HPFF-PTC system to minimize loss of space in public ROWs and also to minimize impact on existing utilities, the record shows that use of an HPFF-PTC system would cost more and would likely result in greater environmental impact, as described in Section IV above. The record shows that installing the New Line below all town utilities as proposed by Winchester and Stoneham would require more extensive structures to support existing utilities during construction, significantly increasing Project construction duration and resulting in increased reliability risks, costs, and construction impacts.

Stoneham requests that the Board refrain from approving the Project unless the Companies have entered a mutually-acceptable HCA with Stoneham. We must decline this request. The Siting Board notes that an HCA is a private agreement between two parties (Walpole-Holbrook at 85 n.32; Exelon West Medway, LLC, EFSB 15-01/D.P.U. 15-25, at 6 (2016) ("Exelon West Medway"); Salem Cables at 4, 5). The Board traditionally does not incorporate the HCA into a decision nor does the Board enforce the terms of an HCA (Walpole-Holbrook at 85 n.32; Exelon West Medway at 6). Nevertheless, if the Companies and any municipality in this proceeding enter into an HCA, they must submit a copy of it to the Board. An HCA provides useful information and a context helpful for understanding any future changes to the Project (see Salem Cables at 5).

Given the implementation of the mitigation measures proposed by the Companies and the conditions described above, the Siting Board finds that land use impacts from the construction and operation of the Project along the Primary Route would be minimized.

2. Wetlands and Water Resources

a. Companies' Description

As discussed above, both routes involve stream crossings, primarily in culverts or over bridges within streets (Exh. JP-1, at 6-30 to 6-32).[87,88] According to the Companies, both the

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[87] As described in Section VI.B.3, above, waterbody crossings along the Primary Route include: (1) Horn Pond culvert outfall in Woburn; (2) Aberjona River bridge crossing on Cross Street in Winchester; (3) Aberjona River bridge crossing on Washington Street in Winchester; (4) Aberjona River bridge crossing on Montvale Avenue in Woburn;

Primary and the Noticed Alternative Routes would be located within buffer zones to resource areas (as defined in the Massachusetts Wetlands Protection Act) (id.). In addition, both routes cross through Riverfront Area ("RA") and Bordering Land Subject to Flooding ("BLSF") as they occur within roadways and railroad ROW (id.).

The Companies stated that, because Project construction would occur within a combination of existing paved roadways, existing railroad ROWs, and/or existing gravel-surface substation yards, no permanent impacts to wetlands, waterways or Outstanding Resource Waters ("ORWs") are anticipated along either the Primary Route or the Noticed Alternative Route (Exh. JP-1, at 6-32). However, the Primary Route requires clearing and grading within the BLSF and RA associated within the Mill River on the Wakefield railroad ROW (id.). The Primary Route has more of its length in wetland buffer zones and has a greater number of water body crossings than the Noticed Alternative Route, but affects significantly less ORWs area than the Noticed Alternative Route (id.). Based on the need for clearing and grading within BLSF and RA along the Primary Route, the Companies concluded that the Noticed Alternative Route would be slightly preferable to the Primary Route with respect to Project wetlands and water resources impacts (id.).

To address the potential for erosion and sedimentation within wetland resource areas, the Companies would prepare a Stormwater Pollution Prevention Plan ("SWPPP") for the Project that would specify erosion control measures to be implemented (id. at 6-31).[89]

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(5) Sweetwater Brook culvert crossing on Montvale Avenue in Stoneham; (6) Sweetwater Brook culvert crossing on Elm Street; and (7) Mill River culvert crossing on Salem Street (Exh. JP-1, at 6-2).

88 Waterbody crossings along the Noticed Alternative Route include: (1) Horn Pond culvert outfall in Woburn; (2) Aberjona River bridge crossing on Cross Street in Winchester; (3) an unnamed intermittent stream culvert on Forest Street in Winchester; (4) Mill Street bridge crossing on Water Street in Stoneham; and (5) an unnamed intermittent street culvert in Montrose Avenue in Wakefield (Exh. JP-1, at 6-4).

89 The Companies' storm control measures would include: (1) installing filter fabric barriers to prevent sedimentation to the storm drain system; (2) loading trench spoils into dump trucks and removing them promptly; and (3) maintaining spill containment gear

The Companies stated that there are no state-regulated wetland resource areas within the fenceline of the Woburn Substation, and no wetland resource areas would be affected by the proposed work (Exh. JP-1, at 6-32). The Woburn Substation is located within a Massachusetts Department of Environmental Protection ("MassDEP") Zone II Wellhead Protection Area (id. at 6-44). The Companies stated that the proposed work would not impact the wellhead protection area because the work would not alter surface water, groundwater, or runoff (id.). The Companies stated that all substation work at the Wakefield Junction Substation would take place within upland areas and outside of wetland buffer zones; therefore, the proposed substation improvements would have no impacts on wetland resource areas or associated buffer zones (id.).

As indicated in Section VI.B.3, above, the Companies have not made a final determination on what method they would use for each individual stream crossing.

b. Analysis and Findings

Project construction would occur in existing paved roadways, existing railroad ROWs, and existing substation yards. Therefore, no permanent impacts are anticipated to wetlands and water resources along either the Primary or the Noticed Alternative Routes. The record shows that although the Noticed Alternative Route affects a larger area of Outstanding Resource Waters, the Primary Route has more of its length in wetland buffer zones and involves greater number of waterbody crossings. The Siting Board therefore finds that the Primary Route and the Noticed Alternative Route are comparable with respect to wetlands and water resource impacts.

In order to minimize the potential for erosion and sedimentation from soil disturbance entering wetland resource areas, the Companies committed to developing a SWPPP that would specify erosion control measures to be implemented, including installation of fabric barriers and prompt removal of trench spoils. The Siting Board directs the Companies to submit a copy of the final SWPPP to the Siting Board when available, but no less than four weeks prior to the commencement of construction.

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and absorption materials for immediate use in the event of any inadvertent spills or leaks from fueling and lubrication of heavy equipment (Exh. JP-1, at 6-30).

Although preliminary plans indicated that the Companies proposed to use jack-and-bore method to cross waterbodies along both the Primary Route and the Noticed Alternative Route, the record shows that the Companies will make a final determination upon the completion of ongoing test pit and geotechnical boring program. The Siting Board notes that each method has different impacts on wetland and water resources, and therefore, as discussed above in Section VI.C.1, the Board imposed a condition regarding waterbody crossings.

Given the implementation of the mitigation measures proposed by the Companies and the conditions described above, the Siting Board finds that wetland and water resource impacts from the construction and operation of the Project along the Primary Route would be minimized.

3. Traffic and Transportation

a. Companies' Description

i. Primary Route

In order to characterize potential Project traffic impacts along both the Primary Route and the Noticed Alternative Route, the Companies observed traffic and parking conditions along both routes (Exh. JP-1, at 6-21). The Companies also identified public bus routes along both the Primary and the Noticed Alternative Routes (id.). For seven segments of roadway along the Primary Route, the Companies collected hourly traffic volume counts (Exh. EFSB-T-1(1); Tr. 8, at 1387 to 1390).

As discussed above, approximately 1.0 mile of the Primary Route would be on an inactive railroad ROW while the remainder 7.5 miles of the route would be on public roadways (Exh. JP-1, at 6-21). The Companies stated that, among these roads, Montvale Avenue in Woburn and Stoneham is a relatively high-volume two-to-four-lane arterial road with direct access to I-93 (id.). Similarly, the Main Street segment of the Primary Route in Stoneham is a four-lane road with relatively high traffic volumes that provides access to the downtown Stoneham area from I-95 (to the north) and I-93 (via Montvale Avenue to the west) (id.). The Companies also identified Washington Street in Winchester and Woburn, and Salem Street in Wakefield as two-lane commuter routes (Exh. JP-1, at 6-21; Tr. 8, at 1470 to 1471). According to the Companies, the rest of the roadways along the Primary Route are medium volume, two-lane local roads (id.). Traffic data collected along the Primary Route indicated a morning peak

period between 7:00 a.m. to 9:00 a.m., and an afternoon peak period between 4:00 p.m. to 6:00 p.m. for most of the roadways (Exh. EFSB-T-1(1); Tr. 8, at 1387 to 1390).[90]

In order to mitigate potential traffic impacts, the Companies would work closely with all four municipalities to develop a traffic management plan ("TMP") for Project construction (Exh. JP-1, at 6-28). The Companies prepared a draft TMP and will produce a final TMP in consultation with the municipalities after Project design is completed (Exhs. EFSB-T-31; COM-BAS-1, at 5; Tr. 8, at 1390-1393; RR-EFSB-5(1); Companies Reply Brief at 35).

The Companies stated that Project traffic impacts would be temporary in nature and confined to the period necessary to construct the Project (Exh. JP-1, at 6-20). The draft TMP for the Primary Route indicated that the proposed Project impacts would include lane reductions, lane closures and roadway closures (RR-EFSB-5(1)). The Companies indicated that Lake Avenue in Woburn and Border Street in Winchester would have to be closed for regular trench construction (Exh. EFSB-T-19; RR-EFSB-5; Tr. 8, at 1412-1416). For approximately 90 percent of the Primary Route, including Pickering Street, Cross Street, Washington Street, Montvale Avenue, Elm Street, Albion Street, Broadway, and New Salem Street, the roadways are wide enough to accommodate the work zone and one eleven-foot travel lane; a police detail could control two-way alternating traffic on these roads (Exh. EFSB-T-19; RR-EFSB-5; Tr. 8, at 1403-1405). On the remainder of Primary Route roadways, including Main Street and in the vicinity of the I-93 interchange on Montvale Avenue, the Companies stated that they would be able to maintain two eleven-foot lanes, one in each direction (RR-EFSB-5; Tr. 8, at 1403-1405).

At trenchless crossing locations where construction would take place for a relatively extended period of time (i.e., two to four months), to mitigate traffic disruptions, the Companies would implement traffic and construction management measures (Exh. JP-1, at 6-24; Tr. 12, at 2263). The Companies noted that after consultation with local municipalities, roadways along

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[90] The seven segments are: Cross Street, Washington Street, Montvale Avenue, Main Street, Elm Street, Broadway, and Salem Street (Exh. EFSB-T-1(1)).

a route may be closed during trenchless crossings (Tr. 8, at 1508).[91] As discussed above, the Primary Route involves eight trenchless crossings with a potential for one additional trenchless crossing (Exh. JP-1, at 6-2; RR-EFSB-19).

The Companies would require their construction contractor(s) to obtain off-site parking for construction workers (Exh. EFSB-T-2). The Companies stated that the Woburn and Wakefield Junction Substations each have enough space to accommodate equipment staging areas and construction vehicles (Exh. JP-1, at 6-47, 6-50). The Companies do not anticipate a need for road closures at the substations either during material delivery or movement of construction equipment, but traffic control measures such as police details may be required to ensure that traffic continues to move smoothly (Exh. EFSB-T-12).

The Companies stated that construction work hours would be developed in consultation with each community (Exh. EFSB-T-4). For mitigating impacts along roadways that have high traffic volumes, the Companies stated that construction may be performed at night or during off-peak hours (id.). Night work is typically implemented in areas that exhibit the following characteristics: (1) road segments with high traffic volumes and congestion during the day; (2) adjacent land uses are primarily commercial and/or industrial; and/or (3) the municipality (or MassDOT, in the case of roads under state jurisdiction) require that construction occurs at night (Exh. EFSB-T-9). The Companies identified Montvale Avenue between Washington Street in Woburn and Lindenwood Road in Stoneham as a potential corridor for nighttime work, pending consultation with Woburn, Stoneham, and MassDOT; MassDOT and Woburn have both agreed that Montvale Avenue in Woburn would require nighttime construction (Exhs. EFSB-T-20; EFSB-T-26).[92] According to the Companies, municipal officials, residents, businesses, and representatives of other sensitive receptors that abut the Project route would be notified of

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91 The Companies noted that the Town of Wakefield indicated it prefers to maintain Broadway and Salem Street open only for local traffic in order to complete project construction quickly (Tr. 8, at 1465 to 1466).

92 MassDOT has jurisdiction over a section of Montvale Avenue between the ramps of I-93 in Woburn and over a small portion of Salem Street between the ramps of I-95 in Wakefield (Exh. EFSB-T-28).

upcoming scheduled construction using a combination of mail, e-mail, telephone and/or door-to-door outreach methods for notification (Exh. EFSB-T-3).

The Companies stated that access to schools and activities on school grounds would be maintained throughout Project construction (Exh. EFSB-T-13). The Companies proposed to limit construction work in front of the Doyle School, located off of Albion Street in Wakefield, to summer months (Tr. 8, at 1396-1397). The Companies identified that the Primary Route passes several school bus stops: three in Woburn, 16 in Winchester, two in Stoneham, and 17 in Wakefield (Exh. EFSB-T-13). At locations where public bus stops may be relocated, the Companies would coordinate with the MBTA or bus operating companies (Exh. EFSB-T-21). The Companies stated that the public would be informed about bus stop location changes through temporary signage, pamphlets, website updates, and/or social media notifications (id.).

To mitigate potential Project impacts on businesses on Montvale Avenue and Main Street, the Companies committed to working with appropriate departments in each community (e.g., police, DPW) to include in the TMP construction work hours that would allow efficient performance of work, and measures that provide acceptable access to local businesses (Exh. EFSB-T-17).[93] In particular, to maintain access to local businesses where many businesses have more than one access point, such as Montvale Avenue, the Companies would maintain at least one driveway open (Exh. EFSB-T-32). The Companies asserted that, in the unlikely situation where it is not possible to maintain access during business hours due to technical or other circumstances, the Companies would, to the extent possible, conduct the work activity during hours when the businesses are closed; the Companies would use "Business Open" signs where appropriate (id.).

Additional mitigation measures proposed by the Companies include: coordination with police and fire departments; communication with adjacent businesses so critical product deliveries are not interrupted by construction; notification of municipal officials, local businesses, and the public of the timing and duration of closed curbside parking spaces and travel

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[93] The Companies identified that there are a total of 142 businesses that have access to Montvale Avenue with 134 of these businesses sharing twelve parking lots (Exh. EFSB-T-18).

way restrictions; implementing traffic-control devices such as barricades, reflective barriers, advance warning signs, traffic regulation signs, traffic-control drums, flashers, detour signs, and other protective devices; routing and protection of pedestrian and bicycle traffic; and maintenance of access for emergency vehicles (Exh. JP-1, at 6-28 to 6-29). According to the Companies, traffic-control plans would be developed consistent with the Federal Highway Administration Manual on Uniform Traffic Control Devices and MassDOT requirements (id.). Furthermore, the Companies stated that they would plate over trenches at the end of each workday to make roadways available for traffic (Exh. JP-1, at 6-11; Tr. 12, at 2274-2275). Jacking pits at trenchless locations would not be steel plated, but the Companies would place safety barriers to protect the public (Tr. 8, at 1473-1474). Safety considerations at trenchless crossings are discussed in Section VI.C.7, below.

ii. Noticed Alternative Route

The Companies stated that the entire 8.0 miles of the Noticed Alternative Route travels within local roadways that can generally be characterized as two-lane local arterials of medium to high traffic volume (Exh. JP-1, at 6-24). Along the Noticed Alternative Route, the Companies identified Summer Street and Forest Street as commuter routes (id.; Tr. 8, at 1470-1471). Similar to the Primary Route, for approximately 90 percent of the Noticed Alternative Route, the Companies would maintain one eleven-foot travel lane with two-way traffic alternating under police detail (Exh. EFSB-T-19). The Companies do not plan to develop a TMP for the Noticed Alternative Route (Exh. EFSB-T-6).

