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May 20, 2014

Brian Mills
Senior Planning Advisor
Office of Electricity Delivery and Energy Reliability, OE-20
U.S. Department of Energy
1000 Independence Avenue SW
Washington, DC 20585

Jay Ryan
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Dear Mr. Mills,

Champlain VT, LLC, d/b/a TDI-New England ("TDI-NE" or "Applicant") hereby files the enclosed application for a Presidential Permit with the U.S. Department of Energy ("DOE"). As described in the application, TDI-NE proposes to develop the New England Clean Power Link Project ("Project") to connect renewable sources of power generation in Canada with the transmission system owned by the Vermont Electric Power Company ("VELCO") and operated by the Independent System Operator of New England ("ISO-NE).

The proposed Project is a 1,000-megawatt ("MW") high-voltage direct current ("HVDC") underground and underwater electric transmission system, comprised primarily of two approximately five-inch, solid-state HVDC electric cables that will connect from a HVDC transmission line in the Canadian Province of Québec and transmit electric power to a proposed HVDC converter station in the Town of Ludlow, Vermont. The new HVDC converter station will convert the electrical power from direct current ("DC") to alternating current ("AC") and then connect to the 345-kilovolt Coolidge substation in Cavendish, Vermont owned by VELCO.

Approximately 100 miles of the 154-mile-long section of the Project located in the United States will be buried in Lake Champlain using low-impact installation techniques. The remaining approximately 50 miles of the transmission line will be buried underground along existing rights-of-way ("ROW") before terminating at the proposed location of the new converter station site in Ludlow, Vermont. TDI-NE believes that this approach will minimize the visual, landscape, and other environmental impacts associated with traditional overhead transmission lines, while simultaneously providing the critical capacity required to meet the increasing clean energy demands of the Vermont and New England markets.

TDI-NE will own the section of the Project located within the United States and that section will be under the operational control of ISO-NE. The estimated total capital cost of the Project will be approximately $1.2 billion. TDI-NE believes that the construction and operation of the Project will further the New England States' energy and environmental policy goals, diversify fuel supply in ISO-NE, lower energy prices for consumers, reduce carbon emissions in New England, improve the economic competitiveness of the New England States, and provide economic benefits to Vermont and other New England States.

In accordance with Executive Order 10485, as amended by Executive Order 12038, TDI-NE is applying to the DOE for a Presidential Permit authorizing the construction, operation, maintenance, and connection of facilities for the transmission of electric energy at the international border between the United States and Canada. The enclosed application has been prepared in accordance with the DOE's applicable administrative procedures at 10 CFR § 205.320 *et seq*. The required $150 application filing fee has also been enclosed with this submittal.

We look forward to working with your office as we proceed with the Project and welcome the opportunity to discuss this matter with you at any time. Please do not hesitate to contact the undersigned should you have any additional questions or comments regarding this application.

Respectfully submitted,

Marcia Hook

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May 20, 2014

Counsel for Champlain VT, LLC

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Sean Murphy, HDR, Inc.
Andy Raubvogel, Dunkiel Saunders

APPLICATION OF
CHAMPLAIN VT, LLC

FOR A PRESIDENTIAL PERMIT FOR
THE
NEW ENGLAND CLEAN POWER LINK
HVDC TRANSMISSION PROJECT

May 20, 2014

NEW ENGLAND CLEAN POWER LINK

HVDC TRANSMISSION PROJECT

PRESIDENTIAL PERMIT APPLICATION

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Acronym List

AC ....Alternating current

APE ....Area of Potential Effects

AUC ....Alberta Utilities Commission

BCA ....Bird Conservation Area

BCR...Bird Conservation Region

BMP ....Best Management Practices

BOD ....Biological Oxygen Demand

B.P. ....Before Present

BPA...Bonneville Power Administration

°C ....Degrees Celsius

CFR...Code of Federal Regulations

cm..Centimeters

CMACS...Centre for Marine and Coastal Studies

CWA ....Clean Water Act

dBA ....A-weighted Decibel

DC ....Direct current

DDT ....Dichloro-diphenyl-trichloroethane

DOE ....U.S. Department of Energy

EMF ....Electromagnetic fields

EFH...Essential Fish Habitat

EMI ....Electromagnetic Interference

EO ....Executive Order

EPRI..Electric Power Research Institute

EPSC ....Erosion Prevention and Sediment Control Plan

ERRP...Emergency Repair and Response Plan

ESA...Endangered Species Act

°F..Degrees Fahrenheit

FEMA ....Federal Emergency Management Agency

FERC...Federal Energy Regulatory Commission

FIRM...Flood Insurance Rate Maps

FR...Federal Register

FTC ....Fisheries Technical Committee

G...Gauss

GHz..Gigahertz

GIS ....Geographic Information System

HAA..Hartgen Archeological Associates, Inc

HDD..Horizontal directional drilling

HDPE..High-density polyethylene

HVDC ....High-voltage direct current

Hz...Hertz

ISM ....Industrial, Scientific, Medical

ISO-NE ....Independent System Operator-New England

kg..Kilograms Per Meter

kHZ ....KiloHertz

km ....Kilometers

km2 ....Square Kilometers

kV...Kilovolts

kV/m ....Kilovolts Per Meter lb/ft..Pounds Per Foot

LCBP..Lake Champlain Basin Program

LUB..Lacustrine Unconsolidated Bottom

MBTA...Migratory Bird Treaty Act

mG..Milligauss

mg/l ....Milligrams per liter

MHz ....Megahertz

mi2 ....Square Miles

MP..Milepost

MPT ....Maintenance and Protection of Traffic

MSL ....Mean Sea Level

MW ....Megawatt

NECPL...New England Clean Power Link

NHPA...National Historic Preservation Act

NPDES...National Pollutant Discharge Elimination System

NPS ....National Park Service

NRHP...National Register of Historic Places

NRI...Nationwide Rivers Inventory

NTU ....Nephelometric turbidity units

NWI..National Wetlands Inventory

NYSDEC..New York State Department of Environmental Conservation

PAH..Poly-aromatic-hydrocarbons

PCBs ....Polychlorinated biphenyls

PEM ....Palustrine Emergent

PFO ....Palustrine Forested Wetlands

POI ....Point of Interconnection

PSS ....Palustrine Scrub-scrub

PUB ....Palustrine Unconsolidated Bottom

RTE ....Rare, Threatened and Endangered

ROI ....Region of Influence

ROV ....Remotely Operated Vehicle

ROW ....Right-of-way

SAV ....Submerged Aquatic Vegetation

SPA ....Source Protection Areas

TDI-NE ....TDI-New England

TMDL ....Total Maximum Daily Loads

TSS ....Total Suspended Solids

USACE ....U.S. Army Corps of Engineers

USCG ....U.S. Coast Guard

USEPA ....U.S. Environmental Protection Agency

USFWS ....U.S. Fish and Wildlife Service

USGS ....U.S. Geological Survey

µV/m ....Microvolts Per Meter

VANR ....Vermont Agency of Natural Resources

VCGI ....Vermont Center for Geographic Information

VDEC ....Vermont Department of Environmental Conservation

VDHP ....Vermont Division for Historic Preservation

VELCO ....Vermont Electric Power Company

VFWD..Vermont Fish and Wildlife Department

V/m ....Volts Per Meter

VNHI..Vermont Natural Heritage Inventory

VNRB ....Vermont Natural Resources Board

VPSB..Vermont Public Service Board

VSWI ....Vermont Significant Wetland Inventory

VTrans..Vermont Agency of Transportation

VWQS..Vermont Water Quality Standards

VWR ....Vermont Wetland Rules

WHO..World Health Organization

WMA ....Wildlife Management Area

XLPE..Cross-linked Polyethylene

UNITED STATES OF AMERICA

BEFORE THE DEPARTMENT OF ENERGY

OFFICE OF ELECTRICITY DELIVERY AND

ENERGY RELIABILITY

Docket No. PP-________

APPLICATION OF

CHAMPLAIN VT, LLC

FOR A PRESIDENTIAL PERMIT FOR THE

NEW ENGLAND CLEAN POWER LINK
HVDC TRANSMISSION PROJECT

May 20, 2014

____

In accordance with Executive Order 10485, as amended by Executive Order 12038, Champlain VT, LLC, d/b/a TDI-New England hereby applies to the United States Department of Energy for a Presidential Permit authorizing the construction, operation, maintenance, and connection of facilities for the transmission of electric energy at the international border between the United States and Canada. This application is made pursuant to the United States Department of Energy's applicable administrative procedures (10 CFR § 205.320 *et. seq.*).

Section 1
Information Regarding the Applicant

1.1 Legal Name of Applicant

Champlain VT, LLC d/b/a TDI-New England (the Applicant or TDI-NE) is the Applicant for this Presidential Permit. The Applicant is a limited liability company organized and existing pursuant to the laws of the State of Delaware. The Applicant has its principal place of business at 600 Broadway, Albany, New York 12207-2283.

1.2 Legal Name of All Partners

TDI-NE is the sole Applicant for this Presidential Permit.

1.3 Communications and Correspondence

All communications and correspondence regarding this application should be addressed to:

Mr. Donald Jessome, General Manager
Champlain VT, LLC d/b/a TDI-New England
P.O. Box 155
Charlotte, VT 05445
Phone: (416) 214-0018
Cellular: (902) 440-0664
Fax: (416) 352-1634
Email: donald.jessome@chvtllc.com

1.4 Foreign Ownership and Affiliations

Neither the applicant nor its transmission lines are owned wholly or in part by a foreign government or directly or indirectly assisted by a foreign government or instrumentality thereof. Additionally, the applicant does not have any agreement pertaining to such ownership by, or assistance from, any foreign government or instrumentality thereof.

1.5 List of Existing Contracts with Foreign Governments or Foreign Private Concerns Relating to the Purchase, Sale or Delivery of Electric Energy

The Applicant does not have any existing contracts with any foreign government or any foreign private concerns relating to the purchase, sale, or delivery of electric energy.

1.6 Opinion of Counsel

Appendix A includes a signed opinion of counsel attesting that the construction, connection, operation, and maintenance of the proposed New England Clean Power Link Project (the Project or NECPL Project) is within the Applicant's corporate powers and that TDI-NE has complied with or will comply with all pertinent federal and state laws.

Section 2
Information Regarding the Proposed Transmission Facility

2.1 Project Overview

The Project purpose is:

The delivery of clean, renewable power from the Canadian province of Quebec into Vermont and ISO-NE through a new 1,000 MW HVDC underground/underwater merchant transmission line. The Project is needed:

> To further the New England States' energy and environmental policy goals, diversify fuel supply in ISO-NE, lower energy prices for consumers, reduce carbon emissions in New England, improve the economic competitiveness of the New England States, and to provide economic benefits to Vermont and other New England States.

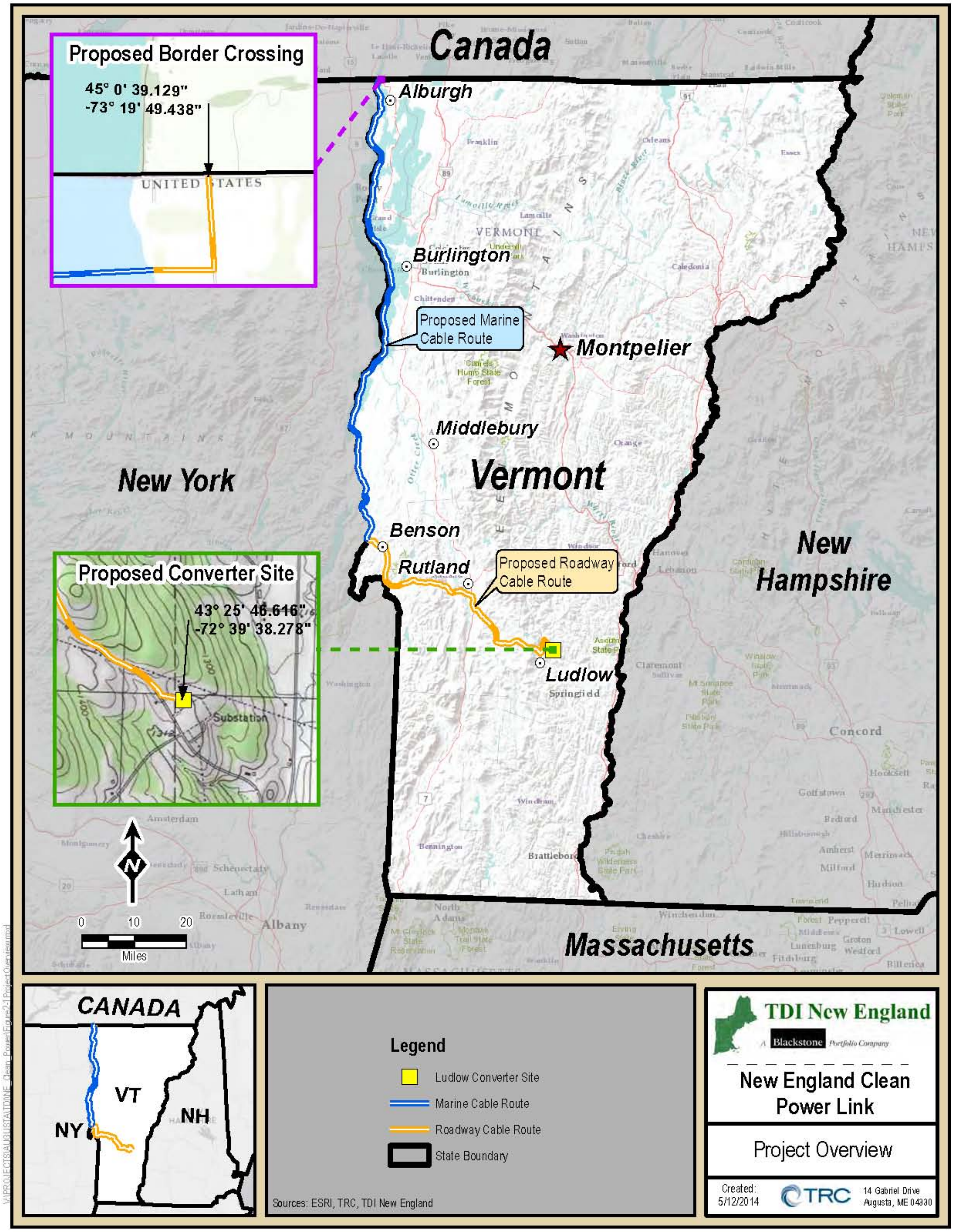
2.2 Project Overview

The Project will include construction, operation, and maintenance of an approximately 154-mile (248-km)-long, 1,000-MW, high-voltage electric power transmission system that will have both aquatic (underwater) and terrestrial (underground) segments in the State of Vermont. (see Figure 2-1). The underwater portions of the transmission line will be buried in the bed of Lake Champlain, except at depths of greater than 150 feet (46 m) where the cables are proposed to be placed on the bottom. The terrestrial portions of the transmission line will be buried underground within roadway rights-of-way (ROWs).