As discussed in Section VI.B.3, above, the Project along the Noticed Alternative Route would require subsurface crossings of five waterbodies and two active railroad ROWs (Exh. JP-1, at 6-24). Similar to the Primary Route, temporary disruptions to traffic and abutting residences and businesses along the Noticed Alternative Route may occur at these subsurface crossings, and would require traffic and construction management measures to mitigate potential impacts (id.). In addition, the Noticed Alternative Route includes the crossing of I-93 via HDD at the Forest/Marble Street Bridge near the Winchester/Stoneham border (id.). The drilling process at this HDD crossing is estimated to last three to four months, with additional

construction time required for cable pulling and splicing (id.). During this period, traffic on Forest Street would likely be disrupted, with one lane of Forest Street closed during the pull-back process (id.). According to the Companies, Forest Street experiences congestion at its intersection with Washington Street in Winchester; although work to cross the railroad ROW and Aberjona River would be completed at some distance from this intersection, nevertheless construction may increase traffic congestion along Forest Street (id.).

Comparing potential Project traffic impacts along the Primary Route and the Noticed Alternative Route, the Companies stated that, although segments of the Primary Route such as Montvale Avenue, Main Street, and Elm Street have relatively high traffic volumes, additional traffic impacts along the Primary Route are reduced by the simpler crossing of I-93 on Montvale Avenue and by using the inactive Wakefield railroad ROW in that section (Exh. JP-1, at 6-27). By contrast, work on or adjacent to Forest Street/Marble Street at the Noticed Alternative Route's I-93 crossing would potentially cause significant traffic impacts for a three-to-four month period along a roadway with known traffic congestion (id.). The Companies concluded that traffic management challenges are similar along both the Primary and the Noticed Alternative Routes (id. at 6-28). Each route traverses a congested town center and requires complex trenchless construction techniques that could result in extended lane closures (id.). Either route would require development of TMPs and close coordination with affected municipalities to ensure that traffic delays are minimized (Exh. JP-1, at 6-24, 6-28). The traffic management measures would include the use of police details and implementation of detours and lane closures (id. at 6-28). The Companies concluded that overall, the Primary Route and the Noticed Alternative Route are comparable with respect to traffic impacts (id.; Exh. EFSB-T-19).

b. Positions of the Parties

With respect to Project traffic impacts, Winchester proposed a list of measures that should be implemented if the Project is approved along the Primary Route. Similarly, Stoneham listed specific mitigation measures to address its concerns including measures to mitigate traffic impacts along Stoneham's Main Street Hybrid Route. Wakefield's comments were limited to comparing the Primary Route and Stoneham's proposed Main Street Hybrid Route with respect

to potential Project traffic impacts. Positions of Winchester and Stoneham are described below. Wakefield's issues with the Main Street Hybrid Route are addressed in Section V, above.

i. Winchester

Winchester asserts that a full or partial closure of Cross and Washington Streets would worsen traffic congestion in Winchester because these roadways serve as local and regional transportation routes (Exhs. TOW-KC-1, at 3; TOW-BR-1, at 11; Winchester Brief at 6). Winchester notes that Washington Street in particular is very congested in the morning as it provides access to Muraco Elementary School and Winchester Town Center, where the McCall Middle School, Winchester High School, and Winchester Center Commuter Rail Station are located (Exh. TOW-BR-1, at 11-12; Winchester Brief at 7). Winchester also maintains that the proposed jack-and-bore construction on Cross and Washington Streets would require closure of these roads for a period of weeks to months, resulting in severe impacts to abutting properties and traffic patterns in the rest of the town (Exh. TOW-BR-1, at 12; Winchester Brief at 7). Furthermore, Winchester contends that construction of the Project may cause disruption and delays to emergency vehicle access and school bus schedules (Exh. TOW-BR-1, at 13; Winchester Brief at 7). Winchester also argues that the proposed jack-and-bore on Washington Street would completely isolate the Ambulatory Care/Cancer Care Center, as well as ten homes and the Calvary Cemetery located north of the Aberjona River crossing, from the rest of Winchester; these properties would then only be accessible through Woburn (Exh. TOW-BR-1, at 12; Winchester Brief at 7).[94]

In order to mitigate Project traffic impacts, Winchester recommends that the Companies implement the following measures: (1) clearly detail in bid documents adequate control of work provisions to mitigate issues related to impacts to abutters; (2) develop work provisions that comply with any related regulations governing access along emergency evacuation routes;

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[94] Winchester's fire chief testified that the Winchester Fire Department relies heavily on Washington Street to respond to fire and rescue incidents and to transport ill and injured patients to the Winchester Hospital Emergency Department (Exh. TOW-JN-1, at 2; Winchester Brief at 6).

(3) perform a "comprehensive analysis of daily traffic control" based on anticipated construction means and methods and prevailing work hour limitations; (4) identify staffing capacities and anticipated shortfalls to adequately address secondary resources to provide sufficient enforcement of public safety during construction; and (5) coordinate with local emergency management services to comply with prevailing regulations (Exh. TOW-BR-1, at 13). Winchester argues that Cross Street is an important access road to the town's school district (Tr. 9, at 1709-1713). To protect the safety of school children that walk across Cross and Washington Streets, Winchester proposes that the Companies start construction at 9:00 a.m. (id.).

ii. Stoneham

Stoneham's concerns with respect to the Primary Route include: (1) the ability to maintain safe and efficient access and circulation during construction activities; (2) the proximity of the Primary Route to Stoneham Central Middle School and impacts to school access routes that are already overburdened during school drop-off/pick-up periods; (3) availability of police details to staff the construction zones; (4) access to abutting properties and senior housing facilities; (5) public transportation accessibility; (6) pedestrian and bicycle accommodation; and (7) impacts to emergency vehicle response and access to medical facilities during construction (Exh. TOS-JD-1, at 3-4; Stoneham Brief at 7-8). Stoneham asserts that Montvale Avenue is a central traffic artery in the town; and eliminating a travel lane, which would be required during Project construction, would slow emergency vehicle responses and would have a negative effect throughout the Town (Exh. TOS-JD-1(2) at 4; Stoneham Brief at 8).[95] Furthermore, Stoneham's

[95] Stoneham's fire chief stated that construction along Montvale Avenue, Main Street, and Elm Street would impact Stoneham Fire Department responses to surrounding communities that are part of the Massachusetts MetroFire mutual aid association (Exh. TOS-MG-1, at 3-4; Stoneham Brief at 10). According to Stoneham's fire chief, the agreement provides for mutual aid among local fire departments particularly when a fire is too large for a single community (Stoneham Brief at 10). Stoneham indicated that the town follows the National Fire Protection Association response time goal of 240 seconds or less for the arrival of the first engine at a fire (Exh. TOS-MG-1, at 6; Stoneham Brief at 10). Stoneham's concern was shared by Michael Woronka, chief executive officer of Action Ambulance, Inc., a regional ambulance company based in Wilmington (Tr. 9, at 1602-1612; Stoneham Brief at 11).

traffic consultant asserts that because of the high volume traffic on Montvale Avenue, maintaining one-lane alternating traffic, as proposed by the draft TMP, would significantly worsen traffic congestion in Stoneham; Stoneham's traffic consultant maintains that it is essential that nighttime construction be required on Montvale Avenue (Tr. 9, at 1554-1555). Stoneham also notes that construction work zones could impact access to multiple businesses simultaneously along the Primary Route (Exh. TOS-JD-1(2) at 4; Stoneham Brief at 8).

In order to mitigate Project traffic impacts along the Primary Route, Stoneham recommends that the Companies adopt the following mitigation measures: (1) construction on Main Street, which currently provides on-street parking for businesses and residents, must provide for mitigation of the loss of on-street parking; (2) construction near the Stoneham Central Middle School should be limited to Monday through Friday 9:00 a.m. to 1:00 p.m. with some nighttime work, avoiding school drop-off and pick-up periods;[96] (3) jack-and-bore work on Central and Elm Streets in the vicinity of the Stoneham Central Middle School must be limited to summer season when school is not in session; (4) Elm Street should not be used given space constraints and the number of residences and businesses, and because it provides access to the important resources for the Stoneham Senior Center, St. Patrick's Cemetery and the Stoneham Housing Authority; (5) Eversource should provide funding to station an engine company (one fire truck, two fire fighters and one officer) on Elm Street (on the opposite side of construction from the fire station) during construction; and (6) the Companies should develop a detailed TMP that includes adequate provisions on police details (Exhs. TOS-MG-1, at 7; TOS-JD-1(2) at 4-6; Tr. 9, at 1607; Tr. 10, at 1931-1932; Stoneham Brief at 8-10). In addition, to minimize traffic impacts, Stoneham recommends that construction on Montvale Avenue in Stoneham be limited to nighttime hours (Exh. TOS-JD-1(2) at 5).

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[96] A study conducted by Stoneham's traffic consultant indicated that traffic flow and operating conditions along Main Street are strongly influenced by the Stoneham Central Middle School (Exh. TOS-JD-1(2) at 5). According to this study, during school drop-off/pick-up periods, the segment of Main Street between and including William Street and Elm Street is congested (id.). The consultant recommends that, to minimize traffic impacts in the vicinity of the school, construction activities be suspended during school drop-off/pick-up periods, or, alternatively, construction limited to overnight hours (id.).

iii. Companies' Response

(A) Response to Winchester

The Companies dispute Winchester's characterization of the extent and scope of necessary road closures (Tr. 8, at 1498-1499; Companies Reply Brief at 36). The Companies assert that there is no need to close Cross Street and Washington Street for an extended period of time (Companies Reply Brief at 36). The Companies argue that, although some select activities or limited portions of the Project construction work could potentially require temporary closure and detour of a particular roadway, the need for such closures and detours along the Primary Route is under ongoing evaluation and would be coordinated with the relevant municipality (id.). The Companies further argue that, even if it were determined that Cross Street would need to be closed for an extended period of time, Winchester has closed Cross Street before for approximately six to eight weeks over the summer to implement part of the town's long-term flood mitigation program (id., citing Tr. 9, at 1696).[97] The Companies assert that, to the extent detours of Cross Street are warranted, there is precedent for a reasonable solution (Companies Reply Brief at 36 n.39, citing Tr. 9, at 1697).

The Companies aver that Project construction, on the northbound side of Washington Street, would under no circumstances simultaneously block the two entrance driveways to the Winchester Cancer Center, located on the southbound side of Washington Street (Tr. 8, at 1450). To minimize traffic impacts at the Winchester Cancer Center, the Companies commit that they would meet with facility officials regarding their traffic concerns, develop a specific

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[97] Winchester indicated that it was able to detour ambulances via Swanton Street during construction of this flood mitigation Project (Companies Reply Brief at 36 n.39; Tr. 9, at 1696-1697). Winchester's town engineer stated that the implementation of the long-term flood mitigation program involved the installation of an additional culvert where Cross Street crosses the Aberjona River, the same location that the Companies are proposing a trenchless crossing for the Project (Tr. 9, at 1696). The Town engineer maintains that traffic patterns have since changed significantly as commuters are now cutting through Winchester (id. at 1697). In addition, the director of the Winchester Department of Public Works stated that, although detouring traffic down Swanton Street worked in the past, the town is now proposing a similar flood mitigation culvert installation project on Swanton Street (id.).

construction schedule for the site with the Town of Winchester, and arrange for police details to assist with traffic management and ensure emergency vehicle access (id. at 1450-1451; Exh. EFSB-T-33).

(B) Response to Stoneham

To minimize potential impacts to businesses on Montvale Avenue and Main Street in Stoneham along the Primary Route, the Companies commit to working with appropriate departments in Stoneham to develop a TMP to include hours of construction and signage that would allow an efficient performance of the work required and provide acceptable access to local businesses during construction (Companies Brief at 25-27). The Companies represent that, as of November 2015, they have conducted door-to-door outreach efforts to all 195 businesses along the Primary Route on Montvale Avenue and Main Street and are committed to continuing to communicate with these businesses (id.; Exh. EFSB-G-3).

With respect to Stoneham's concerns about construction near Stoneham Central Middle School, which the Companies stated is located 1,300 feet from the Primary Route, the Companies commit to performing work near the school in the summer when there is less school-related traffic (Exh. COM-SF/JP-1, at 5; Companies Reply Brief at 15).

The Companies argue that construction on Elm Street would not materially affect emergency response times because police details have the ability to halt all traffic and provide emergency vehicles the right of way (Companies Reply Brief at 15). The Companies commit to working with Stoneham to identify reasonable detours around the work zone on any given day (id. at 16).

c. Analysis and Finding

The record shows that construction of the Project along either the Primary Route or the Noticed Alterative Route would result in traffic impacts that include lane reductions, lane closures, and roadway closures. Comparison of the two routes with respect to traffic impacts shows that the Noticed Alternative Route is a shorter route and avoids relatively high traffic volume segments such as Montvale Avenue, Main Street, and Elm Street. The Noticed

Alternative Route also would involve one fewer trenchless crossing than the Primary Route, which may reduce traffic impacts. However, the Noticed Alternative Route generally consists of narrower streets which could pose traffic management issues. Also the Noticed Alternative Route would require an HDD crossing of I-93 which would result in several months of traffic impact at the Winchester/Stoneham town line. Furthermore, about one mile of the Primary Route is on an inactive railroad ROW, lessening traffic impact. Finally, each route travels on roadways through a congested town center (Stoneham and Wakefield, respectively). Therefore, the Siting Board finds on balance that overall traffic impacts of the Project along the Primary Route and the Noticed Alternative Route are comparable.

The record shows that traffic is one of the most significant construction impacts associated with the Project given that there is already moderate to high traffic along much of the Primary Route, especially during peak commuter periods. To minimize traffic delays, the Project along either route would require the development of a TMP and close coordination with the affected municipalities. The record shows that Project traffic impacts on high volume roadways on either route could be minimized by scheduling construction to nighttime hours or to hours that avoid peak commuter periods. Nighttime work is typically implemented in areas that exhibit the following characteristics: (1) segments that experience high traffic volumes and congestion during the day; (2) adjacent land uses are primarily commercial; and/or (3) the municipality or MassDOT has required/approved nighttime work. The record shows that, Montvale Avenue (starting at the intersection of Washington Street in Woburn to Lindenwood Road Stoneham) meets the Companies' criteria for nighttime work, pending approval from each municipality and MassDOT. In addition, the record shows that MassDOT and Woburn have agreed that Montvale Avenue west of Lindenwood Road in Stoneham requires nighttime construction. Therefore, the Siting Board directs the Companies to limit construction to nighttime hours on Montvale Avenue in Woburn from the Washington Street intersection to the Woburn/Stoneham border. The Siting Board encourages the Companies, along with state and local authorities, to give consideration to the three criteria that the Companies identified as relevant in deciding whether to require additional nighttime construction. Further, state and local authorities should give careful consideration to enforcing a time-of-day limitation that restricts

construction during peak traffic hours in the vicinity of schools, medical facilities, and businesses.

The record shows that the Companies would maintain access to residences and businesses along the Project. The record also shows that Montvale Avenue in Stoneham is an important local artery with a relatively high traffic volume and extensive commercial development. To mitigate impact to local businesses on Montvale Avenue in Stoneham, the Companies committed to maintaining at least one entrance to businesses at all times. To further mitigate traffic impacts on Montvale Avenue, Stoneham's traffic consultant recommended limiting construction on Montvale Avenue in Stoneham to nighttime hours. Given the high traffic volume on Montvale Avenue, limiting traffic flow to one-lane two-way alternating traffic would exacerbate traffic congestion in Stoneham. Considering adjacent land uses and the town's recommendation, the Siting Board directs the Companies to limit construction on Montvale Avenue in Stoneham to nighttime hours.