The transmission system will consist of one 1,000-MW High Voltage Direct Current (HVDC) transmission line and an aboveground HVDC converter station. The transmission line will be a bipole line consisting of two transmission cables, one positively charged and the other negatively charged. Two solid dielectric (no fluids), cross-linked polyethylene (XLPE) cables, approximately 154-miles (248-km) in length, will have a nominal operating voltage of approximately +/- 300 to 320 kV. From the converter station, two underground HVAC lines rated at 345-kV will be installed to interconnect to an existing electrical substation in the Towns of Ludlow and Cavendish, Vermont. This underground circuit will be approximately 0.3 miles (.5 km) in length. See Figure 2-1.

The transmission line will connect from an HVDC transmission line in the Canadian Province of Québec and transmit electric power to a proposed HVDC converter station in the Town of Ludlow, Vermont. The new HVDC converter station will convert the electrical power from direct current (DC) to alternating current (AC) and then connect to the 345-kV Coolidge Substation in Cavendish, Vermont owned by the Vermont Electric Power Company (VELCO).

FIGURE 2-1
PROJECT OVERVIEW



On March 10, 2014, the Federal Energy Regulatory Commission (FERC) issued an order conditionally authorizing TDI-NE to sell transmission rights for the Project at negotiated rates. 146 FERC ¶ 61,167 (2014). Pursuant to this order, TDI-NE must turn over operational control of the Project to the New England Independent System Operator (ISO-NE) and ISO-NE will operate the transmission line pursuant to its FERC-approved open access transmission tariff.

The Project, which has an estimated total capital cost of approximately $1.2 billion, is anticipated to be in service by 2019.

2.3 NECPL Project Location, Design, and Construction Methods

The following subsections describe the route segments analyzed in this document and specific engineering details of the transmission system: the aquatic DC transmission cables; horizontal directional drilling (HDD) methods; terrestrial DC transmission cables; the proposed HVDC converter station in Ludlow, Vermont, and the substation interconnection in Ludlow and Cavendish, Vermont.

The following subsections also discuss how the Applicant proposes to install and operate the transmission line and aboveground facilities of the proposed NECPL Project.

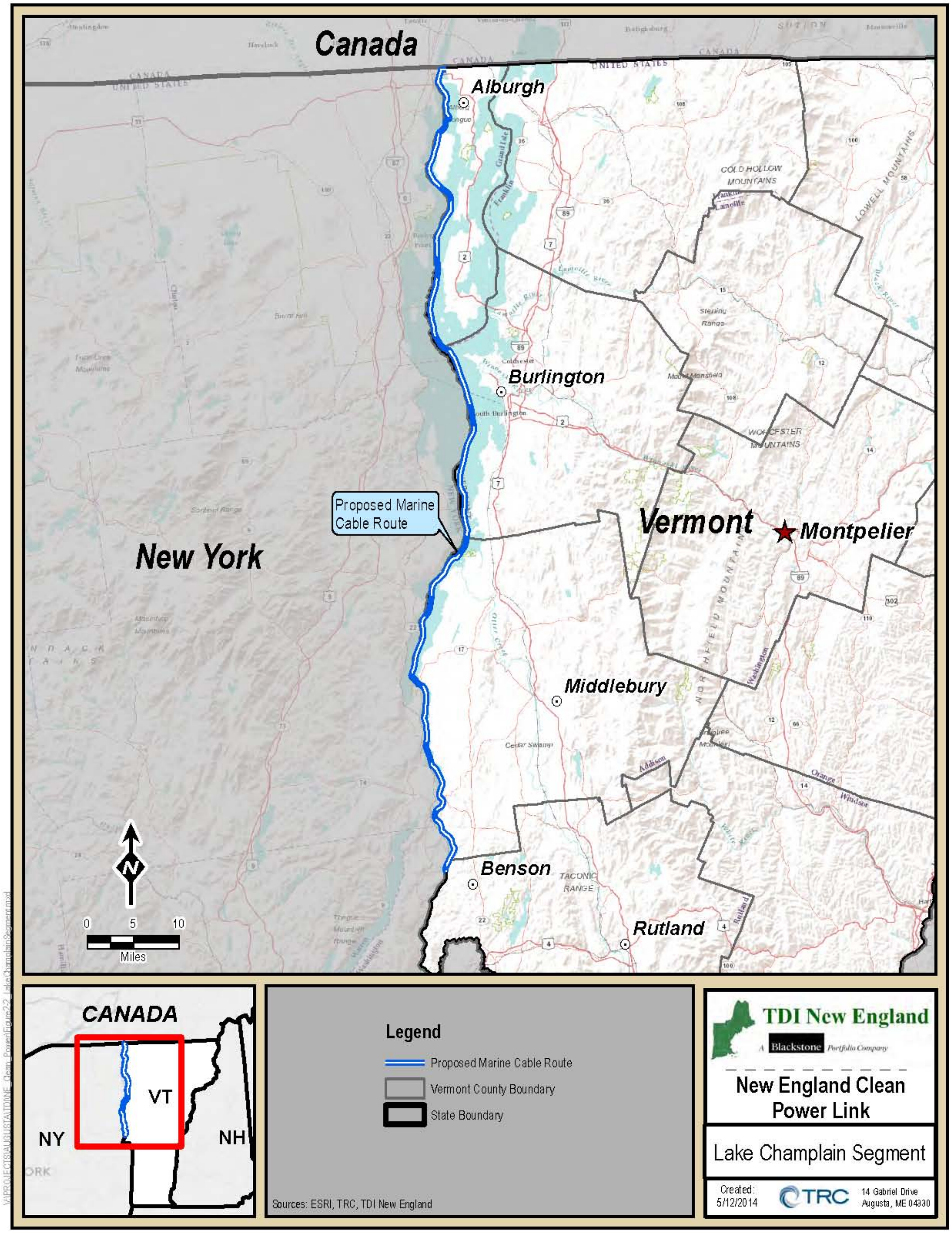
2.3.1 Description of the Route Segments

For the purpose of understanding the various environmental settings associated with the proposed NECPL Project, and to facilitate the analysis in this document, the transmission line route was divided into two geographically logical segments:

- Lake Champlain Segment; and
- Overland Segment

The two segments are identified on Figures 2-2 through 2-3, respectively. From the U.S./Canadian border, the HVDC transmission line will be located underground within the Town of Alburgh, Vermont for approximately 0.5 miles (0.8 km). The HVDC transmission system will then enter Lake Champlain via HDD and be installed beneath, or in deeper waters on top of, the Lake Champlain lake bed for approximately 97.6 miles (157.1 km), entirely within the jurisdictional waters of the State of Vermont to the Town of Benson, Vermont. This portion of the route comprises the Lake Champlain Segment (see Figure 2-2).

FIGURE 2-2
LAKE CHAMPLAIN SEGMENT



The Overland Segment begins at the southern end of Lake Champlain in the Town of Benson where the HVDC transmission line will exit the water to a privately held property. The cables will be installed buried overland as follows:

- Town roads (in ROW or underneath roadways) east to Route 22A (4.4 miles (~7.1 km))
- Route 22A ROW south to Route 4 in Fair Haven (~8.1 miles (13.0 km))
- Route 4 ROW east to Route 7 in Rutland (~17.2 miles (27.7 km))
- Route 7 ROW south to Route 103 in North Clarendon (~2.6 miles (4.2 km))
- Route 103 ROW south / southeast to Route 100 in Ludlow (~17.8 miles (28.6 km))
- Route 100 ROW north to Town Roads (~0.8 miles (1.3 km))
- Town Roads to proposed HVDC converter station (~4.8 miles (7.7 km)

The Ludlow HVDC Converter Station will occupy approximately 4.5-acres (1.8-hectare) (although the cleared area could be larger due to required grading) and will convert the DC electrical power to AC. Underground double-circuit 345-kV AC cables will be installed for approximately 0.3 miles (.5 km) to connect the converter station with the Coolidge substation owned by the Vermont Electric Power Company (VELCO) (see Figure 2-3). The permanent area that must be maintained as void of deep routed trees for the life of the proposed NECPL Project overland route will be approximately 12' feet (3.6 meters) wide within the roadway ROWs. Along road ROWs, the transmission cables will be installed in the cleared area of the road or, where that is not possible due to constraints, under the road.

FIGURE 2-3
OVERLAND SEGMENT

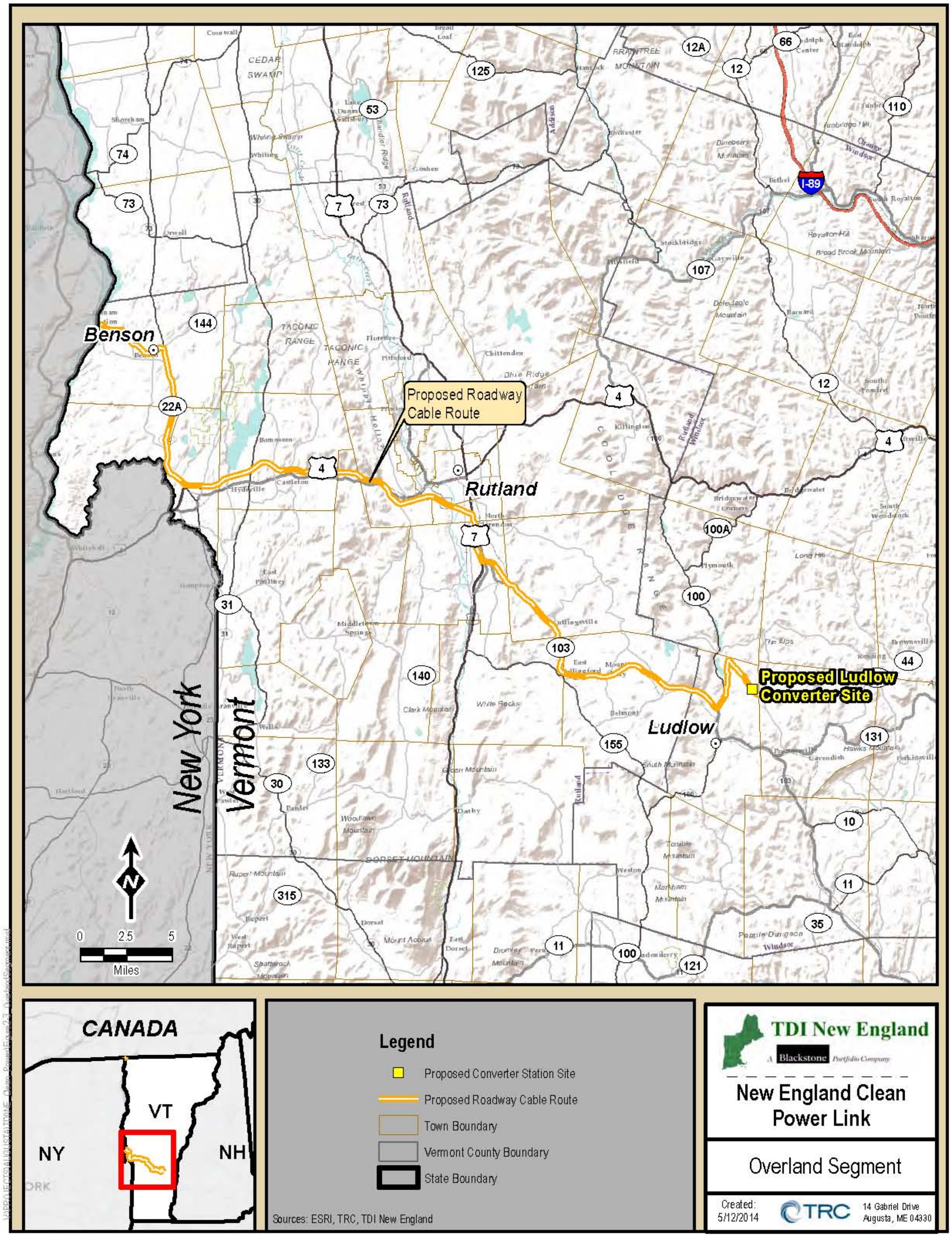


Table 2-1 provides a breakdown of the cable sections associated with the proposed NECPL Project route, including the segment, corridor type (aquatic or terrestrial), reference MPs, and length. Approximately 60 percent of the route is aquatic, while 40 percent is overland.

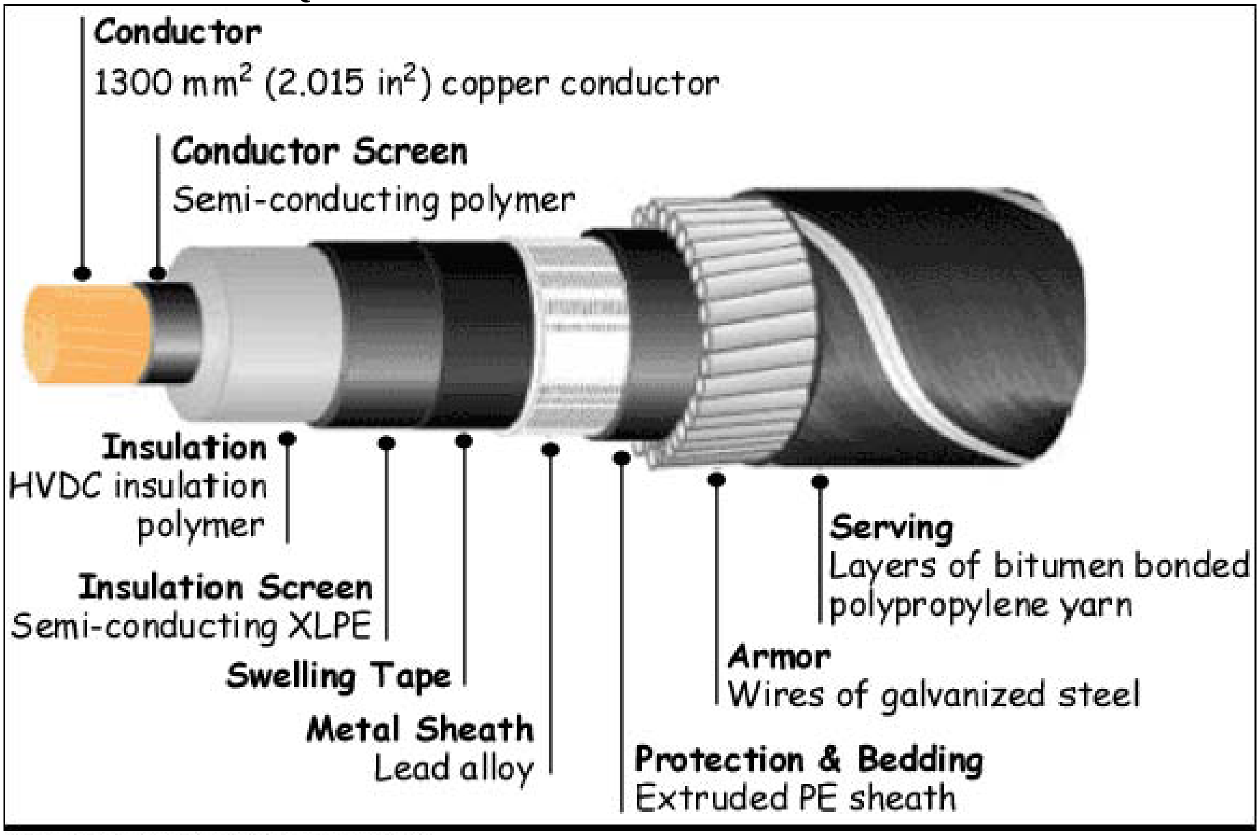
TABLE 2-1
SUMMARY OF THE PROPOSED NECPL PROJECT TRANSMISSION LINE ROUTE

Cable Section	Segment	Corridor Type	Approximate Length (miles)
U.S./Canada Border to Alburgh, VT	Lake Champlain	Terrestrial	0.5
Lake Champlain from Alburgh, VT to Benson, VT	Lake Champlain	Aquatic	97.6
Benson to Route 22A (along local roads)	Overland	Terrestrial	4.4
Route 22A to Route 4, Fair Haven	Overland	Terrestrial	8.1
Route 4 to Route 7, Rutland	Overland	Terrestrial	17.2
Route 7 to Route 103, Clarendon	Overland	Terrestrial	2.6
Route 103 to Route 100, Ludlow	Overland	Terrestrial	17.8
Route 100 to East Lake Road, Ludlow	Overland	Terrestrial	0.8
East Lake Road to converter station (along local roads)	Overland	Terrestrial	4.8
		Total Length	**153.7**

2.3.2 Aquatic Direct Current Transmission Cable

The transmission cables proposed for installation in the Lake Champlain segment will be XLPE HVDC cables rated at +/- 300 to 320 kilovolts (kV) (depending upon the manufacturer). The polyethylene insulation in the XLPE cable eliminates the need for fluid insulation, enables the cable to operate at higher temperatures with lower dielectric losses, improves transmission reliability, and reduces risk of network failure. In general, aquatic transmission cables include a polyethylene sheath extruded over a lead-alloy sheath to provide superior mechanical and corrosion protection (see Figure 2-4). An armored layer of galvanized steel wires embedded in bitumen provides additional protection for the aquatic transmission cables. The outer layer of the aquatic transmission cable will consist of an asphaltic compound with polypropylene reinforcement. The diameter of each aquatic cable will be approximately 5 inches (12.4 centimeters (cm)) and the cable will weigh approximately 30 pounds per foot (lb/ft) (44 kilograms/meter (kg/m)).

FIGURE 2-4
EXAMPLE AQUATIC HVDC TRANSMISSION CABLE CROSS-SECTION



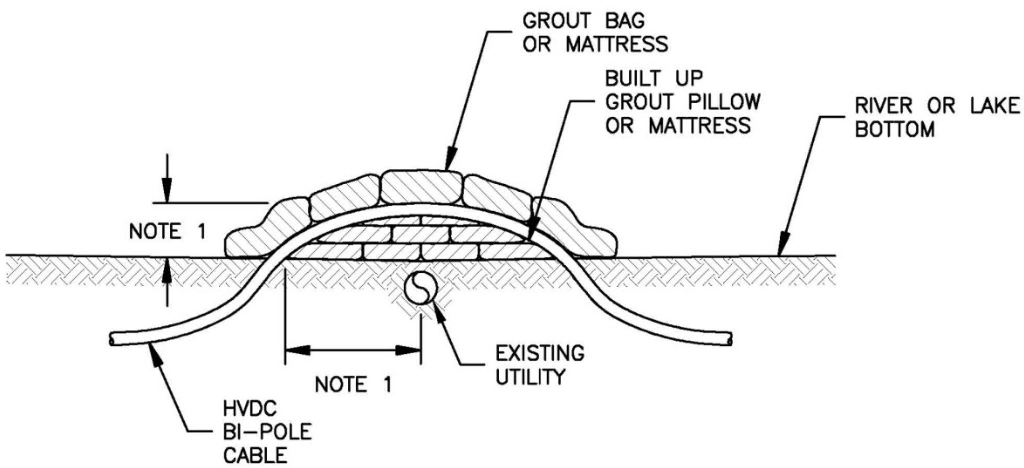
Source: Cross-Sound Cable Company 2012

Aquatic transmission cables are generally sited to maximize the system's operational reliability while minimizing the costs and potential environmental impacts caused during construction, operation, and maintenance. Underwater cable installation activities will likely be limited to certain times of the year to avoid life-cycle impacts on aquatic species in the project area. The transmission cables will be buried beneath the beds of Lake Champlain at a depth of 3 to 4 feet (0.9 to 1.2 meters), to the extent practicable, to prevent disturbance to the cables from unrelated aquatic operations in the waterways. The actual depth of burial that will be achieved will depend on available aquatic construction equipment, soil types and depth to bedrock, existing utilities, and the types of lake activities occurring and their potential threat to cable integrity.

Burial depths also might vary in response to site-specific factors identified within Lake Champlain. These factors could include the presence of existing infrastructure, the potential for anchor damage, the identification of archaeological or historic resources, localized geological or topographical obstacles, or other environmental concerns. For example, in areas where there are soft-bottom conditions, the transmission cables could be buried at a greater depth to provide additional protection against damage. Where the transmission cables cross an existing utility such as a pipeline or another cable, they will be laid over the existing utility and protective coverings such as articulated concrete mats will be installed over the cable crossing (see Figure 2-5). Articulated concrete mats (see Figure 2-6) are typically made of small pre-formed 9- to 12-inch (23- to 30-cm)-thick concrete blocks that are interconnected by cables or synthetic ropes in a two-dimensional grid and will typically range in size from 6 feet by 6 feet (1.8 meters by 1.8

meters) to 8 feet by 25 feet (2.4 meters by 7.6 meters). Coordination with utility owners will occur and standard utility crossing procedures will be employed to prevent damage to pre-existing utilities. In deepwater sections of Lake Champlain (i.e., greater than 150 feet (43 meters)), the possibility of damage to the cables might be so low as to allow the cables to be laid on the lakebed without burial. Where bedrock is near the surface and burial is not practicable, protective coverings such as concrete mats will be installed to protect the cables.

FIGURE 2-5
REPRESENTATIVE SCHEMATIC OF PROTECTION MEASURES FOR AQUATIC TRANSMISSION CABLES



NOTE:
1. VARIES BASED ON STABILITY OF EXISTING BOTTOM SEDIMENT, UTILITY DIAMETER AND BEND RADIUS OF CABLE.

FIGURE 2-6
TYPICAL ARTICULATED CONCRETE MATS

Source: IMCA 2011

2.3.3 Horizontal Directional Drilling (HDD)

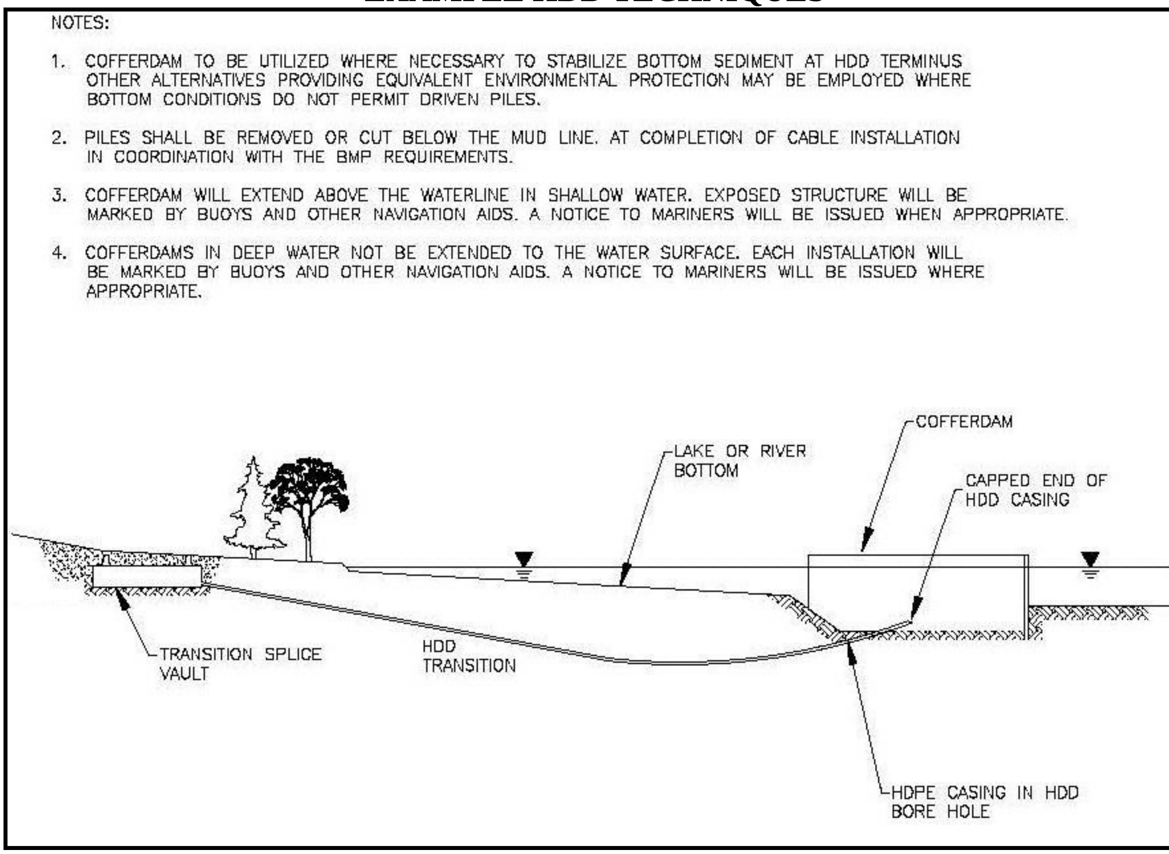
HDD will be used to install the transmission cables in transition areas between aquatic and terrestrial portions of the proposed NECPL Project route, and may also be used in limited situations to install cables under roadway or railway crossings where trenching is not possible, or under environmentally sensitive areas such as lakes or rivers. The equipment used and scale of the HDD operation will vary depending on the length and depth of the installation. It is anticipated that the largest, most complex, HDD operation will occur at the two land-to-water transitions that are planned. This larger-scale HDD operation will be used at the transitions from water to land in Alburgh and Benson. This process is described below.

For each proposed HDD location, two separate drill holes will be required, one for each cable. Each cable will be installed within a 10-inch (64-cm)-diameter, or larger, high-density polyethylene (HDPE) tube-shaped duct, or conduit. To maintain appropriate separation between the two cables, a minimum of 6 feet (1.8 meters) will be required between each drill path.

During installation, a drill rig will be placed onshore behind a temporary fluid return pit and a 40-foot (12-meter) drill pipe with a cutting head will be set in place to begin the drilling process. As the initial pilot borehole is drilled, a slurry composed of water and bentonite (i.e., a shrink-swell clay) will then be pumped into the hole to transport the drill cuttings to the surface, to aid in keeping the borehole stable, and to lubricate the drill.

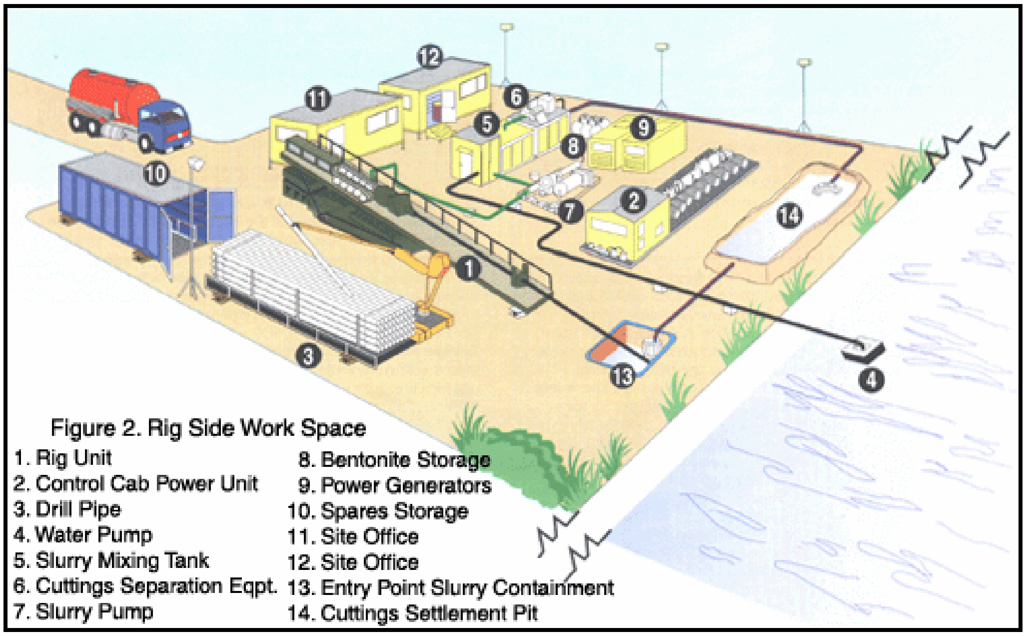
After each 40-foot (12-meter) segment of pipe is installed, an additional length of drill pipe will be added until the final drill length has been achieved (see Figure 2-7). As necessary, the borehole will be widened by repeated passes of a widening tool called a reamer. When the desired borehole diameter has been achieved, a pulling head will be attached to the end of the drill pipe and the drill pipe will then be used to pull back an HDPE conduit pipe into the borehole from the exit end. Separate conduits will be installed for each of the bipole cables. After the HDPE conduits are in place, the transmission cables will be pulled through these pipes, which will remain in place to protect the transmission cable.

FIGURE 2-7
EXAMPLE HDD TECHNIQUES



The HDD operation will include an HDD drilling rig system, a drilling fluid collection and recirculation system, and associated support equipment. Excavated soils will be temporarily stored on site during construction, and will be used to restore the site to its previous grade once the drilling process has been completed, or removed and disposed of at an approved location. The Applicant estimates that approximately 100 cubic yards (76 cubic meters) of drill cuttings (used bentonite and excess soil) will be generated for appropriate disposal at each of the major HDD installations. Figure 2-8 shows an example of an HDD drill rig operation staging area for landfall locations. HDD staging areas in entirely terrestrial locations (i.e., roadway crossings) will likely be smaller in size and less complex due to smaller equipment requirements.