Winchester has traffic- and safety-related concerns regarding the construction of trenchless crossings on Cross and Washington Streets, especially during the school year. Stoneham has similar concerns regarding the proposed trenchless crossing on Elm Street. The Companies have committed to limiting construction near Central Middle School in Stoneham and Doyle School in Wakefield to summer months. The Siting Board supports these plans and directs the Companies, to the extent practicable, to limit trenchless crossings construction on Cross and Washington Streets in Winchester to summer months when school is not in session. The Siting Board also directs the Companies to start typical construction on Cross and Washington Streets no earlier than 9:00 a.m. on school days.

The record shows that Winchester and Stoneham are concerned that extended lane and roadway closures on Cross and Washington Streets in Winchester and Montvale Avenue and Elm Street would result in emergency vehicle response delays and medical facility access constraints. The record also shows that the Companies have committed to coordinate with the medical facilities and municipalities to minimize delays in emergency vehicle response time and allow access to medical facilities. The Siting Board emphasizes the importance of these commitments and fully expects the Companies to make emergency and medical access a priority.

The Siting Board notes that the Companies indicated that, as part of the TMPs, it would address community outreach and notification to residents and businesses relevant to traffic issues. Because the Project requires approximately 7.5 miles of in-street construction through four municipalities, each TMP likely would be an extensive document. Community outreach and notification will be critical to the success of the Project for all impacts. As a result, the Siting Board directs the Companies, in consultation with Woburn, Winchester, Stoneham, and Wakefield to develop a separate, comprehensive outreach plan for the Project. The outreach plan should describe the procedures to be used to notify the public about: the scheduled start, duration, and hours of construction in particular areas; the methods of construction that will be used in particular areas (including any use of nighttime construction); and the anticipated street closures and detours. The outreach plan should also include information on complaint and response procedures, Project contact information, the availability of web-based project information, and protocols for notifying the MBTA and schools of upcoming construction.

The Siting Board also directs the Companies to submit a copy of the final TMPs to the Siting Board and all other parties when available, but no less than 30 days prior to the commencement of construction, and to publish them on a Project website with links from each Company's public website.

With the implementation of the TMP condition and schedule-related conditions imposed below in Section VI.C.4, the Siting Board finds that traffic impacts from construction and operation of the Project along the Primary Route would be minimized.

4. Noise

a. Companies' Description

i. Introduction

The Companies stated that, along either the Primary Route or the Noticed Alternative Route, noise associated with the construction of the proposed Project may result in temporary elevated sound levels near abutting receptors (Exh. JP-1, at 6-36, 6-38). Transmission line construction would generate noise levels that are periodically audible at staging areas, manhole installation and trench excavation sites, conductor pulling and splicing sites, and trenchless

construction locations (id. at 6-36; RR-EFSB-26). The potential for noise impacts from Project construction is a function of proximity of receptors to work zones, the equipment used, and the proposed hours of construction (Exh. JP-1, at 6-36). Maximum sound levels from typical transmission line construction equipment range from 82 to 90 dBA at a distance of 50 feet (id. at 6-37).[98]

ii. Primary Route

The Companies reported that along the Primary Route there are approximately 260 residences located within 50 feet from the proposed duct bank and manhole locations, with the closest residence and the closest business measured at 17 feet and 33 feet from the duct bank respectively (Exh. EFSB-NO-2).[99] Based on field measurements recorded from a comparable underground transmission line installation project, the Companies reported that maximum sound levels would range from 66 to 92 dBA at the closest residence and from 61 to 87 dBA at the closest business (id.). The Companies stated that noise levels from construction experienced by a person inside a building would be attenuated significantly by the structure (Exh. EFSB-NO-1). According to the Companies, sound levels can be expected to be reduced by up to 17 dBA in homes even with windows open, and by up to 27 dBA lower indoors with the windows closed (id.).

The Companies stated that manhole installation and trench excavation typically are the loudest phases of construction (Exh. JP-1, at 6-38). The Companies noted that along either route, the Companies do not anticipate any blasting; if required, removal of rock would typically be completed with an excavator or hydraulic hammer (Exh. EFSB-NO-14). The Companies

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98 The source for these figures is the U.S. Environmental Protection Agency ("USEPA"). Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances prepared by Bolt, Beranek and Newman, Report No. NTID300.1, December 31, 1971; and Thalheimer, E., "Construction Noise Control Program and Mitigation Strategy at the Central Artery/Tunnel Project", Noise Control Eng. Journal 48 (5), 200-Sept-Oct (Exh. JP-1, at 6-37).

99 This residence is located at 324 Albion Street in Wakefield while the business is a daycare located at 14 Border Street in Winchester (Exh. EFSB-NO-2).

stated that the use of such equipment would temporarily increase noise levels (Exh. JP-1, at 6-38).[100] In general, the Companies indicated that construction hours would be Monday to Saturday from 7:00 a.m. to 5:00 p.m., though in specific instances, at some locations, or at the request of the DPW of any given municipality, the Companies may seek municipal approval to work at night (see Section VI.C.3, above) (id. at 6-36). In residential areas, the Companies proposed Saturday construction from 9:00 a.m. to 5:00 p.m. (Exh. EFSB-NO-6).

The Companies stated that noise-generating equipment associated with cable splicing at manhole locations includes a splicing van with ventilation fans and an electric generator at each manhole location, but in general the cable pulling and cable splicing phases are not expected to generate significant noise (Exh. JP-1, at 6-38). Along the Primary Route, the Companies identified 31 residences and six industrial or commercial structures within 50 feet of a manhole edge, with all locations at least 20 feet away or beyond (Exh. EFSB-NO-3). Noise levels at a residence 20 feet away from a splice location are predicted to range from 68 to 75 dBA (id.). Splicing activities would not be continuous, but would take place over four or five twelve-hour work days at each manhole location (Exh. JP-1, at 6-38). To mitigate noise from splicing, the Companies would use a low-noise/muffled generator, portable sound walls (temporary noise barriers) as needed, blocking the path of generators, and working with municipalities to coordinate work (id.; Exh. EFSB-NO-4).

At jack-and-bore locations, maximum sound levels associated may range from 80 dBA to 89 dBA at a distance of 50 feet (RR-EFSB-26). The nearest residence to a jack-and-bore location is at 134 Salem Street, Wakefield, located 26 feet away (id.). At this residence, maximum noise levels are predicted to range between 86 dBA and 95 dBA (id.). The Companies stated that jack-and-bore and pipe-jacking would produce similar noise levels and would require two to three months of construction (Tr. 12, at 2261-2263).[101]

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[100] According to the Companies, the Project may encounter ledge along either the Primary Route or the Noticed Alternative Route (Tr. 12, at 2263; RR-EFSB-2(1)).

[101] As discussed in Section VI.C.3, to minimize impacts on schools located in the vicinity of trenchless crossings, the Companies proposed to limit trenchless constructions to summer months when schools are not in session (Tr. 8, at 1396-1397; Tr. 9, at 1580, 1591-1592).

The Companies stated that they typically do not use temporary noise barriers unless a complaint is made that cannot be resolved through other measures (Exh. EFSB-NO-10). The Companies contend that temporary noise barriers would add to construction duration due to the need to assemble and disassemble the barriers on a daily basis (id.; RR-EFSB-24).[102] The Companies stated that based on recent measurements performed by Eversource, sound barriers typically provide a 5 to 10 dBA reduction in noise levels (RR-EFSB-24). The Companies indicated that, if there are complaints of excessive noise, they would consider additional mitigation measures in consultation with the affected municipality including use of temporary noise barriers (Exhs. EFSB-NO-10; EFSB-NO-13).[103]

As discussed in Section VI.C.1, land uses adjacent to the Woburn Substation include residential development and a recreational area (Exh. JP-1, at 6-45). The Companies reported that work at the Woburn Substation would take place intermittently over an approximately 20-month period (id.). During this time, nearby residences may be affected by elevated noise levels associated with a construction site (id. at 6-46). Eversource conducted a study for operational noise associated with equipment proposed as part of this Project and the cumulative impact of two other projects proposed at the Woburn Substation (id.). Noise study results showed that noise increases at the nearest property line associated with the three projects is predicted to be at or below seven dBA at the quietest nighttime hours (and four dBA at the nearest residence) (id. at 6-46 to 6-47; Exh. JP-2, app. 6-7, at 5-5).

To minimize operational noise impacts at the Wakefield Junction Substation that would be associated with the installation of a new shunt reactor, the Companies would install a 15-foot-high, 260-foot-long sound wall along the southern and western fencelines (Exh. EFSB-G-11). According to the Companies, as a result of this measure, proposed

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102 The Companies stated that there are two types of sound barriers, rigid sound walls and dampening blankets (curtains) (RR-EFSB-24). Comparatively, rigid sound walls are more effective in blocking sound (id.).

103 Stoneham recommended that construction vehicles, generators, and lighting power units be equipped with noise mufflers (such as Whisper Watt or similar low noise generators used for cable splicing), and that sound mitigation barriers for nighttime work be used as necessary (Tr. 9, at 1571-1572, 1575; Stoneham Brief at 9).

modifications at the Wakefield Junction Substation would not result in any noise increases at any of the sensitive receptor locations (Exhs. JP-1, at 6-50; EFSB-NO-32). The Project is not expected to create pure tone conditions (Exh. JP-1, at 6-50).

To mitigate construction noise at abutting receptors along the Project route and nearby residences to the Woburn and Wakefield Junction Substations, the Companies plan to: (1) require well-maintained equipment with functioning mufflers; (2) require strict compliance with MassDEP anti-idling regulations; (3) operate stationary noise generating equipment away from nearby residences; and (4) comply with municipal restrictions on construction hours when feasible, and work with municipalities to schedule construction outside these hours where necessary (Exh. JP-1, at 6-46, 6-49).

iii. Noticed Alternative Route

The Companies stated that construction related noise would be similar along most of the Primary Route and the Noticed Alternative Route (Exh. JP-1, at 6-38). However, construction of the Noticed Alternative Route would require extended HDD operations over three to four months at the Forest/Marble Street location in Winchester and Stoneham (id.). Noise from the drilling operations would likely affect residences on the western side of I-93, and residences on Hill Street and in the adjacent apartment/condominium complex on the eastern side of I-93 (id.). The Companies stated that HDD equipment would be staged within 50 to 100 feet of nearby residences (Exh. EFSB-NO-16). Based on recent sound monitoring completed at a similarly-sized HDD site, the Companies predicted that noise levels would range from 57 to 73 dBA at residences within 50 feet and from 51 to 67 dBA at residences within 100 feet (id.). The Companies stated that location of manholes and other operational details have not been designed for the Noticed Alternative Route (Exh. EFSB-NO-9).

Comparing the Primary Route and the Noticed Alternative Route in terms of noise impacts, the Companies concluded that, because the Primary Route does not require a similar high-impact crossing (HDD), it is superior to the Noticed Alternative Route (Exh. JP-1, at 6-39).

b. Analysis and Findings

The relative impact of construction-related sound along the Primary and Noticed Alternative Routes depends on the proximity of active work zones to residences, businesses, and other sensitive receptors, as well as the number and type of trenchless crossings along each route. The record shows that compared to the Noticed Alternative Route, the Primary Route traverses relatively wider roadways and abuts fewer residences, while it would involve one more additional trenchless crossing. The Siting Board finds that the Primary Route and the Noticed Alternative Route are comparable in terms of Project noise impacts.

Construction of the Project would produce appreciable noise impacts along the entire route, and particularly in residential areas in all four municipalities. The record shows that typical Project construction noise could be as high as 92 dBA at the outside edge of the closest residential structures. In addition, noise from trenchless crossings could be as high as 95 dBA at the nearest residence.

Receptor locations that would have the longest duration of construction noise impacts would be adjacent to trenchless crossings, where construction might take two to four months. In order to minimize noise impacts at these locations, the Companies commit to using best management practices and to limiting construction near schools to summer months. The noise levels likely to be generated by trenchless construction suggest that trenchless crossings could be disruptive in those residential areas where entry and exit pits are located in close proximity to homes. The Siting Board therefore directs the Companies to use portable noise barriers in locations where there are residences, commercial businesses, and other sensitive receptors within 100 feet of trenchless crossing entry and exit pits.

The record shows that cable splicing would not be a continuous operation and is expected to occur over extended 12-hour workdays. In order to minimize noise impacts from cable splicing operations, the Siting Board directs the Companies to use the quietest generators and portable HVAC units reasonably available to them. In addition, when the Companies operate noisy equipment, such as whole tree chippers or compressors, the Siting Board directs that such equipment be located as far away as possible from nearby residences, where possible, to reduce noise impacts on residences.

With regard to operational noise associated with the proposed Project, there would be moderate increases in existing sound levels at the Woburn Substation as a result of this Project and the other two Woburn projects: NSTAR Electric Company, D.P.U. 15-85 (2016) ("Woburn Substation") and Mystic-Woburn. At the Wakefield Junction Substation, given proposed mitigation, there would be no overall increases in existing sound levels at receptor locations.

With regard to construction noise impacts, the Siting Board finds that, with the exception of Saturday construction, the Companies' proposed construction hours are reasonable. The Companies shall restrict Saturday work at the Woburn and Wakefield Junction Substations to large equipment deliveries and to quiet assembly and testing activities. See Woburn Substation at 27 (2016); Mystic-Woburn at 62-63.[104] Because the in-street construction is in close proximity to many residential areas, including where homes are within 50 feet of the ROW, the Siting Board directs the Companies to limit construction of the transmission line to Monday through Friday from 7:00 a.m. to 5:00 p.m. in residential areas, except for Montvale Avenue in Woburn and Stoneham which would be constructed at night. Work that necessarily has a longer required extended duration than normal construction hours allow, such as cable splicing, shall be exempted from this condition. Should the Companies need to extend construction work beyond those hours and days (with the exception of emergency circumstances on a given day that necessitate extended hours), the Siting Board directs the Companies to seek written permission from the relevant municipal authority before the commencement of such work and to provide the Siting Board with a copy of such permission. If the Companies and municipal officials are not able to agree on whether such extended construction hours should occur, the Companies may request prior authorization from the Siting Board and shall provide the relevant municipality with a copy of any such request.

The Companies shall inform the Siting Board and the relevant municipality in writing within 72 hours of any work that continues beyond the hours allowed by the Siting Board.

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[104] In Woburn Substation, Eversource stated that Saturday construction activities would be limited to large equipment deliveries, and to quiet assembly and testing activities. Woburn Substation at 27. Therefore, the Siting Board allowed Eversource to construct on Saturday from 9:00 a.m. to 5:00 p.m., with Saturday construction activities limited to large equipment deliveries and to quiet assembly and testing activities. Id.

The Companies shall also send a copy to the Siting Board, within 72 hours of receipt, of any municipal authorization for an extension of work hours. Furthermore, the Companies shall keep records of the dates, times, locations, and durations of all instances in which work continues beyond the hours allowed by the Siting Board or, if granted extended work hours in writing by a municipality, work that continues past such allowed hours. The Companies must submit such records to the Siting Board within 90 days of Project completion.

With the implementation of the above noise conditions, the Siting Board finds that noise impacts from construction and operation of the Project along the Primary Route would be minimized.

5. Visual

a. Companies' Description

Companies stated that the Project would not create significant visual impacts to abutters (Exh. JP-1, at 6-34). The Companies stated that because the transmission line is to be located underground, the only permanent visual impact along the route is associated with the vegetation clearing along the Wakefield railroad ROW on the Primary Route (id.). The Wakefield railroad ROW has not been in active use for many years and, due to lack of maintenance, the area is overgrown with small saplings, trees, and brush along the majority of its length, some portion of which would be removed (id.). According to the Companies, the visual buffer created by the existing vegetation along the Wakefield railroad ROW in the vicinity of abutting residences may be affected by tree and vegetation clearing (id.). Assuming that installing the New Line within this ROW would require an average width of 30 feet of cleared land, the Companies estimated that they would need to remove a total of 550 trees to facilitate construction, noting that roughly half of these trees are considered invasive or undesirable species (Exh. STEW-1-1). The Companies committed to retain mature trees along the edges of the Wakefield railroad ROW to the extent possible (id.). Some or all of this clearing would also be needed to develop the ROW into a recreational path (Exh. JP-1, at 6-34). To mitigate the effects of tree and brush removal from the Wakefield railroad ROW, and for visual improvement, the Companies would consult

with the Town of Wakefield and the Wakefield Conservation Commission regarding whether to provide additional vegetative screening (Exh. EFSB-W-5).