FIGURE 2-8
TYPICAL HDD LANDFALL DRILL RIG OPERATION



Source: Laney Drilling 2012

For drilling operations extending from land into the water, the directional drill will exit the ground in water at a depth sufficient to avoid potential impacts on littoral zone or intertidal habitat. A temporary cofferdam will be constructed at the offshore exit-hole location. The cofferdam will reduce turbidity associated with the dredging and HDD operations and to help maintain the exit pit. A cofferdam will be approximately 16 feet (5 meters) by 30 feet (9 meters) with a dredged entry/exit pit typically 6 to 8 feet (1.8 to 2.4 meters) deep and will be constructed using steel sheet piles driven by a barge-mounted crane.

The cofferdam will be rectangular in shape and open at the end facing away from shore to allow for pull back of the conduits and the cables. The depth of the cofferdam will be determined based on existing conditions. The area inside the cofferdam will be excavated to create an exit pit at the waterward end of the borehole. Depending on the sediment composition, approximately 119 to 179 cubic yards (91 to 134 cubic meters) of sediment will be excavated from within a cofferdam. The dredged material will be placed temporarily on a barge for storage and disposed of as allowed under existing state and federal requirements. At the end of cable installation, the exit pit will be backfilled with clean sand, and the HDD staging area will be restored and revegetated as appropriate to preconstruction grades and conditions to the extent practicable.

As a potential alternative to cofferdams at the exit point of land to water HDD operations, a guide shaft may be used. A large diameter pipe segment will be pushed into the lake bottom at the planned HDD exit point. The pipe will be sloped at an incline and extend above the waterline, where the cable lay barge will be stationed. The slope of the exit shaft will be set at a grade suitable for the HDD exit slope. The HDD drill head will be steered into the bottom of the guide shaft and continue up the shaft to the cable lay barge. The shaft will be left in-place until the bore hole is ready to receive the bore casing or cable. At that time sediment and turbid water will be pumped out of the shaft into holding tanks on the lay barge, and the shaft removed.

A visual and operational monitoring program will be developed and conducted during HDD operations to detect any losses of drilling fluid. The monitoring program will consist of visual observations in the surface water at the targeted drill exit point as well as operational monitoring of the drilling fluid volume and pressure within the borehole. Visual observations of drilling fluid in the water, or excessive loss of volume or pressure in the borehole, will trigger response actions by the HDD operator, including halting drilling activities and initiating cleanup of released bentonite. A barge with a pumping system will be positioned at the cofferdam during drilling to collect any drilling fluid released into the cofferdam enclosure. Any collected drilling fluids will be disposed of at a permitted facility.

It is expected that at least three different sized HDD rigs will be employed on the project, requiring varying staging area sizes depending on the length of the drill at the particular location, proximity to sensitive areas such as wetlands, access limits, and other constraints.

2.3.4 Terrestrial Direct Current Transmission Cable

While approximately 60% of the Project would be located in Lake Champlain, approximately 40% will be overland and buried. In general, the buried transmission line will be routed underground beginning at the U.S/ Canadian border into Alburgh and then from Benson to the proposed converter station location in the Town of Ludlow. For the underground transmission cables, the outer sheathing insulation will be composed of an ultraviolet-stabilized, extruded polyethylene layer (see Figure 2-9). The underground transmission cables will have an outside diameter of 4.5 inches (11.4 cm), and each cable will weigh approximately 30 lb/ft (44 kg/m). The two cables within the bipole system will typically be laid side-by-side (approximately 12 to 15 inches [30 to 38 cm] apart) in a trench approximately 4 to 5 feet (1.2 to 1.5 meters) deep to provide for at least 3 feet (0.9 meters) of cover over the cables. Subsequent to laying the cables in the open trench, the trenches will be backfilled with low thermal resistivity material, such as well-graded sand to fine gravel, stone dust, or crushed stone. A protective cover of HDPE, concrete, or polymer blocks will be placed directly above the low thermal resistive backfill material. A marker tape will then be placed 2 to 3 feet (0.6 to 0.9 meters) above the cables (see Figure 2-10).

FIGURE 2-9
EXAMPLE TERRESTRIAL HVDC TRANSMISSION CABLE CROSS-SECTION

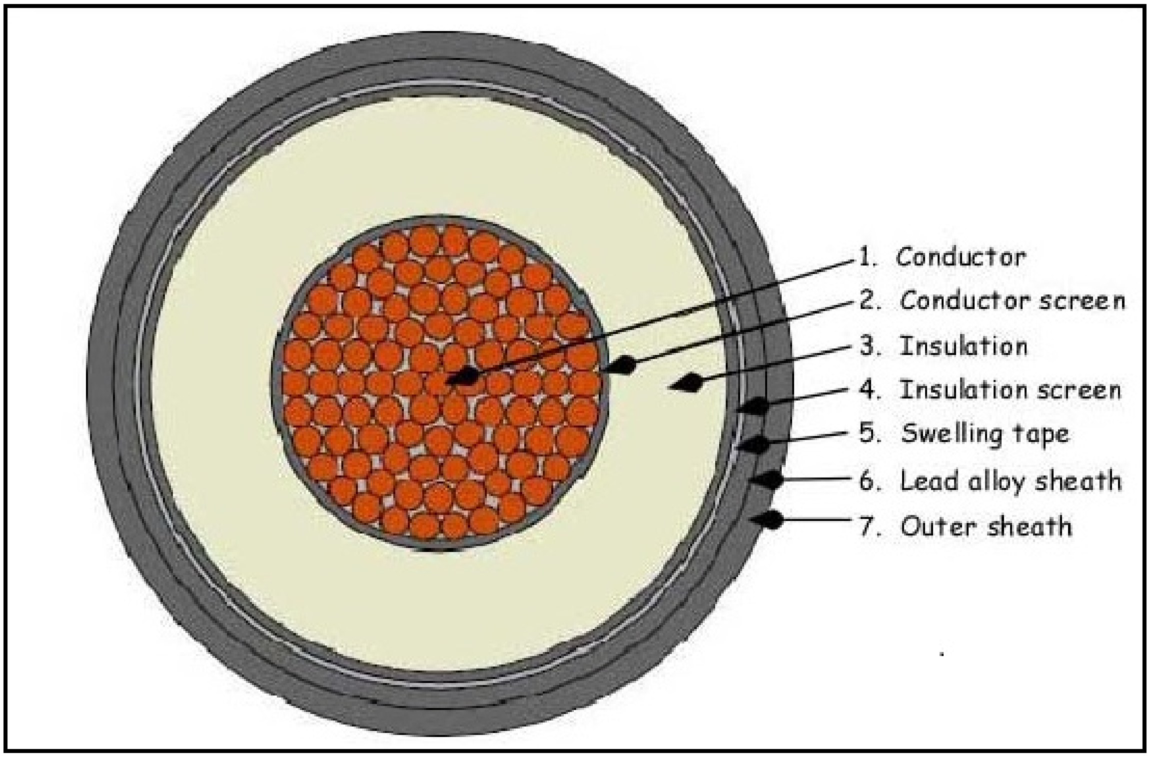
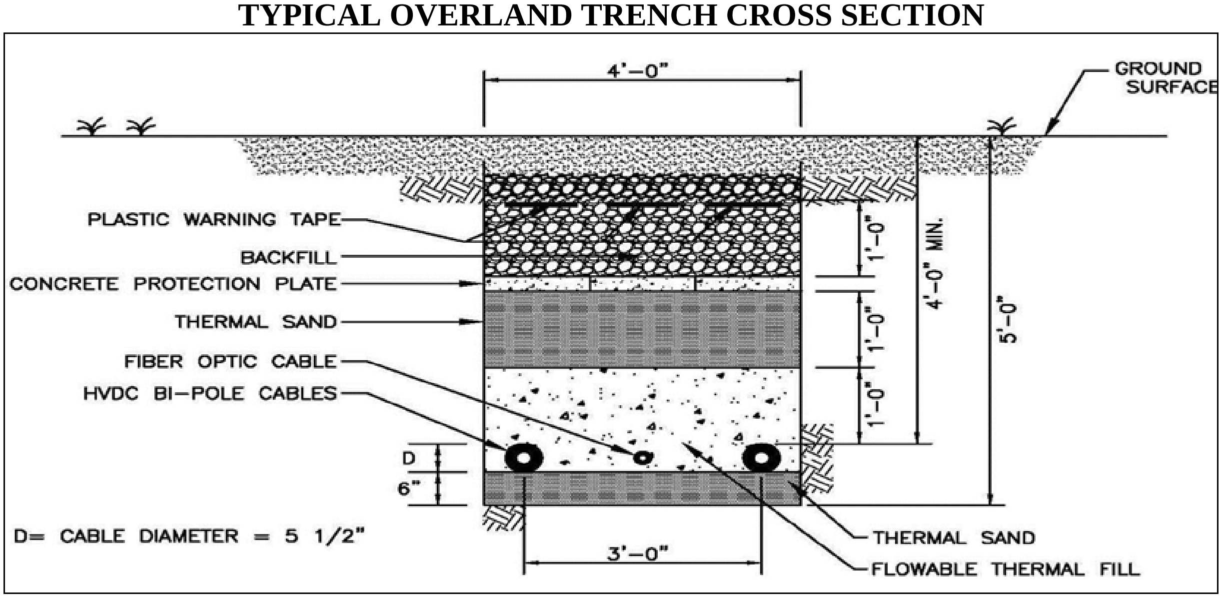
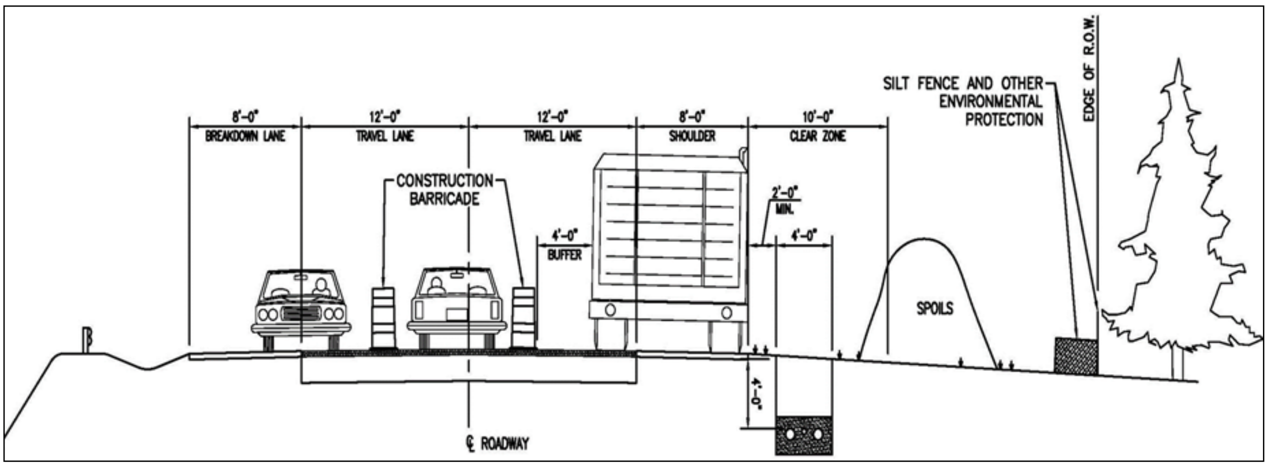


FIGURE 2-10
TYPICAL OVERLAND TRENCH CROSS SECTION



The overland transmission line will be installed for approximately 56.1 miles (90 km) along existing roadway ROWs. The installation of the underground transmission line will primarily be completed via trenching techniques along this portion of the route with HDD installation being utilized in certain areas. Construction layout and staging and work areas for cable installation within road ROWs will be confined to the state road ROW to the greatest extent practical. A typical staging area for construction equipment in a roadway ROW will be approximately 24 to 38 feet (7 to 12 meters) wide along one side of the roadway (see Figure 2-11).

FIGURE 2-11
TYPICAL OVERLAND INSTALLATION



Trenchless technologies may be used where roadways, railroads or significant environmental resources will be crossed by the transmission line. Trenchless technologies could include HDD, horizontal boring, or pipe jacking. Where a trenchless technology is used for road or railroad crossings, a temporary starting pit will be excavated on either side of the road or railroad bed to allow for the installation of a carrier pipe or casing. Horizontal boring is similar to HDD as described in the previous paragraphs, but uses an auger-type drill head (i.e., a rotating screw-shaped blade) to remove soil from the borehole. Pipe jacking involves pushing a casing pipe into the soil along the desired alignment and removing the soil from within the casing pipe. The specific technology used at each crossing location will be selected based on the distance to be crossed, the type of soil present, and the space available for staging the operation.

Any excavated soils will be temporarily stockpiled adjacent to the worksite or transported off site if onsite storage is not possible. Where soil is stockpiled on site, it will be stabilized with erosion and sedimentation controls. Following completion of the transmission cable installation, the excavated area will be backfilled, regraded and revegetated as necessary. The Applicant proposes that once construction is complete, all debris and equipment will be removed from the site and recycled to the maximum extent feasible and the remainder disposed of at an approved facility, and the disturbed area will be returned to its previous condition to the extent practicable.

2.3.5 Ludlow HVDC Converter Station

The HVDC transmission cables are proposed to terminate approximately 153.7 miles (247.3 km) from the U.S./Canada border at a proposed HVDC converter station in Ludlow, Vermont. The Ludlow HVDC Converter Station will convert the electrical power from DC to AC. An underground HVAC line will run approximately 0.3 miles (0.5 km) to connect to the nearby Coolidge Substation located in Ludlow and Cavendish, Vermont, as described in Section 2.4.6.

The HVDC converter station will be a "compact type" with a total site footprint (i.e., building and associated areas and equipment) of approximately 4.5 acres (1.8 hectares), although the cleared area could be bigger due to required grading. The station will be approximately 165 feet by 325 feet (50 meters by 99 meters) with a building footprint of 1.2 acres (0.5 hectares) and a height of approximately 50 feet (15 meters). The entire station will be surrounded by a fence. The Ludlow HVDC Converter Station will be designed to minimize visual impacts to the local environment and surroundings. The indoor design of the converter station will limit the need for exterior switchyards and will reduce audible sound and the risk of flashover (i.e., unintended and undesired electrical discharge or arc). It is anticipated that transformers, cooling equipment, and power line carrier filters will be the major equipment installed outside of the building. The converter station will be powered by electricity taken directly from the proposed NECPL Project transmission line. In the unlikely event this is not possible, electric power from a local utility will be used. A generator may also be used as emergency backup to provide black start capability (i.e., the ability to start operating and delivering electric power without assistance from the electric system in the event of an outage) and providing emergency power for the converter station. The facility will not require onsite personnel during normal operations.

2.3.6 Coolidge Substation Interconnection

The Ludlow HVDC Converter Station will deliver its energy by underground cable to the Coolidge 345-kV substation, which is located on an approximately 6-acre (2.4-hectare) parcel owned by VELCO. The Coolidge Substation is the Project's point of interconnection with the ISO-NE transmission system.

2.3.7 Construction

2.3.7.1 Aquatic Transmission Cable Installation

To the extent practical, the aquatic transmission cables will be buried in Lake Champlain to a target depth of between 3 and 4 feet (0.9 to 1.2 meters), or the maximum reasonably attainable depth, whichever is deeper. In waters of depths greater than 150 feet (46 m), the Applicant proposes to lay the cables on the bottom

Burial depths could vary in response to site-specific factors (e.g., presence of existing infrastructure or archaeological resources, environmental concerns, localized geological or topographical obstacles) identified along the proposed NECPL Project route. Where the transmission cables will cross areas that contain surficial bedrock or existing infrastructure (e.g., other cables, pipelines), the transmission cables will generally be laid atop the existing bedrock or infrastructure and protected by material placed over the transmission cables. Protective material could include concrete (e.g., rip-rap, grout mattresses), protective cable ducts, or other low-impact protective armoring. Aquatic transmission cables will cross under the Ticonderoga–

Larrabee Point Ferry cable ferry crossing in Lake Champlain (approximately Mile Post (MP) 88). The ferry uses two parallel, steel guidance cables that are lifted by steel sheaves to pull the ferry along the cables. The guidance cables rest along the bottom of the lake when they are not in use and typically are replaced every 4 years. The guidance cables may need to be temporarily removed from the lakebed prior to the installation of the transmission cables. After installation and burial of the transmission cables, the guidance cables will be replaced over the top of the transmission cables. Installation of the transmission cables will be coordinated with the ferry operator to minimize impacts on ferry operations.

The Applicant's proposed construction work schedule windows identifies times of the year when work associated with the underwater portion of the transmission line may take place. These established work windows and time of year restrictions are provided in Table 2-2.

TABLE 2-2
UNDERWATER CONSTRUCTION WINDOWS

NECPL Project Milepost	Location within Lake Champlain	Construction Window	Construction Method*
0.5 to 74	Alburgh to Chimney Point, Vermont,	May 1 to September 15	Jet Plow
74 to 98	Chimney Point to Benson Landing, Vermont	September 15 to December 31	Shear Plow

* See below for discussion of construction methods.

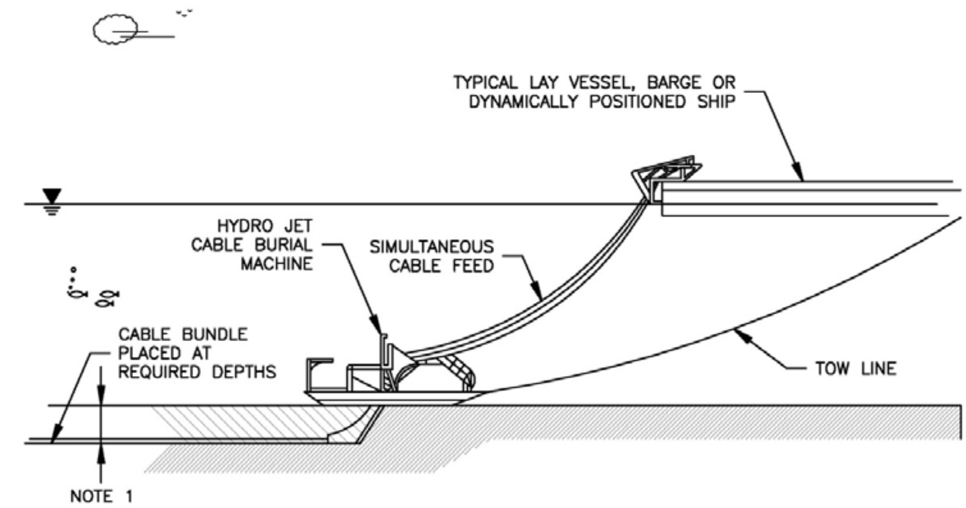
The general sequence for installing the aquatic DC transmission cables is as follows:

- Pre-lay grapnel run
- Cable installation
- Post-installation survey.

The first step in the installation of the aquatic transmission cables will involve conducting a pre-installation route clearance operation. During this operation, or the pre-lay grapnel run, the route is cleared of debris such as logs and out-of-service cables by dragging a grapnel along the route. Once cleared of debris, the next step will be installation of the transmission cables one at a time by either a jet plow or a shear plow. The plowing process will be conducted using either a dynamically positioned cable ship or a positioned cable barge and towed plow device that simultaneously lays and embeds the aquatic transmission cables in a trench. If a barge is used, it will propel itself along the route with its forward winches, with other moorings holding the alignment during the installation. A four-point mooring system will allow a support tug to move the anchors while the installation and burial proceeds. A dynamically positioned cable ship will use thrusters and a propulsion system to tow the plow without the use of anchors.

The skid-mounted plow will be towed by the barge or cable ship, because it has no propulsion system. For burial, the barge or ship tows the plow at a safe distance as the laying and burial operation proceeds (see Figure 2-12). The transmission cables composing the bipole will be deployed from the vessel to a funnel device on the plow. The plow is lowered to the lake or river floor, and the plow blade cuts into the lake or riverbed while it is towed along the pre-cleared route to carry out a simultaneous lay-and-burial operation. The plow will then bury both cables of the bipole in the same trench.

FIGURE 2-12
TYPICAL AQUATIC TRANSMISSION CABLE INSTALLATION PROCESS

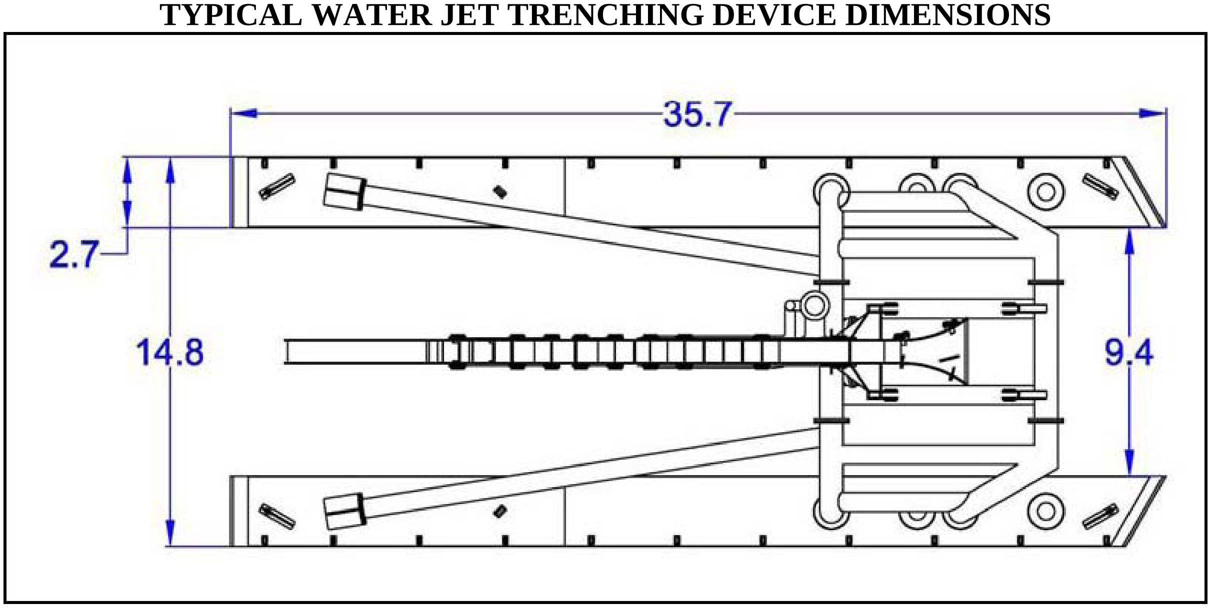


NOTES:
1. BURIAL DEPTH SHALL BE 15 FT. MIN. WITHIN MAINTAINED NAVIGATION CHANNELS AND NOT LESS THAN 4 FT. ELSEWHERE.
2. CABLE LAY MACHINE IS TYPICAL OF EQUIPMENT THAT MAY BE EMPLOYED. ACTUAL EQUIPMENT WILL BE DETERMINED BY THE EPC CONTRACTOR.
3. CABLE LAY MACHINE MAY BE OPERATED WITH OR WITHOUT HYDROJET OPERATION DEPENDING ON BOTTOM SEDIMENT CONDITIONS.

It is anticipated that the buried aquatic cable in the northern part of Lake Champlain will be installed using water-jetting techniques (see Figures 2-13 and 2-14). The water-jetting process uses jets of pressurized water to fluidize the sediments. The jet plow is fitted with hydraulic pressure nozzles that create a downward and backward flow within the trench, allowing the transmission cables to settle into the trench under its own weight before the sediments settle back into the trench.

FIGURE 2-13
EXAMPLE OF WATER JET TRENCHING DEVICE

FIGURE 2-14
TYPICAL WATER JET TRENCHING DEVICE DIMENSIONS



Source: Caldwell Marine International 2010 Note: Dimensions are shown in feet.

For portions of the transmission line route where the sediment stiffness is low and the waterway is narrow, which is expected to be in the southern portion of Lake Champlain, a shear plow will be used. For the shear plowing technique, the plow is tethered to a surface support vessel, which tows the plow along the lake or riverbed. A trench, approximately 2 feet (0.6 meters) wide and 3 to 5 feet (0.9 to 1.5 meters) deep, is made for the cables by the plowshare and the cables settle into the trench. In water deeper than 150 feet (46 meters), such as in portions of Lake Champlain, the transmission cables will be laid on the surface of the lake bottom.

Both water jetting and mechanical plowing will displace lake or river floor sediment within a narrow trench, which will permit the transmission cables to sink under their own weight. The displaced sediment will settle out, and the trench will naturally refill following the installation of the transmission cables. The bottom area directly disturbed by water jetting or mechanical plowing varies depending upon sediments and depth of installation, but will range from 12 to 16 feet (4 to 5 meters) in width (see Figure 2-14).

The Applicant will conduct an immediate post-installation survey to document the location and depth of burial associated with the cables. Where it has been determined that the installation operation did not result in adequate backfill over the transmission cables, a backfill plow can be used, which employs horizontal blades that capture the sediment pushed off to the sides during plowing and pulls it back in o the trench and over the cables. Usually, the trench completely refills over time periods that range from 6 months to 5 years depending on the soil type and water currents (ISE 2003), although the majority of the displaced sediment is expected to refill the trench immediately as bottom sediment naturally backfills the trench over the cable through wave action or bed load transport of sediments. The Applicant proposes to conduct underwater depth-of-burial surveys every 5 years.

In limited areas along the aquatic route, the necessary burial depths for the protection of the transmission cables might not be achievable due to geology (e.g., areas of bedrock) or existing submerged infrastructure crossings (e.g., other electric cables, natural gas pipelines). In these instances, the transmission cables will be buried as deep as possible or simply laid atop the lake or river bottom and covered with articulated concrete mats for protection (see Figures 2-4 and 2-5).

The ROW required for operation of the aquatic transmission cables is dependent on the water depth, but will be expected to be approximately 30 feet (9 meters) in width in most underwater areas. For the majority of the underwater portions of the NECPL Project route, the two cables that compose the bipole will be installed approximately 1 foot (0.3 meters) or less apart in the same trench. In areas where cables will be laid on the bottom (i.e. greater than 150 feet (46 meters) in depth, the cables will be spaced approximately 20 feet (6 meters) apart.

For the installation of the transmission line in Lake Champlain, the Applicant will either fabricate a vessel or transport an existing vessel. An existing vessel will need to transit the New York State canal system, which will limit the size of a cable ship or barge that will be used to install the transmission cables. The Applicant anticipates that the transmission cables will be transported to the Port of Albany, New York, where they will be loaded onto the laying vessel or onto a supply barge. A practical limit for cables is in approximately 1280 short tons (1160 tonne) using special deck barges designed to transit the canal system. The height of the vessel with the cables must comply with maximum 15 feet (5 meters) vertical clearance of bridges along the Champlain Canal.

Given the limitations on barge size and the amount of transmission cable that could be carried on board, the Applicant estimates that the cable-laying vessel will be able to carry approximately 15 miles (24 km) of cables. This will result in approximately 8 segments that will require 16 splices for the two HVDC cables for the approximately 98-mile (157-km)-long aquatic portion of the Lake Champlain Segment of the proposed NECPL Project.

The aquatic transmission cables will likely be manufactured in and shipped on ocean-going vessels from Europe to be installed by one or more United States-registered vessels. The aquatic cables will have to be loaded to a smaller cable-laying vessel (i.e., ship or barge) that will be capable of operating in the Champlain Canal in order for the cables to be installed in Lake Champlain. The Port of Albany has been identified by the Applicant as having adequate berthing and heavy lift facilities to complete this task.

2.3.7.2 Terrestrial Direct Current Transmission Cable Installation

The general sequence for installing the underground terrestrial DC transmission cables along the road ROWs will be conducted in steps as follows:

- Survey work, initial clearing operations (where necessary) and storm water- and erosion-control installation
- Trench excavation
- Cable installation and splicing
- Backfilling
- Restoration and revegetation.

It is anticipated that for installation within roadway ROWs, the majority of the supplies and equipment required for terrestrial transmission cable installation will be transported to the underground portions of the proposed NECPL Project route via roadways whose ROW is being used. It is also anticipated that local roadways will be used by construction workers to get to and from contractor yards or directly to the site.

The underground transmission cables will require a number of joints and a flat pad will be installed under each joint for splicing activities. The number of joints will be determined either by the maximum length of cable that could be transported or by the maximum length of cable that could be pulled. The jointing will be performed in a jointing pit, with typical segment lengths ranging from 0.1 to 0.5 miles (0.2 to 0.8 km). The portion of the transmission line within the road ROWs could therefore require more than 200 splices as part of the installation process.

Along the road ROWs in normal terrain, where soil conditions range from organic, loam, sand, gravel, or other unconsolidated material, the trench will be excavated using wheeled or tracked construction vehicles where possible. The typical trench will be up to 4 feet (1.2 meters) wide at the top and approximately 4 feet (1.2 meters) deep to allow for proper depth and a 1-foot (0.3-meter) separation required between the two transmission cables to allow for heat dissipation. Along road ROWs, the transmission cables will be installed in the cleared area of the road and, where that is not possible due to constraints, under the road.

If shallow bedrock is encountered, the rock will be removed by the most suitable technique given the relative hardness, fracture susceptibility, and expected volume of material. The Applicants preferred approach will be mechanical removal. If that is not possible, then the Applicants will evaluate alternatives, including a more shallow cable installation with enhanced concrete or steel cover protection, an increase in the amount of cover (if the changed topography is not problematic), or blasting, to achieve the standard depth. In areas where blasting may be considered as an alternative installation method, blasting will be performed by licensed professionals and will adhere to all industry standards applying to controlled blasting and blast vibration limits with regard to structures and underground utilities.