The Companies stated that field reconnaissance showed that there are 134 public shade trees along the Primary Route, compared to 186 public shade trees along the Noticed Alternative Route (Exh. EFSB-V-4). According to the Companies, Project construction in paved roadways would not require the removal of any trees along either the Primary Route or the Noticed Alternative Route and is not anticipated to have any direct impacts (id.; Exhs. JP-1, at 6-33).[105] The Companies anticipated no permanent visual impacts along the Noticed Alternative Route associated with the Project (Exh. JP-1, at 6-34).

In comparing the Primary Route and the Noticed Alternative Route in terms of visual impacts, the Companies noted that the Noticed Alternative Route has more public shade trees, and asserted that the clearing of trees along the Wakefield railroad ROW along the Primary Route would be "minimal" (Exhs. EFSB-V-4; Exh. JP-1, at 6-34). On this basis, the Companies concluded that the Primary Route and the Noticed Alternative Route are comparable with respect to visual impacts (Exh. JP-1, at 6-34).

The Companies stated that potentially sensitive abutters to the Woburn Substation include residences along Pond Street to the east and a recreation path that extends around Horn Pond northwest of the property (Exh. JP-1, at 6-45). Most proposed equipment improvements to the Woburn Substation would be installed along the northern side of the substation, within the existing fence line (id.). In addition, the Woburn Substation itself is screened from Pond Street by an existing brick building located on the substation property (id.). The Companies stated that some existing vegetation screening already protects views of some abutting residences, but Eversource is currently engaging a landscape architect to develop a

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105 To minimize potential impact on public shade trees located along paved roadways, the Companies would implement two types of measures (Exh. JP-1, at 6-33). Where trees are encountered within 15 feet of trench edges, they would be protected from bark and limb damage by surrounding them with wire-bound lumber to a height of eight feet; alternative tree protections may be used if accepted in advance by the property owner(s) (id.). If tree roots are encountered during excavation, mechanical excavation would cease, roots would be exposed by hand to the extent possible, and would be kept moist and covered with wet burlap or plastic throughout the exposure period (id.).

planting plan for the site to improve its overall appearance from the recreation path as well as Lake Avenue/Pond Street (id.).[106]

With respect to the Wakefield Junction Substation, the Companies stated that the substation is separated from Montrose Avenue by an approximately 600-foot-long driveway that extends through forested land (Exh. JP-1, at 6-49). According to the Companies, this forested area screens the Wakefield Junction Substation visually from nearby neighborhoods and other land uses (id.). As discussed in Section VI.C.4, above, the Companies propose a 15-foot sound wall that would replace the existing fence which consists of a seven feet of chain link and one foot of barbed wire (Exh. EFSB-V-11). The Companies provided a visual rendering showing that the proposed 15-foot sound wall would screen views of some of the substation and asserted that other proposed modifications to the Wakefield Junction Substation would have no visual impact to neighboring locations, as the modifications would be contained within the existing substation (Exhs. JP-1, at 6-49; EFSB-V-10(S)).

b. Analysis and Findings

The record shows that the proposed Project is an underground transmission line that mostly travels in town streets, and therefore there are no permanent visual impacts associated, except for portion of the route along the Wakefield railroad ROW. Compared to the Noticed Alternative Route, the Primary Route involves some permanent clearing of trees along the Wakefield railroad ROW. However, the Siting Board notes that the Companies have committed to consult with the Town of Wakefield and the Wakefield Conservation Commission about installing vegetative screening along the Wakefield railroad ROW. On this basis, the Siting Board finds that the Noticed Alternative Route is slightly preferable to the Primary Route with

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106 The Companies stated that, in association with work previously approved by the Department at the proposed Woburn Substation, Eversource proposed to replace the existing chain link fence between the Woburn Substation and Horn Pond Recreation Area with a brick pillar and narrow-gauge black mesh fence and add landscaping (Exh. JP-1, at 6-45). In addition, Eversource proposed landscaping along the fence outside of the substation boundary on City of Woburn property (Exh. JP-1, at 6-45). See Woburn Substation at 16.

respect to Project visual impacts. To further minimize visual impact associated with tree clearing within the Wakefield railroad ROW, the Siting Board directs the Companies to avoid removing mature trees to the extent possible. In addition, in areas along this inactive railroad ROW where visual impacts may occur as a result of tree clearing, the Siting Board directs the Companies to work with the Town of Wakefield and the Wakefield Conservation Commission and offer, on a case by case basis, appropriate off-site screening for residences affected by tree-clearing along the Wakefield railroad ROW. See Walpole Holbrook at 50; GSRP at 104-106; Hampden County at 54.

With respect to visual impacts at the Woburn Substation, the record shows that Eversource is engaging a landscape architect to develop a planting plan for the substation to improve its overall appearance from the recreation path as well as Lake Avenue/Pond Street. The Siting Board supports Eversource's plan and directs the Companies to submit to the Board the final landscaping plan for the Woburn Substation when it becomes available. At the Wakefield Junction Substation, the Companies are replacing the existing fence with a 260-foot-long, 15-foot-tall sound wall along the southern and western fencelines. The record shows that there are no adverse visual impacts associated with the proposed sound wall or other proposed modifications at the Wakefield Junction Substation.

With the implementation of the visual mitigation measures proposed by the Companies, the Siting Board finds that visual impacts from the construction and operation of the Project along the Primary Route would be minimized.

6. Magnetic Fields

a. Background

A magnetic field is created whenever current flows in a conductor, and therefore the New Line would induce magnetic fields (Exh. JP-1, at 6-34). Magnetic fields increase when current increases, and typically diminish with distance from the electrical conductor (Exh. JP-2, app. 6-6, at 3). Over the years, some epidemiology studies have yielded statistical associations between power-frequency magnetic-fields and diseases such as childhood leukemia (Exh. EFSB-MF-11). In 2007, the World Health Organization ("WHO") concluded that "the evidence for a causal

relationship is limited, therefore exposure limits based upon epidemiological evidence are not recommended, but some precautionary measures are warranted." Salem Cables at 83. The Siting Board has recognized public concern about magnetic fields and has encouraged the use of low-cost measures that would minimize magnetic fields along transmission ROWs. See Salem Cables at 88.[107]

b. Companies' Description

The Companies' consultant, Gradient, modeled above-ground 60-Hz magnetic field strengths from "average" and peak projected line loadings for the year 2018 along the Primary Route (Exhs. JP-1, at 6-35; EFSB-MF-4). The Companies modeled the expected magnetic fields along a typical line section and at a splice vault (Exh. JP-1, at 6-35). The Companies' model indicated that for peak loadings for typical line sections, the maximum magnetic field value at three feet above the ground would be 41.2 milligauss ("mG"), dropping to 4.4 mG at a lateral distance of 20 feet (Exh. EFSB-MF-9(S)(1) at 10).[108,109] The Companies' model indicates that at splice vaults, the maximum magnetic field value at peak loading would be 53.8 mG, dropping to 11.0 mG at a distance of 20 feet (id.).[110,111]

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107 Once connected, cables also create electric fields since electric fields are created whenever voltage is present on conductors. However, electric fields are shielded by earth, so underground cables would not create above-ground electric fields (Exh. JP-1, at 6-35). Therefore, this section reviews only the magnetic fields that the Project would induce.

108 The closest residence is expected to be 21 feet from the cables (Exh. EFSB-NO-2).

109 The rate that magnetic fields drop off with distance differs slightly where the New Line curves (Exh. TOW-MF-4). For example, using a turn in the line at Washington and Cross Streets in Winchester, at peak loading, the projected magnetic field ten feet away on the inside of the bend would be 14.2 mG, compared to 12.6 mG ten feet from the outside of the bend (id.).

110 In addition to modeling Project impacts, the Companies measured existing 60-Hz magnetic field levels along the Primary Route in four municipalities and reported typical residential levels as ranging from 1 to 5 mG, and levels up to approximately 50 mG under overhead transmission lines and near the Woburn Substation (Exh. EFSB-MF-5(S)).

The Companies stated that the duct bank they would use for the Project would be of the same design and generally the same depth regardless of route, so Project magnetic fields would be similar regardless of route (Exh. JP-1, at 6-36). The Companies concluded that there would be no significant difference between the Primary Route and Noticed Alternative Route with regard to magnetic field impacts (id.).

The Companies stated that the underground placement of the New Line improves mutual cancellation of magnetic fields from the three phases by locating the phases in closer proximity to each other than is possible in overhead construction, so that field levels are both lower near the conductors and fall away more rapidly with distance (Exh. EFSB-MF-1; Tr. 3, at 586). The Companies asserted that additional means of mitigating magnetic fields from the Project, such as changing to a higher voltage, increasing street widths, surrounding the set of cables with a single structure of ferromagnetic shielding, and deep burial of the New Line would be infeasible for this Project (Exh. EFSB-MF-1; Tr. 3, at 581-595). As described in Section IV, the Companies consider an alternative Project design using HPFF-PTC to be inferior, based on a balancing of reliability, cost, and environmental impacts (Exh. TOW-MF-1).

The Companies stated that there are no federal standards for occupational or residential exposure to 60-Hz magnetic fields, and that such state guidelines as exist are not based on health effects (Exhs. EFSB-MF-9(S)(1) at 3; EFSB-MF-11). However, the Companies identified a guideline for both acute and chronic exposure of the general public to 60-Hz magnetic fields, as provided by the International Commission on Non-Ionizing Radiation Protection ("ICNIRP"), of 2,000 mG (Exhs. EFSB-MF-9(S)(1) at 4; EFSB-MF-12). The Companies noted that the predicted magnetic fields from the Project fall below the ICNIRP guideline (Exh. EFSB-MF-9(S)(1) at 9). The Companies noted further that all modeled magnetic field levels, including maximum values at peak load, "fall below the Massachusetts ROW-edge magnetic-field

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[111] At average loadings for typical line sections, the maximum projected magnetic field value directly above the ground is 40.9 mG, while it is 53.5 mG directly above manhole vaults (Exh. EFSB-MF-9(S)(1) at 13).

guideline of 85 mG" (id. at 11; Exh. JP-1, at 6-35).[112] The Companies indicated that they do not expect any adverse health effects due to the magnetic field impacts from the proposed New Line (Exh. EFSB-MF-9(S)(1) at 11).

c. Positions of the Parties

i. Intervenors

Both Winchester and Stoneham express concerns regarding magnetic fields created by the Project, as described below. Winchester and Stoneham assert that the Companies should have modeled magnetic fields ten feet from the centerline, rather than 20 feet from the centerline (Exh. TOW-TOS-DH-1). Winchester and Stoneham point out that the original modeling performed by the Companies did not take into account curves in the proposed Project alignment centerline (id.). Winchester argues that while Eversource construction drawings show an inverted delta duct bank with 14-inch vertical and 16-inch horizontal spacing (Winchester Brief at 29, citing Exh. COM-BAS-1, Att. A, at 90 of 96), the magnetic field calculations performed by Gradient for the Companies used a triangular configuration with 14-inch vertical and 14-inch horizontal spacing, producing a lower modeled magnetic field; fields modeled by Winchester's consultants were about 29 percent greater, using the wider spacing (Tr. 10, at 1772-1777; Winchester Brief at 29, citing RR-EFSB-29).

Winchester and Stoneham assert that modeled magnetic fields can be inaccurate representations of later measured field strengths (Exh. TOW-TOS-DH-1; Tr. 10, at 1772). Additionally, the Town of Stoneham argues that although the Companies did not predict peak currents to increase during the forecast period of 2018 to 2023, there is no guarantee that power

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112 The Companies characterized the Siting Board's 85 mG reference point as a "guideline value" for the edge of a ROW (Exh. JP-1, at 6-35). The Siting Board has not found that by presenting an edge-of-right-or-way magnetic field of 85 mG or lower an applicant is presumed to have mitigated environmental impacts so that no further mitigation would ever be required; rather, the Board has stated that previously accepted magnetic field levels are not a standard limiting acceptable impacts and do not provide the principal basis for Siting Board evaluation of magnetic fields. East Eagle at 116, n.115; GSRP at East Eagle Board decisions do not support the Companies' characterization of 85 mG as a Siting Board guideline.

flows on the line will not increase significantly over the next 40 years, producing corresponding increases in magnetic fields (Stoneham Brief at 27, citing Exh. TOW-MF-5). Also, Winchester and Stoneham's magnetic field specialist opines that public health impacts of the Project should be based on the LTE rating of the line, which would produce a stronger magnetic field than generated by predicted Project electrical current (Tr. 10, at 1762, 1765).[113,114,115] However, Winchester and Stoneham agree with the Companies that neither the U.S. government nor the commonwealth regulates magnetic field intensities associated with electric power transmission (Exhs. TOW-16, at 2; TOW-17, at 3).

Winchester and Stoneham advocate the use of HPFF-PTC, which the towns contend results in five to 50 times less magnetic field strength than an HVED system (Exhs. TOW-TOS-PT-1, at 7; TOW-GO-1, at 10; Winchester Brief at 29; Stoneham Brief at 27-28). Stoneham further argues that in light of the high level of public concern over magnetic field levels, the Companies should implement all reasonable and practical methods to mitigate magnetic fields from the line, such as encompassing ferromagnetic shielding, reducing spacing between phases, or passive shielding loops at splice vaults, as a prudent course of action and also should report to the Siting Board within 30 days of the Final Decision as to the most feasible option to reduce Project magnetic fields (Stoneham Brief at 27-29).

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113 The Town of Winchester argues that with line currents at the maximum rating of the line, magnetic fields well above 85 mG would occur above and along 4,400 linear feet of the Project (Winchester Brief at 30-33).

114 In their Briefs, both Stoneham and Winchester referenced modeling performed by the Companies in response to Stoneham's request for modeling magnetic fields from currents at the LTE line rating (Stoneham Brief at 26-27; Winchester Brief at 30). The Companies' response indicated that if the proposed line carried currents at the winter normal or summer LTE limit, it would create a magnetic field of about 270 mG directly over the cables (Exh. TOS-MF-9; Tr. 4, at 746-749). Winchester's magnetic field witness testified that the magnetic field from a 15-minute STE current is not appropriate for evaluating health effects (Tr. 10, at 1759-1764).

115 In addition to critiquing the Companies' modeling, Winchester and Stoneham measured existing 60-Hz magnetic field levels at cross sections along the Primary Route and reported maximum levels of 1.7 mG in Winchester and 2.2 mG in Stoneham (Exhs. TOW-16, at 1; TOW-17, at 1).

ii. Companies' Response

The Companies argue that although HPFF-PTC would likely provide a numerically lower value for magnetic fields than an HVED system, the technologies are equivalent with regard to public health impact because the above-ground magnetic fields produced by either technology are well below established public health guidelines (Companies Reply Brief at 28, citing Tr. 4, at 707-708). The Companies argue that there is no evidence in the case that the New Line would operate at the LTE, as postulated by the Towns (Companies Reply Brief at 43). The Companies argue that the cables will be placed at the distances modeled by Gradient, and not further apart as suggested by the Towns (id. at 41, citing Exh. EFSB-MF-9(S)(1) at 17; RR-EFSB-30; RR-EFSB-30(1)). However, the Companies note that, even at the highest levels posited by Winchester and Stoneham, neither towns made any assertion that projected magnetic fields associated with the Project would produce magnetic field exposures that would adversely affect the health and safety of residents and abutters (Companies Reply Brief at 39-40).