The operation of the transmission cables will result in the generation of heat, which will reduce the electrical conductivity of the cables; therefore, prior to laying the cables, the trenches will be backfilled with low thermal resistivity material such as sand to prevent heat from one cable affecting a nearby cable. There will be a protective layer of weak concrete or a similar protective material directly above the low thermal resistive backfill material. The whole assembly will have a marker tape placed 2 to 3 feet (0.6 to 0.9 meters) above the cables. The top of the soil covering the trench might be slightly crowned to compensate for settling.

For crossings of waterbodies and small streams, four dry-ditch crossing methods are proposed for installation of the transmission line, although others will be considered. These methods are as follows:

- Flume Crossing Method. This method involves installing a flume pipe to carry the stream water around the work area, allowing the trenching to be done in a dry condition, and limiting the amount of sediment that might enter the waterbody.
- Dam and Pump Crossing Method. For this method, the stream is dammed upstream of the work area and a pump and hose are used to transport the stream flow through the trenching area to a point downstream where it will be discharged back to the streambed. This method also allows the trenching to occur in a dry condition.
- HDD. Under this method, cable conduits will be installed under the streambed using HDD and avoiding any disturbance to the streambed, and the cables will then be pulled through the conduits.
- Open Cut. The open cut method of construction involves digging an open trench across the streambed, laying the cable, and backfilling the trenched area without diverting the stream around the work area.

Intermittent streams that are dry at the time of crossing will only be crossed by open cut with prior approval from state and federal agencies as required by permit conditions.

In wetland areas, the cables will be proposed to be installed by trenching. The typical sequence of activities will include vegetation clearing, installation of erosion controls, trenching, cable installation, backfilling, and ground surface restoration. Equipment mats or low-ground-pressure tracked vehicles will be used to minimize compaction and rutting impacts on wetland soils. To expedite revegetation of wetlands, the top 1 foot (0.3 meters) of wetland soil will be stripped from over the trench, retained, and subsequently spread back over and across the backfilled trench area to facilitate wetland regrowth by maintaining physical and chemical characteristics of the surface soil and preserving the native seed bank. Trench plugs or other methods will be used to prevent draining of wetlands or surface waters down into the trench. If the trenching, stockpiling, cable installation, and backfilling are conducted from the road, soil compaction will be reduced, as heavy equipment operation on the ground surface along the cable trenches will be minimized. A clean-up crew will complete the restoration and revegetation of the construction corridors and other temporary construction workspace. In conjunction with backfilling operations, any woody material and construction debris will be removed from the construction corridor. The temporary construction area will be seeded with a fast growing annual seed mixture to quickly stabilize the wetland area while the rhizomes, rootstock, and seeds in the wetland soils allow the native vegetation to re-establish over the course of the growing season.

The permanent ROW required for maintenance and operation of the transmission line along the terrestrial portions of the proposed NECPL Project route will be approximately 12' feet (3.6 meters) wide along roadway ROWs. The permanent ROW will provide protection of the transmission cables against third party damage and will facilitate any required maintenance or repair. The transmission cables within the trench will generally be separated by a distance of approximately 1 foot (0.3 meters).

2.3.8 Staging Areas

Aquatic Transmission Cable Support Facilities. For the aquatic section of the Project, it is anticipated that minimal land-based support will be required. Transport of the aquatic transmission cables will occur via the cable-laying vessel, supported by resupply barges operated from a temporary storage area on land. This land-based support facility is envisioned to be no greater than 200 by 300 feet (61 by 91 meters). The proposed NECPL Project will not require the construction of new facilities at these ports.

Terrestrial Transmission Cable Support Facilities. For the terrestrial section of the Project, additional nearby temporary aboveground support facilities will be established. Support facilities could include contractor yards, storage areas, access roads, and additional workspace. Additional workspace might be required at HDD locations, cable jointing locations, and areas with steep slopes. The support facilities will be sited within the existing road or at appropriate nearby areas that already support such activities.

2.3.9 Operations and Maintenance

The proposed NECPL Project has an expected life span of at least 40 years. During this period, it is expected that the transmission system will maintain an energy availability factor of 95 percent, meaning that the transmission system will be delivering electricity 95 percent of the time, with the remaining 5 percent allocated for scheduled and unscheduled maintenance.

The HVDC and HVAC transmission cables will be designed to be relatively maintenance-free and operate within the specified working conditions. However, selected portions or aspects of the transmission system will be inspected to ensure equipment integrity is maintained. During normal operations, the Ludlow HVDC Converter Station would require minimal to no on-site personnel. Maintenance activities at the converter station, including inspections and preventative maintenance, would be expected to occur regularly throughout the life of the transmission line.

Transmission Cable Inspection. Following transmission cable installation, regular inspections of visible parts of the transmission cables, landfall areas, and nearshore protection elements will be conducted to ensure cable integrity. All of the aquatic transmission cables will be accessible either by divers or remotely operated vehicles (ROVs) and inspections will be performed in accordance with manufacturer's specifications to ensure equipment integrity and protection (e.g., appropriate burial depths, concrete mats, rip-rap) are maintained. The aquatic portion of the transmission system will be surveyed at least once every 5 years, and inspections will focus on verifying the depth of cable burial, condition of infrastructure protection measures, and identifying areas where protection of the transmission system or the environment could be compromised. The upland cable will be inspected approximately every 3 years to ensure that adequate cover exists.

In addition, spot checks of the transmission cable protection materials will be performed during or after the first year of operation. These spot checks will occur more frequently at locations where strong currents will be expected or in other areas where abnormalities were identified (e.g., extreme storm conditions or ice crush outages).

Following completion of the terrestrial facilities, on-the-ground inspectors will survey the terrestrial ROW periodically for:

- Vegetation on the ROW that might be capable of disrupting (i.e., damaging) the cables below;
- Line exposures at areas with steep slopes and stream banks;
- Unauthorized encroachments;
- Permanent storm water features requiring maintenance; and
- Vandalism.

Although no components of the transmission system will require regular replacement, regular inspections, in accordance with the manufacturer's specifications, will be performed during scheduled outages to ensure equipment integrity is maintained. For example, insulators at the converter station will be inspected and cleaned if there were excess deposits of industrial contaminants and soot. Additionally, metal parts (i.e., nuts, bolts, cable cleats, and grounding scraps) will be inspected for corrosion and tightness and cooling water levels in the cooling stations maintained.

ROW Maintenance. During operation of the proposed NECPL Project, vegetation clearing in the transmission line ROW will be performed on an as-needed basis. Vegetation management will include mowing, selective cutting to prevent the establishment of large trees (i.e., greater than 20 feet [6 meters] tall) directly over the transmission line, and vegetation clearing on an as-needed basis to conduct repairs. Vegetation along the transmission line ROW will primarily be managed by mechanical means including such mechanisms as brush hogging, mowing, or hand cutting. Any vegetation management activities currently conducted by the road operators within the roadway ROWs will continue following the construction and operation of the transmission cable. A vegetation management plan for the operational period of the transmission system will be developed and submitted to resource agencies. The goal of the vegetation management plan will be to establish stable low-growing vegetation with shallow root systems that will not interfere with the cables.

Transmission Cable Repairs. While not anticipated, it is possible that over the expected 40-year lifespan of the proposed NECPL Project, the transmission cables may require repair. The proposed cable installation design and techniques identified by the Applicant will minimize the potential for mechanical damage to the cable system and ensure operational safety and reliability of the cables. If a cable is damaged, a protection system in place will detect the fault and the Ludlow HVDC Converter Station switching system will de-energize the transmission system in approximately 5 milliseconds.

Direct burial of the aquatic transmission cables to an average depth of at least 3 to 4 feet (0.9 to 1.2 meters) below the lake bottom or riverbed provides a margin of safety and reliability against cable damage by vessels or anchors. The transmission cables will have protective steel armoring wires to protect against damage. At the landfall locations, the aquatic transmission cables will be encased within an HDPE conduit to provide protection against mechanical damage. The steel-wire armored cables will be hermetically sealed to prevent the ingress of water and contain no circulating fluids or reservoirs.

Underground terrestrial transmission cables will be buried to an approximate depth of 4 to 5 feet (0.9 to 1.2 meters) below ground surface with a pre-cast concrete cap placed on top of the trench above the cables where they are installed by trenching. At utility and roadway crossings where the cables are installed by HDD, the HVDC transmission cables will be protected by a steel sleeve. The Ludlow HVDC converter station will be designed, manufactured, installed, and tested by a reputable equipment vendor with international HVDC transmission experience.

Before operation of the proposed NECPL Project begins, an Emergency Repair and Response Plan (ERRP) will be prepared to identify procedures and contractors necessary to perform maintenance and emergency repairs.

The ERRP will detail the activities, methods, and equipment involved in repair and maintenance work for the transmission system. Although the scope of work for each situation will be adjusted to fit the conditions of the problem, the typical procedure for repair of a failure within the aquatic and terrestrial portions of the proposed NECPL Project route is described as follows:

- <u>Aquatic Transmission Cable Repair.</u> In the event of aquatic cable repair, the location of the problem will be identified and crews of qualified repair personnel will be dispatched to the work location. Depending on the location of the problem, a variety of equipment will be used to perform the necessary work. As part of the ERRP, appropriate vessels and qualified personnel will be pre-selected to minimize the response time. Once the failure location is identified, a portion of the transmission cable, equal to approximately 2.5 times the water depth, will be excavated in preparation for cable replacement. The damaged portion of the cable will be cut and a new cable section will be spliced in place by specialized jointing personnel. Once repairs are completed, the transmission cable will be reburied using an ROV jetting device.

- <u>Terrestrial Transmission Cable Repair.</u> In the event of terrestrial transmission cable repair, pre-selected local contractors identified during the development of the ERRP will excavate around the location of the problem and along the transmission cable for the extent of cable to be repaired or replaced. Once the portion of the transmission cable is excavated, specialized jointing personnel will remove the damaged cable and install new cable. Once complete, the transmission cable trench will be backfilled and the work area restored using the same methods as described for the original installation.

2.4 Construction and Permit Schedule

The initial permitting phase of the proposed NECPL Project is expected to continue through 2015 into early 2016 (see Section 5 for additional information on regulatory approvals required). Construction-related engineering activities are expected to commence in 2016 and continue through 2018. The Applicant anticipates that the commercial operation date for the proposed NECPL Project will be 2019.

2.5 Bulk Power System Information

Pursuant to the requirements of 10 CFR § 205.322(b)(3), the Applicant is providing the following bulk power supply information for this Project.

2.5.1 Expected Power Transfer Capability

The proposed maximum power transfer capability is 1,000 MW. The ultimate maximum capacity will be determined as the Project's design is finalized. In general, the power transfer capability is limited by the maximum thermal capacity of the proposed transmission line. The normal continuous capacity for each of the HVDC bipoles is approximately 1,000 MW. The estimated short-time (2-hour) emergency overload capability will be approximately 1,150 MW for each bipole.

2.5.2 System Power Flow

Federal regulations at 10 CFR § 205.322(b)(3)(ii) require TDI-NE to provide system power flow plots for the Applicant's proposed service areas for heavy summer and light spring load periods, with and without the proposed international interconnection, for the year the line is scheduled to be placed in service and for the fifth year thereafter. TDI-NE is currently conducting system studies of the transmission networks and energy markets administered by ISO-NE. At the completion of these studies, TDI-NE will provide the required system power flow plots as a supplement to this application.

2.5.3 Interference Reduction Information

The proposed HVDC technology and transmission cable will be designed to eliminate any potential electromagnetic interference (EMI) that could affect television or radio service along the transmission line corridor. The Ludlow HVDC Converter Station will be designed to meet the requirements of local radio, television, and telephone EMI limits. The facility also will comply with the limits stated in CISPR 11 (Industrial, Scientific, and Medical (ISM) Radio-Frequency Equipment—Electromagnetic Disturbance Characteristics—Limits and Methods of Measurement), Group 1 and Class A, in the frequency range of 30 MHz–1 gigahertz (GHz). The corona noise level (caused by the local sound-pressure level changes due to the individual corona discharges) from the outdoor yard at the Ludlow HVDC Converter Station will not exceed 100 microvolts per meter (μV/m) in the frequency range of 500 kHz to 30 MHz within a 1,475-foot (450-meter) perimeter, as measured from any energized component in the converter station or adjacent AC switching station.

Additional details regarding the features required to minimize EMI at the Ludlow HVDC Converter Station will be developed during the detailed design phase of the proposed NECPL Project.

2.5.4 Description of the Relay Protection Scheme

The relay protection scheme will be designed in coordination with the ISO-NE and VELCO. Details of this scheme will be developed during the detailed design phase of the Project. The Applicant will provide a description of the relay design scheme, including associated equipment and proposed functional devices, as a supplement to this application.

2.5.5 System Stability Analysis

As provided in 10 CFR § 205.322(b)(3)(v), the U.S. Department of Energy (DOE) may require the Applicant to prepare a system stability analysis following the DOE's review of the power flow plots. TDI-NE will prepare and furnish the system stability analysis upon request.

Section 3
Information Regarding Potential Environmental Impacts

3.1 Introduction

This section provides a description of the existing environment within the Project area as well as the potential environmental impacts associated with constructing and operating the proposed Project. Section 3 divides the approximately 154-mile (248-km) proposed transmission line route into two segments: the Lake Champlain Segment and the Overland Segment. This division is based on geographical and environmental similarities along the route, as described in Section 2.2.1.

A region of influence (ROI) for each resource area in which impacts could occur is also defined. The ROIs were determined based on regulatory requirements, where applicable, combined with the expected maximum area of measurable construction or operational impacts for that particular resource.

3.2 Land and Water Uses

This section describes existing land uses in the vicinity of the proposed Project route, and land use plans and policies applicable to the Project area. General land use categories have been classified along the proposed Project route based on review of aerial photographs and data from the Vermont Center for Geographic Information (VCGI). This section also describes water-related uses within Lake Champlain.

The land use ROI for the Project is the area within 50 feet (15 meters) on either side of the centerline of the transmission cables when in the Lake Champlain Segment and Overland Segment. This area was selected as the ROI because it includes the permanent ROW (approximately 12 feet (3.6 meters) wide) within which the transmission line will be operated and maintained and the temporary work areas that will be affected during construction (i.e., construction corridors), although the entire width of the construction zone will not necessarily be 100 feet. As the transmission line will be installed underground and underwater, land use impacts during the operational phase of the Project will be limited to the area containing the transmission line. Adjacent land uses outside the permanent transmission line ROW may be temporarily affected by equipment movement and storage in selected areas during the construction process. The ROI for land use is entirely within the State of Vermont.

3.2.1 Environmental Setting

3.2.1.1 Lake Champlain Segment

In Alburgh, which is the only terrestrial segment of the Lake Champlain Segment, land uses adjacent to the Project are primarily open space with some residential homes. The only structure within the Lake Champlain Segment ROI is a residential home that is owned by the Applicant. The transmission line is proposed to be installed underground along Bay Road for approximately 0.3 miles (0.5 km) until it enters the Applicant-owned property. Bay Road is a two-lane local road in a rural area. The ROI for the proposed transmission line with Bay Road includes areas that are residential or open space.

Lake Champlain is a navigable waterway, although no longer used for commercial shipping activities. There are no federally designated shipping lanes or recommended vessel routes within Lake Champlain, with the exception of the Narrows of Lake Champlain (a federal navigation channel) and maintained channels into harbors. The Project would not traverse these channels. Commercial marine navigation is limited to the following two ferry operations connecting points in the states of New York and Vermont (a total of four ferry routes):

- The Lake Champlain Transportation Company operates three ferries, which cross Lake Champlain at the following locations:
  - Grand Isle, Vermont, to Plattsburgh, New York (24-hour service; year round)
  - Burlington, Vermont, to Port Kent, New York (seasonal; mid-June to mid-October)
  - Charlotte, Vermont, to Essex, New York (varying schedule; year round).
- The Fort Ticonderoga Ferry Company operates a seasonal cable-guided ferry service between Shoreham, Vermont, and Ticonderoga, New York, from May through October. The cable guidance system was installed in 1946 and consists of two 2.75-inch (7.0-cm) steel cables, stretched parallel to each other across the lake and securely anchored in concrete on either end. The cables are lifted and carried by four hardened steel sheaves (wheel with a grooved rim), one on each corner of the present barge, and serve to steer the barge between two landing ramps, at each end of the course. When not actually in use on the sheaves, they return to their resting place on the bottom of the lake and do not interfere with other boat traffic. The cables are replaced every 4 years.

There are also wide-ranging recreation opportunities on the lake that include fishing, bird watching, motor boating, kayaking, sailing, swimming, sightseeing, jet skiing and scuba diving.

3.2.1.2 Overland Segment

The Overland Segment will be located in Rutland and Windsor counties.

The Project will be located in ten communities in Rutland County (Benson, West Haven, Fair Haven, Castleton, Ira, West Rutland, Town of Rutland, Clarendon, Shrewsbury, Wallingford, and Mount Holly) and two communities in Windsor County (Ludlow and Cavendish).

Land Uses. The Overland Segment as proposed begins upon exiting Lake Champlain in Benson. The cables will then be installed for approximately 4 miles along local roads to Route 22A. The land uses adjacent to this segment consist of primarily agricultural fields as well as open and forested areas. The cables will be buried within the existing road ROW, either adjacent to or, as allowed by the Town, under the roadway. The cables will then travel 9.4 miles south buried within the Route 22A ROW to Route 4 in Fair Haven, at which point the cables will enter the Route 4 ROW east to West Rutland for 13 miles. Lands adjacent to Route 22A consist primarily of agricultural, open and forested areas with the Taconic Mountains east and northeast of the Overland Segment. The Overland Segment on Route 4 crosses through the Towns of Fairhaven and Castleton and continues to pass through primarily agricultural, open, and forested areas, as well as being adjacent to the Blueberry Hill Wildlife Management Area (WMA), which is located to the north of the Overland Segment.

In Ira and West Rutland, the cables are proposed to continue in roadway ROWs to the east on Route 4 (13 miles). In the Town of Rutland the route crosses Otter Creek, which is listed under the Nationwide Rivers Inventory as a river segment that potentially qualifies as a national, wild, scenic, or recreational river area (National Park Service 2011). The route then continues south on Route 7, east on Route 103 to the intersection with Route 100 in Ludlow, and along Route 100 north to local roads to the proposed converter station located in the Town of Ludlow. This portion of the segment (south and west of Rutland) consists primarily of agricultural, open and forested areas. The route would cross the Appalachian Trail in Clarendon. And the cables would also run north of, but not through, both the Green Mountain National Forest and Okemo State Forest.

Table 3.2-1 presents land cover within the land use ROI of the Overland Segment.

TABLE 3.2-1
HABITATS AND LAND COVER TYPES OCCURRING IN THE ROI OF THE OVERLAND SEGMENT

Habitat/Land Cover Type	Acreage of ROI	Percent of ROI
Brush or Transitional Between Open and Forested	1	0.1
Broadleaf Forest	199	14.6
Coniferous Forest	44	3.3
Mixed Coniferous-Broadleaf Forest	43	3.2
Forested Wetland	5	0.4
Non-Forested Wetland	8	0.6
Brush or Transitional Between Open and Forested	1	0.1
Row Crops	154	11.3
Hay/Rotation/Permanent Pasture	107	7.8
Other Agricultural Land	3	0.2
Residential	37	2.7
Commercial, Services, and Institutional	4	0.3
Transportation, Communication and Utilities	714	52.4
Outdoor and Other Urban and Built-up Land	1	0.0
Water	41	3.0

Source: VCGI 2014

3.2.2 Environmental Impacts

3.2.2.1 Lake Champlain Segment

Impacts from Construction

During installation activities, the presence and operation of the transmission cable installation vessels will result in additional vessel traffic on Lake Champlain. However, transmission line installation will not prohibit any water-dependent commercial or recreational activities, including boating, angling, water sports or commercial sightseeing, because vessels could either transit around the work site or use a different area of Lake Champlain. Additional vessel traffic will be temporary (i.e., for the duration of construction while vessels and equipment will be present) and localized at the work site. Approximately 1 to 3 miles (2 to 5 km) of transmission cables can be installed per day in an aquatic environment, so the work site, which will be off-limits to other vessels, will not remain at any one location for a long period of time. The presence of cable-laying vessels could also temporarily delay or interrupt commercial ferry operations on Lake Champlain. The guidance cables for the Shoreham-Ticonderoga cable ferry will be temporarily removed from the lakebed prior to the installation of the transmission cables. All transmission cable installation activities will be closely coordinated with commercial ferry operators; U.S. Army Corps of Engineers (USACE); U.S. Coast Guard (USCG); harbor masters, local maritime associations; marinas; and other local, state, and Federal agencies, as necessary, and will be scheduled to minimize or avoid impacts. Additionally, an Aquatic Safety and Communications Plan will be provided to the USCG. Local waterway users and other stakeholders will also be notified of the timing of the transmission cable installation activities.

In portions of the Project where the proposed route will intersect with the Shoreham-Ticonderoga cable ferry line, guidance cables will be temporarily removed from the lakebed prior to the installation of aquatic transmission cables. The ferry guidance cables will be reinstalled after the installation of the transmission cables. The ferry operator reports that its cable are replaced every 4 years; therefore, there could be an opportunity to coordinate the transmission line installation schedule with the ferry cable replacement schedule. The scheduling and installation of transmission cables will be coordinated with ferry operators to minimize disruption of ferry service.

Minimal land-based support will be required for installation of the aquatic transmission cables in Lake Champlain. Transport of the transmission cables will occur via the cable-laying vessel or supply barge; and other equipment, materials, and supplies will be transported to the work site by resupply barges. The land-based support facility for supplying transmission cable will likely be located at an existing port with heavy lift facilities, such as the Port of Albany, New York. The project activities that will take place at the Port of Albany will be compatible with adjacent land uses. From the Port of Albany, vessels will transit the New York State canal system to access Lake Champlain. A small (approximately 60,000 square feet [5,574 square meters]) temporary storage area on land in the Lake Champlain Segment might also be required to support the cable installation activities. This site, if needed, will be identified by the Applicant's marine contractor and it is anticipated that an existing commercial marine facility with docking and storage space will be utilized for this purpose.

Impacts from Operations, Maintenance, and Emergency Repairs

The location of the transmission line will be marked on navigation charts to aid in identifying its location. The Project route within the Lake Champlain Segment as proposed was designed such that it avoids designated anchorage areas.

Impacts from the magnetic properties of the transmission line on mechanical navigational compass readings are not be expected to be significant. For cables buried at 4 feet (1.2 meters) into the lake bed and separated by a distance of 6 feet (1.8 meters), the maximum deviance from magnetic north at 19 feet (6 meters) above the water will be an estimated 20 degrees at approximately 20 feet (6 meters) east or west from the cables. The deviance from magnetic north will be reduced to zero at a distance of 50 feet (15 meters) from the cables. Any potential magnetic field deviance is expected to potentially only affect the upper (north of approximately MP 12) and lower (south of approximately MP 69) portions of the route within Lake Champlain where the transmission line will be buried in waters less than 50 feet in depth. The calculated deviance will be less where the cables are laid in deeper water or where the cables will be spaced closer together than six feet.

Periodic (i.e., at least every five years) inspections of the transmission cables within the Lake Champlain Segment will be performed using ship-mounted instruments. Inspections will result in a negligible amount of additional intermittent vessel traffic on Lake Champlain for the lifespan of the Project from the presence of inspection vessels. No impacts on water-dependent recreational activities such as boating, angling, water sports, or commercial sightseeing will occur because inspection vessels will only be stationary in one location for short time periods, and other vessels could either transit around the inspection vessel or use a different area of Lake Champlain.

While not anticipated, emergency repair activities will result in temporary (i.e., for the duration of emergency repairs) impacts on existing commercial and recreational uses of Lake Champlain due to the presence of cable repair vessels at the site of the fault. Repair work will occur over a short time period and repair activities will be limited to the immediate vicinity of the repair site.

3.2.2.2 Overland Segment

Impacts from Construction

Construction of the Project along the road ROWs may result in temporary (i.e., for the duration of construction) disturbances to surrounding land uses within the ROW. Most of the roads to be utilized are used for vehicular transportation (i.e. through traffic); however, scattered residences exist along the roads. These temporary uses will cause disturbances due to lane closures, road detours and the presence of construction work areas and equipment. These disturbances will last for the duration of the presence of an active construction zone, which will generally be from a few days to up to two weeks at any one particular location. The construction schedule will be established to minimize disruption (i.e., disturbances, interruptions, or changes) to land uses along the roadways and the Applicant will provide timely information to affected property owners or tenants regarding construction activities and schedule and coordinate with the Vermont Agency of Transportation (VTrans) and local officials. Impacts will be minimized by installing construction signs and use of barriers in accordance with applicable State of Vermont highway regulations and design standards. Restoration of the roadway ROW, driveways, and landscaped areas will be designed in consultation with VTrans, municipal officials, and adjacent landowners.

The proposed Project route will also traverse across various municipal and state roads; however, paved roads crossings are anticipated to be completed using HDD or Jack and Bore so there will generally be no impacts on roadways. If HDD is not used to span a road, lane restrictions could result. These traffic disturbances will be temporary, lasting only for the duration of construction of that particular crossing.

Temporary staging areas to support overland installation activities will be within existing commercial or industrial areas to the extent possible, and will be compatible with the proposed storage and staging activities. Additional workspace could also be required for support facilities and at HDD staging areas, cable jointing locations, areas with steep slopes, or areas where access roads must be constructed. To the extent possible, these workspace areas will be sited within the existing road ROWs and limited to the minimum space necessary. If additional workspace outside the road ROWs is required, it could result in short-term impacts due to temporary conversion from its current land use to construction-related uses. Impacts will be minimized by using previously disturbed areas or undeveloped areas. All temporary storage areas or workspaces areas will be re-graded and revegetated as required upon completion of their use.

Constructions workers will be dispersed throughout the Project area where work is ongoing. Therefore, the number of construction vehicles at any one location will not add noticeably to the number of vehicle trips. Construction-related vehicles parked within roadway ROWs will not affect any existing parking resources in the vicinity of the Project. Construction vehicles supporting transmission line installation activities in roadway ROWs will be parked within construction zones, but the construction zones will be managed in accordance with a Maintenance and Protection of Traffic (MPT) Plan, which will identify procedures to be used to maintain traffic and provide a safe construction zone for those activities within the roadway ROW. The MPT Plan will also maintain sufficient parking and access at all times.

On average, approximately 50 trucks per day will be required for the transportation of equipment and construction materials to the Ludlow HVDC Converter Station site during peak construction periods. Construction at the converter station is anticipated to be on-going for approximately 18 months. Construction worker vehicles and material deliveries will access the site through local roads. The number of construction-related vehicles in the immediate area at any one location is anticipated to be greater than currently experienced, but deliveries will be coordinated with municipal officials to minimize impacts on traffic flow and the surrounding community.

Construction of the Project is anticipated to be consistent with applicable land use plans and policies. Because the transmission line will be primarily within the road ROWs and will be compatible with surrounding land uses, its operation will be consistent with potentially relevant local plans and policies.

Impacts from Operations, Maintenance, and Emergency Repairs

Generally, there will be no impacts on land use along the road ROWs because the transmission cables will be underground within the existing, previously disturbed ROWs. ROW maintenance on land is necessary to protect the terrestrial cables from being disrupted or broken by tree roots, to maintain the function of permanent storm water management or access-control features, and to replace system location and identification markers, as necessary. A Project-specific ROW Management Plan will be developed in consultation with VTrans and local road officials to ensure conformance with their ongoing maintenance plans and operations. In addition, any maintenance or operational activities will be performed in accordance with the applicable conditions of highway work permits, use and occupancy permits, leases, and other agreements. No impacts on land use are expected from the periodic inspections of the transmission line ROW because these activities primarily consist of passive visual or instrument assessments of conditions, which will not create any disruptions to adjacent land uses.

While not anticipated, emergency repairs could result in impacts similar to those described for construction of the Project, but for a shorter duration and within a smaller area. There will likely be fewer land use disruptions if repairs are needed in undeveloped areas along the road ROWs.

The proposed Ludlow HVDC Converter Station will be designed to avoid undue adverse visual and noise-related impacts and designed to blend into the local environment and surroundings to the extent practical. Operation of the facility will be compatible with nearby electric transmission uses. During normal operations, the Ludlow HVDC Converter Station will not require onsite personnel so there will be no affects on parking resources or traffic flow. During maintenance activities, there will be a small number of additional vehicles and personnel on the site. No impacts are expected from conducting inspection and maintenance at the Ludlow HVDC Converter Station because the activities will be confined to the converter station site and will not disturb adjacent land uses. If emergency repairs are necessary at the converter station, it could generate disturbances such as the presence and operation of repair personnel and equipment.

Most impacts on land use will be avoided because the transmission line will be underground. Moreover, operation of the Project in the Overland Segment will be consistent with land use plans and policies, and compatible with surrounding land uses because the transmission line will be primarily within existing established ROWs. With the exception of the Ludlow HVDC Converter Station, which is located adjacent to a cleared transmission corridor and substation, the Project will not be visible.

In the event of emergency repairs, the Emergency Repair and Response Plan (ERRP) will be implemented. Temporary disruptions to the transportation system could occur due to emergency repairs. These disruptions will cause impacts on traffic that include short-term suspension of road operations in the area of the repairs and result in longer travel times. Vehicular traffic flow will be maintained through emergency repair work zones.