The Companies stated that reducing spacing between conductors reduces cable ratings (Tr. 4, at 653) and also that non-metallic conduits are required to maintain cable ratings (Exh. CUR-1-2(l)). The Companies stated that wire loop shielding as installed at manhole vaults in the Salem Cables project are not proposed for the Project because (a) field levels are not as much enhanced at manhole vaults here because there is only a single cable system and therefore no cancellation effect; and (b) modeled levels are in general lower along the Project than in Salem (id.; Exh. CUR 1-2(n)(S)). In conclusion, the Companies argue that no additional mitigation is warranted because the projected magnetic field levels associated with the anticipated operation of the Project are far below all health-based guidelines, as well as below 85 mG (Companies Reply Brief at 40).

d. Analysis and Findings

The record shows that for typical cable layout locations, maximum magnetic field levels at peak loading are 41.2 mG directly above the cables, dropping to 4.4 mG at a distance of 20 feet. The record shows that magnetic fields from average power flow and expected peak

power flow are very similar. The maximum magnetic field from the Project, at peak loading, would be 53.8 mG above splice vaults, dropping to 11.0 mG at a distance of 20 feet. This magnetic field level is consistent with magnetic fields projected from overhead transmission lines at the edge of rights-of-way and off to the side of underground transmission lines. See East Eagle at 115 (7.3 to 36.1 mG at 20 feet away, peak load); Walpole-Holbrook at 73-76 (up to 43 mG at edge-of-ROW, not mitigated); Salem Cables at 87 (24 to 26 mG at 25 feet from manholes after mitigation); but see also Mystic-Woburn at 69 (only 3.6 mG directly over the line). The Siting Board evaluates magnetic field impacts based on expected power flows on a transmission line, rather than those based on line ratings. See Walpole-Holbrook at 72-73, 77; East Eagle at 114-116, 123. The Companies' reliance on expected power flows, rather than the physical capacity of the cables (e.g., LTE rating), is appropriate. Also, the record shows that the Companies intend to maintain the cable spacing presented in their magnetic field modeling as the standard arrangement for the Project, so these estimates are expected to be reliable.

A number of historical studies appeared to show a statistical association between residential distances from transmission lines and human health effects. GSRP at 85. However, the WHO has stated that the evidence for a causal relationship between magnetic field exposure and childhood leukemia is limited; WHO therefore does not recommend exposure limits based on the epidemiological evidence, but does recommend taking some precautionary measures. Id. Consistent with the WHO recommendations, the Siting Board continues to look for low-cost measures that would minimize exposures to magnetic fields from transmission lines. In prior Siting Board decisions, and consistent with WHO recommendations, the Siting Board has recognized public concern about magnetic fields and has encouraged the use of practical and low-cost design to minimize magnetic fields along transmission ROWs. Salem Cables at 88. The Siting Board requires magnetic field mitigation which, in its judgment, is consistent with minimizing cost. Walpole-Holbrook at 78; Mystic-Woburn at 71; GSRP at 87.

The New Line's close positioning of the three phases provides mitigation of magnetic field impacts that would otherwise occur. An alternative Project design of using an HPFF-PTC system encased in steel pipes would have lower magnetic field levels but, as described in Section IV, above, such an approach would have spacing constraints for ancillary equipment,

would present the possibility of MODF spills, would require an increased construction duration and was estimated to cost between $34 million and $51 million more than an HVED system. Such a change in the Project would not represent a low-cost design. The record shows that mitigation of magnetic fields by reducing the spacing between conductors or adding metal shielding would reduce the capacity of the lines. Further the record does not show that there are applicable locations for installing passive shielding loops, such as were used at manhole vaults in Salem. Nonetheless, the Siting Board directs the Companies to further evaluate any site-specific additional magnetic field mitigation that can be feasibly engineered into the project design, particularly for close residences 20-30 feet from the New Line. The Companies shall file a compliance filing as soon as practicable, but not less than 90 days prior to the commencement of construction in residential areas, identifying additional feasible magnetic field mitigation. The Companies may commence construction at substations and in commercial areas, and may perform site preparation work.

The record shows that magnetic field strengths along the Primary and Noticed Alternative Routes would be similar. Therefore, the Siting Board finds that the Primary Route and the Noticed Alternative Route are comparable with respect to the impact from magnetic fields. The Siting Board finds that magnetic field impacts from construction and operation of the Project using the Primary Route would be minimized.

7. Safety, Air, and Subsurface Contamination

a. Companies' Description

i. Safety

Regardless of which route is chosen for the Project, the Companies maintain that construction safety would be addressed through adherence to all federal, state, and local regulations, as well as industry standards and guidelines established for protection of the public (Exhs. JP-1, at 6-29; EFSB-S-1). The Companies stated that traffic-control plans would be developed consistent with the Federal Highway Administration's Manual of Uniform Traffic Control Devices for Streets and Highways, and the MassDOT publication, Work Zone Safety (Exh. JP-1, at 6-29). In addition, the Companies stated that open trenches would either be

covered with plates or back-filled when not in use or monitored by construction personnel (Exh. EFSB-S-1). Furthermore, the Companies stated that, to maintain public safety around trenchless crossing pits, the Companies would install safety barriers and walls to ensure that no accidents occur (Tr. 8, at 1473-1474). The Companies committed to implementing extra security measures at night that would include jersey barriers and fencing (id.).[116] Other safety considerations associated with trenchless crossings and EMS response times are discussed in Section VI.C.3, above.

ii. Air

The Companies stated that, regardless of the route chosen, they would minimize the potential for airborne dust from construction activities by requiring contractors to implement a combination of best management practices including street sweeping and placing water trucks with misters in or near work areas (Exhs. JP-1, at 6-15; EFSB-A-1). In addition, the Companies would cover temporary stock piles with plastic (Exh. JP-1, at 6-15). Furthermore, the Companies stated that they would comply with state laws concerning vehicle idling (id.). To minimize air emissions from equipment operation, the Companies stated that they would direct contractors to retrofit any diesel-powered, non-road construction equipment rated 50 horsepower or above, whose engine is not certified to USEPA Tier 4 standards, and that will be used for 30 days or more over the course of the Project, with USEPA-verified (or equivalent) emission control devices (id. at 6-16). The Companies would use ultra-low sulfur diesel ("ULSD") fuel in their own diesel powered construction equipment (id.).

The Companies stated that the Project in connection with the 345 kV gas-insulated switching gear would add approximately 7,000 pounds of additional sulfur hexafluoride gas ("SF_6") at the Woburn Substation (Exh. EFSB-A-3). At the Wakefield Junction Substation, the Project in connection with the gas circuit breakers, disconnect and grounding switches, and

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116 The Town of Winchester stated that the layout of the intermediate jacking pit at the railroad and Aberjona River crossings along Cross Street and jacking pits at the Aberjona River crossing along Washington Street provide inadequate safe clearances for temporary jersey barriers and a minimum width for alternating traffic (Exh. TOW-6, at 6; Winchester Brief at 6).

gas-insulated bus and bushings, would add an additional 2,300 pounds of SF_6 (id.). According to the Companies, the new switchgear would be designed for an annual emission rate of 0.1 percent, which the Companies stated would be in compliance with MassDEP's standard of not more than 1.0 percent per year, as set forth in 310 CMR 7.72 (id.).[117] To minimize the potential for SF_6 release, the Companies would perform a monthly or bi-monthly inspection of substation equipment (Exh. JP-1, at 6-51). During these inspections, SF_6 pressure in each gas zone would be recorded, as a redundant method of leak detection to supplement SF_6 low pressure alarms (id.).

iii. Hazardous Materials

The installation of the shunt reactors, an oil-immersed reactor, will necessitate the use of insulating mineral oil for cooling at both the Woburn and Wakefield Junction Substations (Exh. JP-1, at 6-44). To prevent the inadvertent release of MODF from transformers, the Companies would install as part of the Project construction, a concrete containment vault capable of containing 110 percent of the oil in the case of a mechanical failure (id.; Exh. EFSB-HW-6). No other oils or potentially hazardous materials would be employed in association with Project operation (Exh. JP-1, at 6-44).

According to the Companies, subsurface excavation associated with the Project has the potential to encounter contaminated soils from historical releases in the vicinity of both the Primary Route and the Noticed Alternative Route (Exh. JP-1, at 6-33). According to MassDEP's database, there are six active and historical release sites on properties adjacent to the Primary Route and two active and historical sites on properties adjacent to the Noticed Alternative Route (id.).

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117 On August 11, 2017, MassDEP issued final regulations in accordance with the Global Warming Solutions Act ("GWSA") that updated regulations under 310 CMR 7.72 to include declining annual aggregate emission limits for SF_6 and other measures of gas insulated switchgear. Companies and municipalities that own, lease, operate or control Gas-Insulated Switchgear purchased after June 1, 2015, that contains SF_6 and is located in Massachusetts must comply with 310 CMR 7.72.

The Primary Route runs along approximately one mile of the Wakefield railroad ROW, which may be contaminated by former railroad-related operations (Exh. JP-1, at 6-33). To obtain specific details on subsurface contamination and to support construction planning and construction-related soil management, the Companies would conduct soil characterizations along the Wakefield railroad ROW and along the in-street portion of the routes (id.). The Companies stated that, whether in the public way or in the railroad ROW, if contaminated soils are encountered, they would be managed pursuant to the Utility-Related Abatement Measure ("URAM") provisions of the Massachusetts Contingency Plan ("MCP") (id.). The Companies would prepare a soil and groundwater management plan, and would contract a Licensed Site Professional as necessitated by conditions encountered along the Project alignment (id. at 6-34).

The Companies concluded that because of the higher number of MCP sites along the Primary Route and the use of the Wakefield railroad ROW, the Noticed Alternative Route is preferable to the Primary Route with respect to subsurface contamination (id.).

b. Analysis and Findings

The record shows that safety impacts of the Project along the Primary Route and the Noticed Alternative Route are comparable. The Companies commit to following all relevant safety laws and regulations during construction. Based on the Companies' proposed safety mitigation measures, the Siting Board finds that potential safety impacts from construction and operation of the Project along the Primary Route would be minimized.

Based on the above, the Siting Board finds that the air impacts are comparable for the Primary Route and the Noticed Alternative Route. The Companies commit to implementing dust control measures during Project construction, such as sweeping streets and spraying water at worksites. The Companies would comply with the standard Siting Board diesel retrofit provisions referencing the MassDEP Diesel Retrofit Program and follow the Massachusetts anti-idling law and regulations that limit vehicle idling to five minutes.

The Companies would purchase new switchgear and other equipment for the Woburn and Wakefield Junction Substations that contain SF_6, and the Companies commit to complying with MassDEP regulations for SF_6. With the proposed measures to minimize dust and air emissions

from construction equipment and the Companies' selection of low-leakage SF_6 containing equipment, the Siting Board finds that potential air impacts from construction and operation of the Project along the Primary Route would be minimized.

Because there are higher numbers of MCP sites along the Primary Route, and the Primary Route uses the inactive Wakefield railroad ROW which may be contaminated by former railroad-related operations, the Siting Board finds that the Noticed Alternative Route is preferable to the Primary Route with respect to subsurface contamination. The Companies commit to conducting a multi-phase soil pre-characterization program that would include soil sample collection and testing. The Siting Board directs the Companies to comply with all applicable federal and state laws concerning the excavation and disposal of any contaminated soils that the Companies encounter in the construction phase of the Project. With these measures, the Siting Board finds that contaminated soil impacts from construction and operation of the Project along the Primary Route would be minimized.

8. New Salem Street Variation

a. Companies' Description

As discussed above, the Companies proposed the New Salem Street Variation is a workaround for the Primary Route, should the use of the Wakefield railroad ROW prove infeasible due either to encroachments, contaminated soils, or potential inability to obtain easement rights from the MBTA (Exh. JP-1, at 5-22, 5-55 to 5-56; RR-EFSB-8).[118] The Companies stated that the New Salem Street Variation is shorter and avoids complications associated with construction on the northern portion of the Wakefield railroad ROW, such as the need to construct access roads, and vegetation clearing in close proximity to wetlands (Exh. JP-1, at 6-42). However, the Companies stated that, based on discussion with the Town of Wakefield, the use of the New Salem Street Variation also has its own challenges: (1) it is located within the Mill River watershed and is subject to frequent flooding; (2) it poses construction challenges

[118] The Companies stated that the MBTA has been notified that National Grid will be seeking easement rights, however a formal for request rights cannot occur until engineering is further advanced (RR-EFSB-8).

associated with unstable soil conditions; and (3) it has potential subsurface contaminations associated with historical land use (id. at 5-55, 6-42 to 6-43; see Wakefield Brief at 16).

Comparing Project impacts between the New Salem Street Variation and the portion of the Wakefield railroad ROW along the Primary Route, the Companies stated that the New Salem Street Variation would have more impact on wetland resources because it crosses the Mill River and is located within the Federal Emergency Management Agency 100-year floodplain (Exhs. COM-DCK-1(R)(A); JP-1, at fig. 5-6, 5-22; Tr. 6, at 1149). In addition, the Companies stated that the New Salem Street Variation would experience more traffic impacts because of its in-street location (Exh. COM-DCK-1(R)(A)). However, the New Salem Street Variation would have less visual impact because it does not involve any vegetation clearing (Exh. JP-1, at 6-42). Overall, the Companies indicated that the Primary Route using the Wakefield railroad ROW is preferable to the use of the New Salem Street Variation (Exh. COM-DCK-1(R)(A)).

The Companies stated that they would evaluate the use of engineered fill or concrete reinforcement of duct banks installed in New Salem Street, if required to use the Variation (RR-EFSB-20). Selection of such foundation support would require an understanding of the depth and lateral extent of peat deposits (id.; Exh. STEW-1-2). According to the Companies, a more advanced understanding of the potential for differential settlement cannot be determined at this time without an engineering analysis of the soil conditions (RR-EFSB-20).

The Companies request the Siting Board's approval of the Primary Route and the Primary Route with New Salem Street Variation, pending receipt of all permits and property rights (Companies Reply Brief at 9).

b. Position of the Parties

The Town of Wakefield strongly endorses the Primary Route in comparison to the Noticed Alternative Route (Exh. EFSB-CM-22(1)). Further, Wakefield opposes the use of the New Salem Street Variation, citing the advantage of using the unused railroad ROW along the Primary Route, and the location of New Salem Street within the 100-year floodplain where construction may require expensive dewatering (Wakefield Brief at 15). In addition, Wakefield states that Project construction along the New Salem Street Variation would adversely impact the

New Salem business district and truck traffic that accesses the area on a daily basis (Exh. EFSB-CM-22(1)). Wakefield argues that, although feasible as an alternative to the Wakefield railroad ROW, construction on New Salem Street would be needlessly difficult and costly (Wakefield Brief at 15-16).

c. Analysis and Findings

The record shows that the Companies have requested approval of the Primary Route and, as a potential workaround for a section of the Wakefield railroad ROW, the New Salem Street Variation. The record also shows that while the New Salem Street Variation would have less visual impact because it does not require tree removal, the New Salem Street Variation would have greater impact on wetlands and traffic, and could engender greater construction complexities.

Although the Companies continue to seek approval for the New Salem Street Variation pending receipt of all permits and property rights, the Siting Board notes that Wakefield opposes the New Salem Street Variation because of greater overall environmental impacts. To avoid Project impacts along the New Salem Street Variation, the Companies shall employ their most diligent efforts to locate the New Line along the Primary Route as proposed, using the Wakefield railroad ROW. Should the construction of the Primary Route prove infeasible (due to the inability to obtain necessary permits or other significant impediments), the Companies may instead follow the New Salem Street Variation. If the Companies determine that the use of the Primary Route along the Wakefield railroad ROW is infeasible, the Companies shall report to the Board for its review: (1) the reason they are not able to use the Wakefield railroad ROW as part of the Primary Route; (2) measures that could be implemented to mitigate impact along the New Salem Street Variation; and (3) the Companies' selected mitigation measures and the rationale behind the selection. Such notification shall be in writing as soon as possible, but in no event fewer than 60 days prior to the commencement of construction on New Salem Street and/or Salem Street in Wakefield. The Companies shall at the same time provide a copy of such notice to the parties and limited participants.

9. Summary of Environmental Impacts

The Siting Board finds that the information provided by the Companies regarding the Project's environmental impacts is substantially accurate and complete. In comparing the Primary and Notice Alternative Routes, the Siting Board finds that the Primary Route would have significantly lower land use impact. In contrast, the Siting Board finds that the Noticed Alternative Route would have slightly lower visual impact and lower impact from subsurface contamination. The Siting Board further finds that the two routes are comparable with respect to wetlands and water resources, traffic, noise, magnetic field, safety, and air impacts. On balance, the Siting Board finds that the Primary Route, with and without the New Salem Street Variation, and the Noticed Alternative Route are comparable with respect to environmental impacts.

D. Cost

The Companies compared New Line costs of the Primary and Noticed Alternative Routes at an accuracy of -25%/+25% (RR-EFSB-10). The Companies applied the same per-foot costs for typical linear construction for both routes (id.).[119] In addition, the Companies included costs of generic waterbody, highway, and railroad crossings in both estimates, but did not include the costs of specialized trenchless crossings because these were not known for the Noticed Alternative Route (id.). The Companies' resulting estimated costs for the linear portion of the Project were $91.6 million along the Primary Route and $87.7 million along the Noticed Alternative Route (id.; RR-EFSB-33).[120,121]

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119 As noted in Section IV.B.1, above, in addition to the cost of the New Line, Project costs include an estimated $20.9 million for the Woburn Substation and $20.2 million for the Wakefield Junction Substation. These substation upgrade estimates would be the same for both the Primary and Noticed Alternative Routes.

120 As noted in Sections I.A and IV.B.1, above, the Companies estimated the cost of the New Line along the Primary Route to be $96.2 million. In order to provide an "apples-to-apples" comparison between the Primary Route and the Noticed Alternative Route, as noted, the $91.6 million cost does not include the costs of the specialized trenchless crossings (RR-EFSB-10).

121 As noted in Section V.B.4 above, the cost of the transmission line portion of the Primary Route with the New Salem Street Variation is $89.2 million.

The Companies attributed the cost differential of the two routes to the shorter length of the Noticed Alternative Route (approximately 8.0 miles versus approximately 8.5 miles for the Primary Route) and to higher construction costs for the Wakefield railroad ROW section of the Primary Route (RR-EFSB-33). The Companies also indicated, however, that the western portion of the Project would be less expensive to construct along the Primary Route than along the Noticed Alternative Route and that construction costs for the eastern portion of the Noticed Alternative Route would likely increase with the addition of costs for removal of extensive ledge deposits, particularly on Water Street (id.; Exh. JP-1, at 6-40).

Based on the above considerations, the Siting Board concludes that construction estimates for the Project along either the Primary or Noticed Alternative Route would not be significantly different. Accordingly, the Siting Board finds that the Primary Route is comparable to the Noticed Alternative Route with respect to cost.

E. Reliability

The Companies evaluated the Primary Route and the Noticed Alternative Route to assess their reliability with respect to providing a 345 kV line connection between the Woburn and Wakefield Junction Substations (Exh. JP-1, at 6-41). Based on their evaluation, the Companies stated that the length, physical environment, and construction of the Project would be similar along either route (id.). Accordingly, the Siting Board finds that Project reliability is comparable for the Primary and the Noticed Alternative Routes.

F. Conclusion

The Siting Board finds that the Primary Route and the Noticed Alternative Route are comparable with respect to environmental impacts, cost, and reliability. But the Noticed Alternative Route faces significant constructability issues, especially with respect to the crossing of I-93. Furthermore, the Companies assert the superiority of the Primary Route. In contrast, the Noticed Alternative Route has no known public support and no party asserts that the Noticed Alternative Route is superior. For these reasons the Siting Board concludes that the Primary Route, with and without the New Salem Street Variation, is superior to the Noticed 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.

Based on a review of the record, the Siting Board finds that the Companies have provided sufficient information to allow the Siting Board to determine whether the Project has achieved a proper balance among cost, reliability, and environmental impacts. The Siting Board finds that, with the implementation of the specified conditions and mitigation presented above, and compliance with all local, state, and federal requirements, the environmental impacts of the Project constructed along the Primary Route (with and without the New Salem Street Variation) would be minimized. The Siting Board finds that the Project constructed along the Primary Route (with and without the New Salem Street Variation) would achieve an appropriate balance among conflicting environmental concerns as well as among environmental impacts, reliability, and cost.

VII. CONSISTENCY WITH POLICIES OF THE COMMONWEALTH

A. Standard of Review

G.L. c. 164, § 69J requires the Siting Board to determine whether plans for construction of the applicant's new facilities are consistent with current health, environmental protection, and resource use and development policies as adopted by the Commonwealth.

B. Analysis and Conclusions

1. Health Policies

In Section 1 of the Electric Utility Restructuring Act of 1997, the Legislature declared that "electricity service is essential to the health and well-being of all residents of the Commonwealth" and that "reliable electric service is of utmost importance to the safety, health, and welfare of the Commonwealth's citizens." See St. 1997, c. 164. In Section IV.D, above, the Siting Board found that the Project would improve the reliability of electric service in Massachusetts. Reliable electricity service is essential to the health of citizens of the Commonwealth; therefore, an improvement in reliability will result in health benefits.

The Companies have committed to use retrofitted off-road construction equipment to limit emissions of particulate matter during Project construction (Exh. JP-1, at 6-16). This commitment is consistent with MassDEP's Diesel Retrofit Program designed to address health concerns related to diesel emissions. In Sections VI.C and VI.F, the Siting Board finds that the Project's magnetic field, traffic, hazardous materials, noise, safety, land use, wetlands and waterways, visual, and air impacts have been minimized. Accordingly, subject to the Companies' specified mitigation and the Siting Board's conditions set forth in Section XII, below, the Siting Board finds that the Companies' plans for construction of the Project are consistent with current health policies of the Commonwealth.

2. Environmental Protection Policies

The Global Warming Solutions Act ("GWSA"), enacted in August 2008, is a comprehensive statutory framework to address climate change in Massachusetts. St. 2008, c. 298. The GWSA mandates that the Commonwealth reduce its GHG emissions by 10 to 25 percent below 1990 levels by 2020, and by at least 80 percent below 1990 levels by 2050. G. L. c. 21N, §3(b). Pursuant to the GWSA, the Secretary issued the Massachusetts Clean Energy and Climate Plan for 2020 on December 29, 2010 (the "2020 CECP") and an update dated December 31, 2015 (the "2020 CECP Update"). In a determination accompanying the 2020 CECP, the Secretary set the 2020 state-wide GHG emissions limit at 25 percent below 1990 levels. On September 16, 2016, Governor Charles D. Baker issued Executive Order 569, titled "Establishing an Integrated Climate Change Strategy for the Commonwealth." Executive Order 569 included the directive that MassDEP issue regulations pursuant to Section 3(d) of the GWSA, setting declining annual aggregate GHG emissions limits for sources or categories of sources that emit GHGs, in order to achieve the 2020 limit. See Executive Order 569, § 2; see also G.L. c. 21N, § 3(d). On August 11, 2017, MassDEP issued final regulations in accordance with the GWSA. 310 CMR 60.05; 310 CMR 60.06; 310 CMR 7.72; 310 CMR 7.73; 310 CMR 7.74; 310 CMR 7.75.

The GWSA obligates administrative agencies, such as the Siting Board, to consider reasonably foreseeable climate change impacts and related effects when reviewing permit

requests. G.L. c. 30, § 61. The Companies have shown that construction of the Project would have little to no adverse climate change impact (e.g., additional GHG emissions) nor related effects, such as sea level rise (Exh. JP-1, at 7-3, 7-4). In addition, the Siting Board has found in Section VI.C.7, above, that as specified by the Companies, and with additional conditions imposed in this Decision, SF_6 emissions would be minimized.

On August 8, 2016, Governor Baker signed into law "An Act to Promote Energy Diversity" ("Energy Diversity Act"). St. 2016, c. 188. The Energy Diversity Act requires utilities to procure additional renewable energy resources including offshore wind, hydroelectric generation, and new Class I RPS eligible resources. St. 2016, c. 188, § 12. By improving the reliability of the regional transmission system, the Project will help facilitate the integration of these renewable energy resources (Companies Brief at 132-133, citing Exh. JP-1, at 7-3).

In Section VI.C, above, the Siting Board reviewed how the Project would meet other state environmental protection requirements. The Siting Board also: (1) considered the Project's environmental impacts, including those related to land use, wetlands and waterways, traffic, noise, visual impacts, magnetic fields, safety, air impacts, and hazardous materials; and (2) concluded that, subject to the specified mitigation and conditions set forth below, the Project's environmental impacts have been minimized.

The Project does not trigger enhanced public participation or enhanced analysis of impacts and mitigation under either the "Environmental Justice Policy of the Executive Office of Energy and Environmental Affairs" issued on January 31, 2017, or the prior EJ Policy in effect at the time the Companies filed the Petitions (Exhs. JP-1, at 7-3; EFSB-CPC-2; TOW-RS-1; TOW-RS-13).

Subject to the specified mitigation and conditions set forth in this Decision, the Siting Board finds that the Companies' plans for construction of the Project are consistent with the current environmental protection policies of the Commonwealth.

3. Resource Use and Development Policies

In 2007, pursuant to the Commonwealth's Smart Growth/Smart Energy policy, EEA established Sustainable Development Principles. Among the principles are: (1) supporting the

revitalization of city centers and neighborhoods by promoting development that is compact, conserves land, protects historic resources and integrates uses; (2) encouraging reuse of existing sites, structures and infrastructure; and (3) protecting environmentally sensitive lands, natural resources, critical habitats, wetlands and water resources and cultural and historic landscapes. In Section V, the Siting Board reviewed the process by which the Companies selected the Primary Route for the Project. The Project has been designed and conditioned to avoid or minimize impacts to natural and cultural resources by being placed primarily in existing roadways and railroad ROW linking the existing Substations.

Subject to the specific mitigation and the conditions set forth in this Decision, the Siting Board finds that the Companies' plans for construction of the Project are consistent with the current resource use and development policies of the Commonwealth.

VIII. ANALYSIS UNDER G.L. C. 40A, § 3 - ZONING EXEMPTIONS

Pursuant to G.L. c. 40A, § 3, the Companies request individual and comprehensive exemptions from the Zoning Ordinances of the City of Woburn ("Woburn Zoning Ordinance") and the Zoning Bylaw, Chapter 190 of the Code of the Town of Wakefield ("Wakefield Zoning Bylaw") (Exh. JP-5). The Companies argue that they must obtain these exemptions in order to construct the proposed modification to the two Substations: i.e., Eversource's Woburn Substation and National Grid's Wakefield Junction Substation (id. at 1).

A. Standard of Review

G.L. c. 40A, § 3 provides, in relevant part, that:

> Land or structures used, or to be used by a public service corporation may be exempted in particular respects from the operation of a zoning ordinance or by-law if, upon petition of the corporation, the [Department] shall, after notice given pursuant to section eleven and public hearing in the town or city, determine the exemptions required and find that the present or proposed use of the land or structure is reasonably necessary for the convenience or welfare of the public . . .

Thus, a petitioner seeking exemption from a local zoning bylaw under G.L. c. 40A, § 3 must meet three criteria.[122] First, the petitioner must qualify as a public service corporation. Save the Bay, Inc. v. Department of Public Utilities, 366 Mass. 667 (1975) ("Save the Bay"). Second, the petitioner must demonstrate that its present or proposed use of the land or structure is reasonably necessary for the public convenience or welfare. Walpole-Holbrook, at 90; NRG Canal 3 Development LLC, EFSB 15-06/D.P.U. 15-180, at 140-141 (2017) ("NRG"); Tennessee Gas Pipeline Company, D.T.E. 01-57, at 3-4 (2002). Finally, the petitioner must establish that it requires exemption from the zoning ordinance or bylaw. Walpole-Holbrook at 90; NRG at 141; Boston Gas Company, D.T.E. 00-24, at 3 (2001).

Additionally, the Siting Board favors the resolution of local issues on a local level whenever possible, to reduce concern regarding any intrusion on home rule. The Siting Board believes that the most effective approach for doing so is for a petitioner to consult with local officials regarding its project before seeking zoning exemptions pursuant to G.L. c. 40A, § 3. NRG at 141; Mystic-Woburn at 77; Russell Biomass LLC-Western Massachusetts Electric Company, EFSB 07-4/D.P.U. 07-35/07-36, at 61-62 (2009) ("Russell Biomass/WMECo"). Thus, the Siting Board encourages petitioners to consult with local officials, and in some circumstances, to apply for local zoning permits, before seeking zoning exemptions from the Department under G.L. c. 40A, § 3. NRG at 141; Mystic-Woburn at 77; Russell Biomass/WMECo at 68.

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[122] G.L. c. 40A, § 3 applies to the Department. The Department refers zoning exemption cases to the Siting Board for hearing and decision pursuant to G.L. c. 25, § 4. When deciding cases under a Department statute, the Siting Board has the power and the duty:

> to accept for review and approval or rejection any application, petition or matter related to the need for, construction of, or siting of facilities referred by the chairman of the department . . . provided, however, that in reviewing such application, petition or matter, the board shall apply department and board standards in a consistent manner.

G.L. c. 164, § 69H.

1. Public Service Corporation

a. Standard of Review

In determining whether a petitioner qualifies as a "public service corporation" for the purposes of G.L. c. 40A, § 3, the Massachusetts Supreme Judicial Court has stated:

> among the pertinent considerations are whether the corporation is organized pursuant to an appropriate franchise from the State to provide for a necessity or convenience to the general public which could not be furnished through the ordinary channels of private business; whether the corporation is subject to the requisite degree of governmental control and regulation; and the nature of the public benefit to be derived from the service provided.

Save the Bay at 680; Walpole-Holbrook at 91; Berkshire Power Development, Inc., D.P.U. 96-104, at 26-36 (1997) ("Berkshire Power").[123]

b. Analysis and Findings

Both Eversource and National Grid are electric companies as defined in G.L. c. 164, § 1, and, therefore, are public service corporations. NSTAR Electric Company, D.P.U. 15-85, at 6 (2016); New England Power Company, D.P.U. 15-44/15-45 (2016) ("MVRP")[124] at 8. Accordingly, the Siting Board finds that each of the Companies is a public service corporation for the purposes of G.L. c. 40A, § 3.

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[123] The Department interprets this list not as a test, but rather as guidance to ensure that the intent of G.L. c. 40A, § 3 would be realized, i.e., that a present or proposed use of land or structure that is determined by the Department to be "reasonably necessary for the convenience or welfare of the public" not be foreclosed due to local opposition. See Berkshire Power at 30; Save the Bay at 685-686; Town of Truro v. Department of Public Utilities, 365 Mass. 407 (1974). The Department has interpreted the "pertinent considerations" as a "flexible set of criteria which allow the Department to respond to changes in the environment in which the industries it regulates operate and still provide for the public welfare." Berkshire Power, D.P.U. 96-104, at 30; see also Dispatch Communications of New England, D.P.U./D.T.E. 95-59-B/95-80/95-112/96-113, at 6 (1998). The Department has determined that it is not necessary for a petitioner to demonstrate the existence of "an appropriate franchise" in order to establish public service corporation status. See Berkshire Power at 31; MVRP at 6; Eversource Hopkinton at 4-5.

[124] MVRP stands for "Merrimack Valley Reliability Project."

2. Public Convenience or Welfare

a. Standard of Review

In determining whether the present or proposed use is reasonably necessary for the public convenience or welfare, the Department must balance the interests of the general public against the local interest. Save the Bay at 680; Town of Truro v. Department of Public Utilities, 365 Mass. 407, 409 (1974). Specifically, the Department is empowered and required to undertake "a broad and balanced consideration of all aspects of the general public interest and welfare and not merely [make an] examination of the local and individual interests which might be affected." New York Central Railroad v. Department of Public Utilities, 347 Mass. 586, 592 (1964) ("NY Central Railroad"). When reviewing a petition for a zoning exemption under G.L. c. 40A, § 3, the Department is empowered and required to consider the public effects of the requested exemption in the State as a whole and upon the territory served by the applicant. Save the Bay at 685; NY Central Railroad at 592.

Therefore, when making a determination as to whether a petitioner's present or proposed use is reasonably necessary for the public convenience or welfare, the Department examines: (1) the need for, or public benefits of, the present or proposed use; (2) the present or proposed use and any alternatives or alternative sites identified;[125] and (3) the environmental impacts or any other impacts of the present or proposed use. The Department then balances the interests of the general public against the local interest and determines whether the present or proposed use of the land or structures is reasonably necessary for the convenience or welfare of the public. Walpole-Holbrook at 92-93; NRG at 143-144; Tennessee Gas Company, D.T.E. 98-33, at 4-5 (1998).

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[125] With respect to the particular site chosen by a petitioner, G.L. c. 40A, § 3 does not require the petitioner to demonstrate that its primary site is the best possible alternative, nor does the statute require the Department to consider and reject every possible alternative site presented. Rather, the availability of alternative sites, the efforts necessary to secure them, and the relative advantages and disadvantages of those sites are matters of fact bearing solely upon the main issue of whether the primary site is reasonably necessary for the convenience or welfare of the public. Martarano v. Department of Public Utilities, 401 Mass. 257, 265 (1987); NY Central Railroad at 591.

b. Analysis and Findings

With respect to the need for, or public benefits of, the Project, the Siting Board found in Section III, above, that additional transmission capacity is needed to ensure reliability in the area of the Project. In Section IV, the Siting Board analyzed a number of different project approaches that the Companies might use to meet the reliability need (such as NTAs) and concluded that the proposed approach is superior to other approaches. The Siting Board also reviewed the Companies' route selection process in Section V, and found that the Companies have demonstrated that they examined a reasonable range of practical siting alternatives and that the proposed facilities are sited in locations that minimize cost and environmental impacts.

The Siting Board then compared the impacts of the Primary Route and the Noticed Alternative Route, and concluded that the Primary Route (with or without the New Salem Street Variation) is superior to the Noticed Alternative Route in providing a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. Finally, regarding Project impacts, in Section VI, the Siting Board reviewed the environmental impacts of the Project and found that, while the Project may result in some local adverse impacts, the environmental impacts of the proposed Project would be minimized with the implementation of certain mitigation and conditions. Based on the foregoing, the Siting Board finds that the general public interest in constructing the Project outweighs identifiable adverse local impacts. Accordingly, the Siting Board finds that the proposed Project is reasonably necessary for the convenience or welfare of the public.

B. Individual Exemptions Required

1. Standard of Review

In determining whether exemption from a particular provision of a zoning bylaw is "required" for purposes of G.L. c. 40A, § 3, the Department looks to whether the exemption is necessary to allow construction or operation of the petitioner's Project. Walpole-Holbrook at 93-94; NRG at 143-144; Mystic-Woburn at 80-81. The Petitioner bears the burden to identify

the individual zoning provisions applicable to the Project and then to establish that exemption from each of those provisions is required:

> The Company is both in a better position to identify its needs, and has the responsibility to fully plead its own case . . . The Department fully expects that, henceforth, all public service corporations seeking exemptions under c. 40A, § 3 would identify fully and in a timely manner all exemptions that are necessary for the corporation to proceed with its proposed activities, so that the Department is provided ample opportunity to investigate the need for the required exemptions.

New York Cellular Geographic Service Area, Inc., D.P.U. 94-44, at 18 (1995); NRG at 145; Mystic-Woburn at 80-81.

2. List of Exemptions Sought

Table 9 below summarizes: (1) each of the specific provisions of the Woburn Zoning Ordinance or Wakefield Zoning Bylaw from which the Companies seek an exemption; (2) the relief available from the appropriate municipality; and (3) the Companies' argument as to why the Project cannot comply with the identified zoning provision. The municipalities support the granting of the exemptions (Exhs. JP-5, Att. G, Att. H). Because municipal support, as an argument in favor of granting an exemption, applies to all zoning exemption requests, it is not repeated in the two tables immediately following. This issue is discussed in more detail in Section VIII.B.3, below.

Table 9. Requested Individual Exemptions from the Woburn Zoning Ordinance – Summary of Companies' Position

Section of the Zoning Ordinance	Available Relief	Why Exemption is Required: Companies' Position
Section 5.2, Subsection 1, Parts 1 and 3 and Section 5.2, Subsection 2	None	These provisions restrict production of noise and creation of a nuisance. Zoning Ordinance contains no definition of a nuisance, and no standards by which compliance may be measured; interpretation of these sections is necessarily subjective. Woburn Zoning Ordinance prohibits the Board of Appeals from granting use variances. Therefore, no zoning relief is available.
Section 15	None	Substation is located in a Groundwater Protection Overlay District in which this use is not allowed. Although the Substation itself has been exempted by prior Orders of the Department, new substation-related construction would be prohibited. Board of Appeals is prohibited from granting a use variance. Therefore, no zoning relief is available.
Section 6.1, Table of Dimensional Regulations	Variance	Project involves construction of a 35-foot wall surrounding the shunt reactor and a 100-foot-tall shielding mast. Both walls would exceed the 30-foot height limit for the district. Difficult to meet the criteria for the grant of a variance; and even if a variance were granted, the grant could be appealed.
Sections 8.1 through 8.6	Variance	Provisions regulate off-street parking and require a minimum number of parking spaces for each use. Substation would fall under "other use," which establishes a subjective requirement because "sufficient" parking spaces based on opinion of the Building Commissioner. There is currently parking for twelve vehicles on site, which would be adequate given that the substation will be unmanned. Standard articulated in the zoning ordinance is subjective, the Building Commissioner's opinion, even if favorable, could be contested. The Companies would need a variance, which is difficult to obtain and subject to appeal.

Section of the Zoning Ordinance	Available Relief	Why Exemption is Required: Companies' Position
Section 13	Variance	Section regulates signage. The Companies will post signs identifying their ownership, providing an emergency telephone number, and warning public of the high voltage equipment within the Substation. Neither section 13 nor any other section of the zoning ordinance allows the posting of such signs. Therefore, the Companies would require a variance, which is difficult to obtain and subject to appeal.

Source: Exh. JP-5, at 14-22, and Attachments A, G.

Table 10. Requested Individual Exemptions from the Wakefield Zoning Bylaw - Summary of Companies' Position

Section of the Zoning Bylaw	Available Relief	Why Exemption is Required: Companies' Position
Sections 190-23, 190-44, 190-45	Amendment to Substation Use and Site Plan Approval, or New Special Permit and Site Plan Approval	Substation was originally constructed pursuant to a number of petitions granted by the Wakefield Zoning Board of Appeals ("ZBA"). The proposed modifications would require either amendments by the ZBA of the special permits and site plan approval or issuance by ZBA of a new special permit and site plan approval. Required special permit findings are subjective and create legal uncertainty: an appeal would be lengthy, expensive, and the result uncertain. Obtaining an amended, or new, site plan approval would involve technical engineering of electrical issues beyond the usual scope of municipal reviews.
Section 190-34 and Table of Dimensional Regulations	Height Variance	The lightning mast would be 55 feet tall and would exceed the applicable height limit of 35 feet, therefore the Project would require a height variance. Variance may only be granted based on a number of highly specific and unusual findings, including a finding relating to the "soil conditions, shape or topography" of the parcel. Therefore, it would be difficult to obtain a height variance and, even if one could be obtained, it would be subject to appeal.

Source: Exh. JP-5, at 22-25, and Attachments B, H.

3. Consultation with the Municipalities

Prior to seeking zoning relief, the Companies conducted outreach to both local residents and local officials in the affected municipalities (Exhs. JP-1, at 1-14 to 1-18; EFSB-G-3; EFSB-G-3(1)). Specifically, the Companies held 52 public outreach meetings targeted toward specific municipal officials and toward residents of the affected towns (Exh. JP-1, at 1-16 to 1-18). The Companies also set up a website, hotline, and email address through which members of the public could obtain information and send inquiries (id. at 1-14 to 1-15). Scott Galvin, the Mayor of Woburn, and John Roberto, the Inspector of Buildings and Zoning Administrator for the Town of Wakefield have both written letters supporting the granting of zoning relief (Exh. JP-5, Att. G, Att. H). Consequently, we find that the Companies have made a good faith effort to consult with municipal authorities regarding their proposal to seek zoning relief for construction of the Project under G.L. c. 40A, § 3, and that the Companies' communications have been consistent with the spirit and intent of Russell Biomass/WMECo and Salem Cables.

4. Analysis and Findings

The Companies have identified a number of specific zoning provisions of the Woburn Zoning Ordinance and the Wakefield Zoning Bylaw from which it seeks exemption to minimize delay in the construction and ultimate operation of the Project (Tables 9 and 10, above). First, we address the requested individual exemptions from the Woburn Zoning Ordinance. After a review of the record, we find that construction of the Woburn Substation would most likely require a use variance from the provisions of Section 5.2, Subsection 1, parts 1 and 3 and Section 5.2, Subsection 2, of the Woburn Zoning Ordinance. As noted in Table 9 above, however, the Woburn Zoning Board of Appeals is prohibited from granting such a variance. Therefore, we find that these variances are necessary for the Woburn Substation construction.

Regarding whether the Siting Board should also grant zoning exemptions for operations of the Woburn Substation, we note that Eversource recently sought an exemption from some of the same zoning provisions at issue here in a proceeding before the Department of Public Utilities for upgrades to the Woburn Substation. Woburn Substation. In that proceeding, as in the present one, Eversource sought individual exemptions from certain provisions of the Woburn

Zoning Ordinance – including Section 5.2, Subsection 1, parts 1 and 3 and Section 5.2, Subsection 2 – as well as a comprehensive exemption from said Ordinance. Woburn Substation at 1, 33, 39. The Department issued an Order in that proceeding granting the individual exemption from Section 5.2, Subsection 1, parts 1 and 3 and Section 5.2, Subsection 2, of the Woburn Zoning Ordinance for the "*construction* of the Project only." Id. at 37 (emphasis in original). In denying NSTAR's request that the individual exemption extend to the *operation* of the Project, the Department stated that: "The Department notes that it has not generally granted exemptions from zoning bylaws or ordinances relating to environmental aspects of the ongoing operation of a proposed project." Woburn Substation at 36, citing New England Power, D.P.U. 14-128/14-129, at 45-46 (2015); Western Massachusetts Electric Company, D.P.U. 13-187/13-188, at 50-51 (2015); NSTAR Electric Company, D.P.U. 13-126/13-127, at 34-35 (2014)).

We see no reason to depart, in this case, from Department precedent articulated in the Woburn Substation Order and the Orders cited therein. While that case and the cases to which it cites were adjudicated by the Department, the Siting Board and the Department are statutorily required to apply their standards in a consistent manner. G.L. c. 164 § 69H(2). Furthermore, there is also Siting Board precedent for excluding from zoning exemptions the environmental aspects of the ongoing operation of a proposed project. Walpole-Holbrook at 99; Hampden County at 93. Therefore, the Siting Board grants to the Companies their requested exemptions from the Woburn Zoning Ordinance, with one significant exception: the exemption from Section 5.2, Subsection 1, parts 1 and 3, and Section 5.2, Subsection 2 relates to the construction of the Project only and not to its operation.

Furthermore, we find that the Companies would most likely need variances from Section 6.1, Sections 8.1 through 8.6, and Section 13 of the Woburn Zoning Ordinance to construct the Project. While the Woburn ZBA has the authority to grant variances, we concur with the Companies' argument that obtaining a variance is difficult, that it could unduly delay the Project, and that the variances may be overturned in court. See, e.g., Lussier v. Zoning Board of Appeals of Peabody, 447 Mass. 531, 534 (2006) (variances are not allowed as a matter of right and should be sparingly granted); 39 Joy Street Condominium Assn v. Board of Appeals of

Boston, 426 Mass. 485 (1998) (same). Consequently, we find that the requested exemptions from the Woburn Zoning Ordinance are required within the meaning of G.L. c. 40A § 3.

Next we turn to the requested individual exemptions from the Wakefield Zoning Bylaw.[126] After a review of the record, we agree with the Companies that construction of the Wakefield Junction Substation would require that the Wakefield ZBA either modify the existing special permits and site plan approval or else issue a new special permit and a new site plan approval. We further find that the subjective nature of the findings required to grant a special permit creates significant uncertainty: the ZBA might not grant a special permit for the Project, and even if it does, the grant could be subject to appeal, which would cause undue delay. With respect to amending the existing site layout, we agree with the Companies' argument that National Grid must have the discretion to design the Project and site layout in a manner consistent with established utility standards. Consequently, we find that the requested exemptions from the Wakefield Zoning Bylaw are required within the meaning of G.L. c. 40A § 3.

C. Conclusion on Request for Individual Zoning Exemptions

The Siting Board has found above that: (1) the Companies are public service corporations; (2) the proposed use is reasonable necessary for the public convenience and welfare; and (3) the specifically named zoning exemptions are required for construction of the Project – provided that an exemption from Section 5.2, Subsection 1, parts 1 and 3 and Section 5.2, Subsection 2, of the Woburn Zoning Ordinance is not required for the ongoing operation of the Project – within the meaning of G.L. c. 40A, § 3. Additionally, the Siting Board found that the Companies engaged in good faith consultation with the municipalities of Woburn and Wakefield.

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126 The Wakefield Zoning Bylaw does not have any environmental controls provisions (Exh. JP-5, Attachment B). Consequently, an exemption from such provisions is not at issue with respect to the Wakefield Zoning Bylaw.

Accordingly, the Siting Board grants the Companies' request for the individual zoning exemptions listed above in Tables 9 and 10, with the exception noted above and subject to the conditions in this Decision.

IX. REQUEST FOR A COMPREHENSIVE ZONING EXEMPTIONS PURSUANT TO G.L. C. 40A, § 3

A. Standard of Review

The Companies have requested comprehensive zoning exemptions from the Woburn Zoning Ordinance and the Wakefield Zoning Bylaw. The Siting Board grants such requests on a case-by-case basis where the applicant demonstrates that issuance of a comprehensive exemption could avoid substantial public harm by serving to prevent a delay in the construction and operation of the proposed use. Walpole-Holbrook at 98; NRG at 153, 154; Hampden County at 92.

In order to make a determination regarding substantial public harm, the Department and the Siting Board have articulated relevant factors, including, but not limited to, whether: (1) the project is time sensitive; (2) the project involves multiple municipalities that could have conflicting zoning provisions that might hinder the uniform development of a large project spanning these communities; (3) the proponent of the project has actively engaged the communities and responsible officials to discuss the applicability of local zoning provisions to the project and any local concerns; and (4) the affected communities do not oppose the issuance of the comprehensive exemption. NRG at 154; Salem Cables at 99; Hampden County at 89-90.

B. Companies' Position

The Companies argue that construction of the Project is needed to ensure reliability (Companies Brief at 150; Exhs. JP-5, at 27-28; EFSB-N-17; EFSB-N-18). Furthermore, because the need for aspects of the Project existed before 2013, the need is imminent (Companies Brief at 150; Exhs. JP-5, at 27-28; EFSB-N-17; EFSB-N-18). In addition, the Companies note that the substation improvement portion of the Project involves multiple municipalities: Woburn and Wakefield (Companies Brief at 150). The Companies have engaged with both the communities of Woburn and Wakefield and their City and Town officials (Companies Brief at 150).

Furthermore, the Companies have addressed the concerns raised by local officials, including the City of Woburn's request for additional screening (Companies Brief at 150; Exhs. JP-5, at 28; EFSB-G-3; EFSB-V-7; EFSB-V-9). Finally, the Companies point to the letters of support from the host communities, Woburn and Wakefield, for the grant of all requested zoning exemptions (Companies Brief at 150; Exhs. JP-5, at 28; JP-5, Attachments G and H).

C. Analysis and Findings

In the present case, all of the factors that justify the granting of comprehensive zoning exemptions are present. The Project involves multiple municipalities; the Companies have engaged the residents and the officials of Woburn and Wakefield; and these communities do not oppose the issuance of a comprehensive exemption. Most importantly, the Project is time sensitive. Under these circumstances, the Siting Board finds that any delay in the completion of the Project would likely cause substantial public harm because such delay would impede the Companies' ability to meet applicable system planning criteria and standards. These circumstances justify the grant of comprehensive zoning exemptions with one exception: for reasons described above, the comprehensive exemption does not apply to Section 5.2, Subsection 1, parts 1 and 3 and Section 5.2, Subsection 2, of the Woburn Zoning Ordinance as they relate to the ongoing operation (as opposed to construction) of the Project. This grant of a comprehensive zoning exemption shall apply to the construction and operation of the Project as described herein. See Planning Board of Braintree v. Department of Public Utilities, 420 Mass. 22, at 29 (1995); Walpole-Holbrook at 99-100.

X. ANALYSIS UNDER G.L. C. 164, § 72

A. Standard of Review

General Laws, c. 164, § 72 requires, in relevant part, that an electric company seeking approval to construct a transmission line must file with the Department a petition for:

> authority to construct and use … a line for the transmission of electricity for distribution in some definite area or for supplying electricity to itself or to another electric Company or to a municipal lighting plant for distribution and sale … and shall represent that such line will or does serve the public convenience and is consistent with the public interest ....

> The [D]epartment, after notice and a public hearing in one or more of the towns affected, may determine that said line is necessary for the purpose alleged, and will serve the public convenience and is consistent with the public interest.[127]

The Department, in making a determination under G.L. c. 164, § 72, considers all aspects of the public interest. Boston Edison Company v. Town of Sudbury, 356 Mass. 406, 419 (1969). Among other things, Section 72 permits the Department to prescribe reasonable conditions for the protection of the public safety. Id. at 419-420.

In evaluating petitions filed under G.L. c. 164, § 72, the Department examines: (1) the need for, or public benefits of, the present or proposed use; (2) the environmental impacts or any other impacts of the present or proposed use; and (3) the present or proposed use and any alternatives identified. East Eagle at 164; Walpole-Holbrook at 100-101; Boston Edison Company, D.T.E. 99-57, at 3-4 (1999). The Department then balances the interests of the general public against the local interests and determines whether the line is necessary for the purpose alleged and will serve the public convenience and is consistent with the public interest. East Eagle at 164; Walpole-Holbrook at 101.

B. Analysis and Findings

As described above in Sections III through VI, the Siting Board examined: (1) the need for, or public benefits of, the proposed Project; (2) the environmental impacts of the proposed Project; and (3) any identified alternatives. With implementation of the specified mitigation measures proposed by the Companies and the conditions set forth by the Siting Board in Section XII, below, the Siting Board finds pursuant to G.L. c. 164, § 72 that the proposed transmission line is necessary for the purpose alleged, would serve the public convenience, and is consistent with the public interest. Thus, the Siting Board approves the Section 72 Petition.

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[127] Pursuant to G.L. c. 164, § 72, the electric company must file with its petition a general description of the transmission line, a map or plan showing its general location, an estimate showing in reasonable detail the cost of the line, and such additional maps and information as the Department requires.

XI. SECTION 61 FINDINGS

MEPA provides that "[a]ny determination made by an agency of the Commonwealth shall include 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." G.L. c. 30, § 61. Pursuant to 301 CMR 11.01(3), these findings are necessary when an Environmental Impact Report ("EIR") is submitted by a petitioner to the Secretary of Energy and Environmental Affairs, and should be based on such EIR. Where an EIR is not required, G.L. c. 30, § 61 findings are not necessary. 301 CMR 11.01(3).[128]

In this case, the record indicates that the Secretary of Energy and Environmental Affairs issued a Certificate on the Environmental Notification Form on November 6, 2015, stating that the Project does not require an EIR (Exh. EFSB-G-1(2)). Accordingly, Section 61 findings are not necessary in this case.

XII. 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. Thus, an applicant must obtain Siting Board approval under G.L. c. 164, § 69J, prior to construction of a proposed energy facility.

In Section III, above, the Siting Board finds that additional energy resources are needed to maintain a reliable supply of electricity within the Greater Boston Area.

In Section IV, above, the Siting Board finds that the Project is superior to the other alternatives identified with respect to providing a reliable energy supply for the Commonwealth with minimum impact on the environment at the lowest possible cost.

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128 If an EIR were submitted in this case, a finding under G.L. c. 30, § 61 would be necessary for the Companies' Zoning Exemption Petition and its Section 72 Petition. Regardless of whether the Companies submit an EIR, the Siting Board is not required to make a G.L. c. 30, § 61 finding under G.L. c. 164, § 69J because the Siting Board is exempt from MEPA requirements. G.L. c. 164, § 69I.

In Section V, above, the Siting Board finds that the Companies have developed and applied a reasonable set of criteria for identifying and evaluating alternatives to the Project in a manner that ensures that the Companies have not overlooked or eliminated any routes that, on balance, are clearly superior to the Project. The Siting Board also finds that the Companies have identified a range of practical transmission line routes with some measure of geographic diversity. Consequently, the Siting Board finds that the Companies have demonstrated that it examined a reasonable range of practical siting alternatives.

In Section VI, above, the Siting Board finds that the proposed facilities along the Primary Route would be superior to the proposed facilities along the Noticed 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.

In Section VI, above, the Siting Board reviewed environmental impacts of the Project and finds that with the implementation of the specified mitigation and conditions, and compliance with all applicable local, state and federal requirements, the environmental impacts of the Project along the Primary Route would be minimized.

In Section VII, above, the Siting Board finds that with the implementation of specified mitigation and conditions, the Project is consistent with the health, environmental and resource use and development policies of the Commonwealth.

In addition, the Siting Board finds, pursuant to G.L. c. 164, § 72, that the New Line is necessary for the purpose alleged, and will serve the public convenience and is consistent with the public interest, subject to the following Conditions A through T.

In addition, the Siting Board finds, pursuant to G.L. c. 40A, § 3, that construction and operation of the Companies' proposed facilities are reasonably necessary for the public convenience or welfare. Accordingly, the Siting Board approves the Companies' Petition for an exemption from certain provisions of the zoning ordinance of the City of Woburn and the zoning bylaw of the Town of Wakefield, with limitations, as enumerated in Section VIII.B, above. In addition, the Siting Board finds, pursuant to G.L. c. 40A, § 3, that construction and operation of the Companies' proposed facilities are necessary to avoid substantial public harm. Accordingly, the Siting Board approves the Companies' Petition for comprehensive exemptions from the

provisions of the zoning ordinance of the City of Woburn and the zoning bylaw of the Town of Wakefield, with limitations, as enumerated in Section IX.C, above.

Accordingly, the Siting Board APPROVES pursuant to G.L. c. 164, § 69J, the Companies' Petition to construct the Project using the Primary Route, as described herein, subject to the following Conditions A through U.

A. The Siting Board directs the Companies to report to the Siting Board, at least 60 days before starting construction at each location: (1) the crossing method proposed for each railroad and waterbody crossing; (2) the rationale for selecting the crossing method; and (3) the Companies' mitigation of impacts.

B. The Siting Board directs the Companies to fund reasonable and appropriately documented costs for independent field engineers to assist the municipalities of Woburn, Winchester, Stoneham, and Wakefield solely in furtherance of the Project. Pursuant to this condition, the field engineer is to be afforded all necessary municipal authority to approve changes in the field and to make sure Project construction proceeds in an efficient, safe, and expeditious manner.

C. The Siting Board directs the Companies to perform a pre-construction interior video recording of existing sewer facilities and a video recording of existing roadway conditions prior to commencing construction.

D. The Siting Board directs the Companies to submit a copy of the final Stormwater Pollution Prevention Plan to the Siting Board when available, but no less than four weeks prior to the commencement of construction.

E. The Siting Board directs the Companies to limit construction to nighttime hours on Montvale Avenue in Woburn from the Washington Street intersection to the Woburn/Stoneham border.

F. The Siting Board directs the Companies to limit construction on Montvale Avenue in Stoneham to nighttime hours.

G. The Siting Board directs the Companies, to the extent practicable, to limit trenchless crossings construction on Cross and Washington Streets in Winchester to summer months when school is not in session. The Siting Board also directs the Companies to start typical construction on Cross and Washington Streets no earlier than 9:00 a.m. on school days.

H. The Siting Board directs the Companies, in consultation with Woburn, Winchester, Stoneham, and Wakefield to develop a separate, comprehensive outreach plan for the Project. The outreach plan should describe the procedures to be used to notify the public about: the scheduled start, duration, and hours of

construction in particular areas; the methods of construction that will be used in particular areas (including any use of nighttime construction); and the anticipated street closures and detours. The outreach plan should also include information on complaint and response procedures, Project contact information, the availability of web-based project information, and protocols for notifying the MBTA and schools of upcoming construction.

I. The Siting Board also directs the Companies to submit a copy of the final traffic management plans to the Siting Board and all other parties when available, but no less than 30 days prior to the commencement of construction, and to publish them on a Project website with links from each Company's public website.

J. The Siting Board directs the Companies to use portable noise barriers in locations where there are residences, commercial businesses, and other sensitive receptors within 100 feet of trenchless crossing entry and exit pits.

K. The Siting Board directs the Companies to use the quietest generators and portable HVAC units reasonably available to them. In addition, when the Companies operate noisy equipment, such as whole tree chippers or compressors, the Siting Board directs that such equipment be located as far away as possible from nearby residences, where flexibility exists to do so, to reduce noise impacts on residences.

L. The Siting Board directs the Companies to limit construction of the transmission line to Monday through Friday from 7:00 a.m. to 5:00 p.m. in residential areas, except for Montvale Avenue in Woburn and Stoneham which would be constructed at night. Work that necessarily has a longer required extended duration than normal construction hours allow, such as cable splicing, shall be exempted from this condition. Should the Companies need to extend construction work beyond those hours and days (with the exception of emergency circumstances on a given day that necessitate extended hours), the Siting Board directs the Companies to seek written permission from the relevant municipal authority before the commencement of such work and to provide the Siting Board with a copy of such permission. If the Companies and municipal officials are not able to agree on whether such extended construction hours should occur, the Companies may request prior authorization from the Siting Board and shall provide the relevant municipality with a copy of any such request.

The Companies shall inform the Siting Board and the relevant municipality in writing within 72 hours of any work that continues beyond the hours allowed by the Siting Board. The Companies shall also send a copy to the Siting Board, within 72 hours of receipt, of any municipal authorization for an extension of work hours. Furthermore, the Companies shall keep records of the dates, times, locations, and durations of all instances in which work continues beyond the

hours allowed by the Siting Board, or, if granted extended work hours in writing by a municipality, work that continues past such allowed hours, and must submit such record to the Siting Board within 90 days of Project completion.

M. The Siting Board directs the Companies to avoid removing mature trees within the Wakefield railroad ROW to the extent possible.

N. The Siting Board directs the Companies to work with the Town of Wakefield and the Wakefield Conservation Commission and offer, on a case by case basis, appropriate off-site screening for residences affected by tree clearing along the Wakefield railroad ROW.

O. The Siting Board directs the Companies to submit to the Board the final landscaping plan for the Woburn Substation when it becomes available.

P. The Siting Board directs the Companies to further evaluate any site-specific additional magnetic field mitigation that can be feasibly engineered into the project design, particularly for close residences 20-30 feet from the New Line. The Companies shall file a compliance filing as soon as practicable, but not less than 90 days prior to the commencement of construction in residential areas, identifying additional feasible magnetic field mitigation. The Companies may commence construction at substations and in commercial areas, and may perform site preparation work

Q. The Siting Board directs the Companies to comply with all applicable federal and state laws concerning the excavation and disposal of any contaminated soils that the Companies encounter in the construction phase of the Project.

R. The Siting Board directs the Companies to provide to the Board a copy of any Host Community Agreement, or similar agreement, entered into between the Companies (or any one of them) and any municipality affected by the Project.

S. The Siting Board directs the Companies and its contractors and subcontractors to comply with all applicable federal, state, and local laws, regulations, and ordinances from which the Companies have not received an exemption.

T. The Siting Board directs the Companies to submit to the Board an updated and certified cost estimate for the Project prior to the commencement of construction. Additionally, the Siting Board directs the Companies to file semi-annual compliance reports with the Siting Board starting within 60 days of the commencement of construction, that include projected and actual construction costs and explanations for any discrepancies between projected and actual costs and completion dates, and an explanation of the Companies' internal capital authorization approval process.

U. The Siting Board directs the Companies, within 90 days of Project completion, to submit a report to the Siting Board documenting compliance with all conditions contained in this Decision, noting any outstanding conditions yet to be satisfied and the expected date and status of such resolution.

Because issues addressed in this Decision relative to this facility are subject to change over time, construction of the proposed Project must be commenced 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 Companies, and their successors in interest, 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. The Companies or their successors in interest 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.

The Secretary of the Department shall transmit a copy of this Decision and the Section 61 findings herein to the Executive Office of Energy and Environmental Affairs and the Companies shall serve a copy of this Decision on the Town of Wakefield Board of Selectmen, the Town of Wakefield Planning Board, the Town of Wakefield Zoning Board of Appeals, the City Council for the City of Woburn, the City of Woburn Planning Board, and the City of Woburn Zoning Board of Appeals within five days of its issuance. The Companies shall certify to the Secretary of the Department within ten business days of issuance that such service has been made.

Robert J. Shea
Presiding Officer

Dated this 28th day of February 2018

APPROVED by unanimous vote of the Energy Facilities Siting Board at its meeting on February 27, 2018, by the members present and voting. Voting for the Tentative Decision as amended: Matthew A. Beaton, Secretary of the Executive Office of Energy and Environmental Affairs, EFSB Chairman; Angela M. O'Connor, Chairman of the Department of Public Utilities; Cecile M. Fraser, Commissioner of the Department of Public Utilities; Judith Judson, Commissioner of the Department of Energy Resources; Gary Moran, Deputy Commissioner and designee for the Commissioner of MassDEP; Glenn Harkness, Public Member; and Joseph Bonfiglio, Public Member.

Matthew A. Beaton, Chairman
Energy Facilities Siting Board

Dated this 28th day of February 2018

Appeal as to matters of law from any final decision, order or ruling of the Siting Board may be taken to the Supreme Judicial Court by an aggrieved party in interest by the filing of a written petition praying that the order of the Siting Board be modified or set aside in whole or in part. Such petition for appeal shall be filed with the Siting Board within twenty days after the date of service of the decision, order or ruling of the Siting Board, or within such further time as the Siting Board may allow upon request filed prior to the expiration of the twenty days after the date of service of said decision, order or ruling. Within ten days after such petition has been filed, the appealing party shall enter the appeal in the Supreme Judicial Court sitting in Suffolk County by filing a copy thereof with the clerk of said court. Massachusetts General Laws, Chapter 25, Sec. 5; Chapter 164, Sec. 69P.