3.3 Water Resources and Quality

Water resources include surface water, floodplains, and groundwater. An evaluation of water resources examines the quantity and quality of the resource and its demand for various purposes.

The ROI for water resources and quality for the Lake Champlain Segment of the Project includes Lake Champlain from Alburgh, Vermont (MP 0.5) south to Benson, Vermont (MP 98). The ROI for water resources and quality in the Overland Segment is 100 feet (30 meters) centered on the transmission line centerline (50 feet (15 meters) on either side). This ROI was selected because this constitutes the area where any measurable or significant potential impacts could occur.

3.3.1 Environmental Setting

3.3.1.1 Lake Champlain Segment

Surface Water. Lake Champlain is one of the largest freshwater lakes in the United States, encompassing approximately 435 square miles (mi^2) (1,127 square kilometers [km^2]) and 587 miles (945 km) of shoreline within the Lake Champlain Basin. The 8,234-mi^2 (21,343-km^2) Lake Champlain basin includes land in Vermont, New York, and the Province of Quebec. Lake Champlain is approximately 120 miles (193 km) in length and approximately 12 miles (19 km) wide at its greatest width. Lake Champlain flows from Whitehall, New York, north across the U.S./Canadian border to its outlet at the Richelieu River in Quebec. The Richelieu River then flows north to the St. Lawrence River. The Lake Champlain Basin Program (LCBP) reports that Lake Champlain averages about 64 feet in depth (20 meters), but reaches depths of 400 feet (122 meters) at its deepest section, with water level fluctuations in response to precipitation, temperature, and runoff variations (LCBP 2014).

Lake Champlain is divided into five distinct areas, each with different physical and chemical characteristics: Missisquoi Bay, the Inland Sea (or Northeast Arm), Malletts Bay, the Main Lake (or Broad Lake), and South Bay. Missisquoi Bay lies mostly within Canada and is shallow with relatively warm waters. Water from the Missisquoi Bay flows into the Inland Sea. The Inland Sea contains water that generally flows south from Missisquoi Bay, and north from Malletts Bay, and passes through and around the Champlain Islands. Malletts Bay is restricted by causeways constructed along the northern and western boundary of the bay and has the most restricted circulation of the five distinct areas of Lake Champlain. The Main Lake contains the deepest, coldest water and about 81 percent of the volume of the entire lake. The South Lake is narrow and shallow, similar to a river. Water retention time varies by lake area (LCBP 2009). Retention time is longest in the Main Lake (about 3 years), and shortest in the South Lake (less than 2 months) (LCBP 2014). The Project would be located within the Main Lake and South Bay sections of the lake.

Lake Champlain has a number of uses. Approximately 200,000 people, or about 35 percent of the Lake Champlain Basin population, depend on Lake Champlain for drinking water. Approximately 4,200 people draw water directly from Lake Champlain for individual use. State parks, public beaches, boat launches, and wildlife management areas (WMAs) are along the shoreline of Lake Champlain for recreational use (LCBP 2014). Although there are no designated commercial shipping lanes within Lake Champlain, several ferries use the lake.

Water Quality. Water quality for overland waterbodies in the Lake Champlain watershed is generally good to excellent; however, Lake Champlain itself is the dominant feature of the watershed and the most significant water quality issues are associated with the lake. Lake Champlain is listed in the *State of Vermont 2012 303(d) List of Impaired Surface Waters In Need of TMDL*, which is approved by the U.S. Environmental Protection Agency (USEPA, 2012). The Vermont Department of Environmental Conservation (VDEC) listed Lake Champlain as an impaired waterbody, meaning it frequently does not support designated uses based on its water quality classification in the Vermont Water Quality Standards (VWQS) as set by the Vermont Natural Resources Board (VNRB). The impaired waters list divides the lake into two regions through which the Project's proposed route passes. The northern section (north of Ferrisburgh), is listed for elevated levels of nutrients (phosphorous), sediment, polychlorinated biphenyls (PCBs), mercury, and e. coli. The southern section is listed for elevated levels of PCBs and mercury. A health advisory has been issued for fish consumption for certain species in Lake Champlain due to elevated levels of mercury and PCBs (Vermont Department of Health 2014).

Total phosphorus is listed as a cause of impairment for all regions and lists the probable cause as agriculture and, more specifically, animal feeding operations leading to nonpoint source pollution. The States of Vermont and New York jointly developed a Lake Champlain Phosphorus Total Maximum Daily Load (TMDL) in 2002 (VDEC and NYSDEC 2002), which was approved in the same year by the USEPA (2002). The implementation plan contained in the TMDL was subsequently revised and updated (VDEC 2010). However, as a result of a federal lawsuit, the USEPA initiated the process of developing a new TMDL for Lake Champlain in 2011, which is expected to be completed in the Spring of 2014 (USEPA 2014a).

The waters of Lake Champlain are generally classified as Class B under the VWQS (VNRB 2011). Designated uses in Class B waters include aquatic habitat, aesthetics, swimming and other primary contact recreation, boating and fishing, water supply and agricultural uses (VDEC 2012).

The Lake Champlain Long-Term Water Quality and Biological Monitoring Program has conducted water quality sampling annually since 1992. The project is conducted jointly by the VDEC and the NYSDEC and includes a variety of sampling parameters. The sampling network consists of 15 lake stations and 21 tributary stations. The purpose of this program is to identify water quality issues and assess the progress of reducing water pollution in the lake (VDEC 2014a). A report by the U.S. Geological Survey (Medalie 2013) using data collected by the Program found that over the study period of 1990 to 2011 there were overall reductions in total and dissolved phosphorus and total nitrogen concentrations as well as the concentration and flux of chloride on the eastern side of Lake Champlain. Total Suspended Solids (TSS) values varied throughout the lake.

The former Lake Champlain Sediment Toxics Assessment Program documented contaminant levels within sediments on the lake bottom. During initial surveys in 1991, samples were collected from 30 sites throughout the lake and analyzed for common contaminants such as trace elements, PCBs, chlorinated hydrocarbon pesticides (e.g., dichloro-diphenyl-trichloroethane [DDT]), and poly-aromatic-hydrocarbons (PAHs). The surveys identified the presence of contaminants at elevated levels in sediment, water, and biota. The program’s final report prioritized PCBs and mercury as persistent contaminants found lake wide, and arsenic, cadmium, chromium dioxins/furans, lead, nickel, PAHs, silver, zinc, copper, and persistent chlorinated pesticides as persistent contaminants in localized areas (McIntosh 1994).

Floodplains. The aquatic transmission line will be primarily routed through Lake Champlain. With respect to floodplains, Lake Champlain itself is classified as a 100-year floodplain by the Federal Emergency Management Agency (FEMA) (Zone AE, defined as a “High-Risk Area”). AE zones have established Base Flood Elevations. The Base Flood Elevation for Lake Champlain is 102 feet (31 meters) above mean sea level (MSL) (FEMA 2014).

Groundwater. In Vermont, an estimated sixty-six percent of the population depends on groundwater for their drinking water supply (VDEC 2003a). Groundwater is also used for manufacturing, agriculture, commercial enterprises, and to support aquatic habitat. The majority of groundwater for private wells and small-scale municipal supply comes from fractures in the bedrock (Nystrom 2011). Bedrock in this area is mainly crystalline rock with smaller areas of carbonate rock, sandstone, and shale. The surficial material throughout the area was deposited primarily during the Pleistocene epoch when glaciers covered the northeastern United States and consists primarily of glacial till deposited over the area when glaciers melted, and outwash deposits comprised of sands and gravels. Glacial till generally yields low amounts of water, whereas sand and gravel deposits can form productive aquifers. In 2008, the Vermont legislature declared that groundwater in Vermont is a public trust resource.

To enhance regulatory protection in areas where groundwater resources are most productive and most vulnerable, Vermont has established Source Protection Areas (SPAs) for public drinking water sources. The SPAs are defined as Zone 1, which is a 200-foot radius around a source, and Zones 2 and 3 for geologically delineated recharge areas. The proposed Project route does not cross any SPAs in the Lake Champlain Segment.

3.3.1.2 Overland Segment

Surface Water. The terrestrial transmission cables will be buried beneath the ground primarily within ROWs for state and local roads. This segment of the proposed Project route intersects with an estimated 72 streams and rivers.

The National Wild and Scenic Rivers System was created to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The National Park Service (NPS) has compiled and maintains the Nationwide Rivers Inventory (NRI), a register of river segments that potentially qualify as national, wild, scenic, or recreational river areas (NPS 2011). Otter Creek is the only surface water crossed by the Project that is listed in the NRI and it is anticipated that an HDD will be used to install the cables beneath this waterbody so that there will be no impacts.

Construction activities disturbing one or more acres (0.4 hectares) of land in Vermont require a permit under the National Pollutant Discharge Elimination System (NPDES). This permit must be supported by an Erosion Prevention and Sediment Control (EPSC) Plan, which provides facility-specific information regarding potential pollutant sources as well as Best Management Practices (BMPs) to support pollution prevention.

Water Quality. In this segment of the Project, the majority of the transmission line is terrestrial; however, some surface waters will need to be crossed. Vermont has applicable narrative and numeric water quality standards, VT Code R. 12 004 052, for these waters. Vermont surface water quality classifications for Overland Segment surface waters include Classes A and B waters. Classes A and B are defined in 10 V.S.A. Section 1252. Class A waters are classified as suitable for public water supply and high quality waters. Class B waters are classified as suitable for bathing and recreation, irrigation and agricultural uses; good fish habitat; good aesthetic value; acceptable for public water supply with filtration and disinfection. Water quality criteria for these classifications are described in Section 3-01 of the VWQS. With respect to turbidity, the VWQS provide that for Class A and Class B (cold water fish habitat waters) a project should not result in concentrations that will prevent the full support of uses and not exceed 10 nepholometric turbidity units (NTU) as an annual average under dry weather base-flow conditions. Class B warm water fish habitat waters are not to exceed 25 NTU. With respect to phosphorus and nitrogen, the general criteria indicate loadings shall be limited so that they will not contribute to the acceleration of eutrophication or the stimulation of the growth of aquatic biota in a manner that prevents the full support of designated uses. Numeric phosphorus criterion exists for select waterbodies to reduce loadings to Lake Champlain and Lake Memphremagog. Otter Creek, which crosses the Project route, is one of these waterbodies and has a phosphorus criterion of 0.14 milligrams per liter (mg/l). The VWQS also contains numeric criteria for nitrates, where nitrate concentrations for lakes, ponds, and reservoirs cannot exceed 5.0 mg/l nitrate-nitrogen regardless of classification. Criteria for all other waters vary based on classification, but range from 0.2 mg/l to 5.0 mg/l of nitrate-nitrogen at flows exceeding low median monthly flows.

In relation to flow, stream flow and water level fluctuation criteria vary with classification and are described in Section 3-01(C)(1) and Section 3-01(C)(3) of the VWQS, respectively. The 2012 State of Vermont 303(d) list identified impaired surface waters in need of a TMDL to determine the amount of a pollutant that may be introduced into the water after the application of required pollution controls and to ensure the VWQS are attained and maintained. The Project does not appear to cross any of these listed streams but the Applicant will consult with the state agencies to confirm.

Floodplains. The Applicant conducted a review of FEMA Flood Insurance Rate Maps (FIRMs), to determine the 100-year floodplains associated with rivers, streams, and unnamed tributaries within the ROI in the Overland Segment (see Appendix B). These floodplains include FEMA Zones AE and A. Zone AE is a 100-year floodplain that has an established base flood elevation; Zone A is a 100-year floodplain with no base flood elevation established (FEMA 2012).

Groundwater. Approximately the first 50 miles (80 km) of the Overland Segment are within the Lake Champlain Basin. The remaining portion of the proposed route within the Overland Segment is in the Connecticut River Basin. According to the U.S. Geological Survey, these areas are underlain almost entirely by igneous and metamorphic rock (USGS 2014). Drilled wells accessing fractured bedrock aquifers are common as residential and commercial water supplies in these basins. Groundwater is also accessed from aquifers comprised of surficial sand and gravel deposits, with many of the aquifers consisting of very small areas with little or no hydraulic connection with other aquifers. The Project route within the Overland Segment as proposed does not cross any Sole Source Aquifers (USEPA 2014b).

3.3.2 Environmental Impacts

3.3.2.1 Lake Champlain Segment

Impacts from Construction

Surface Water and Water Quality. Installation of the transmission line in or on the lake bottom of Lake Champlain will temporarily result in localized impacts to water quality in Lake Champlain during construction. Between the U.S./Canada border and approximately MP 74, when the aquatic transmission cables are installed within the lakebed sediment it will be at depths of approximately 4 feet (1.8 meters) using water-jetting techniques. Impacts on water quality will be caused by temporary localized increases in turbidity (a measurement of the cloudiness or amount of TSS in water) resulting from the resuspension of sediments from trenching and disturbance within the waterbody. South of MP 74, where the lake is shallower and narrower, shear plow techniques, described in Section 2.4.10.1, will be used to bury the transmission cable approximately 3 to 4 feet (1.2 to 1.8 meters) deep to minimize turbidity and sediment resuspension.

Increased turbidity has the potential to reduce light levels in aquatic habitats and could result in temporary changes to water chemistry, including effects on pH and reduced dissolved oxygen. Reduced dissolved oxygen levels result if lowered light levels decrease the oxygen production of photosynthetic organisms, or biological oxygen demand (BOD) is increased by sedimentation. Fish and other mobile organisms will be expected to avoid areas that are temporarily impacted by construction activities, but less mobile or sessile aquatic organisms could be affected by changes in water quality. See Section 3.4 for a detailed discussion of impacts on aquatic habitats and species.

HDD technology will be used for the transition from water to land. HDD does have the potential for leaks of HDD drilling fluid containing bentonite clay during HDD operations, which could cause drilling fluid to become suspended or dispersed and could impact water quality. However, an emergency response plan will be developed and any releases of drilling fluid will be contained in the temporary cofferdam area during construction. The sheet pile cofferdam will be installed around the HDD exit point. The area inside the cofferdam will be dredged to create a pit at the end of the HDD conduit to allow the cable to be pulled into the conduit. This dredging will result in suspension of sediment, which will be contained within the cofferdam area. The cofferdam will remain in place during the HDD operation to minimize the chance of a release of drilling fluids into the lake. As a potential alternative to cofferdams at the exit point of land to water HDD operations, a guide shaft may be used. A large diameter pipe segment will be pushed into the lake bottom at the planned HDD exit point. The pipe will be sloped at an incline and extend above the waterline, where the cable lay barge will be stationed. The slope of the exit shaft will be set at a grade suitable for the HDD exit slope. The HDD drill head will be steered into the bottom of the guide shaft and continue up the shaft to the cable lay barge. The shaft will be left in-place until the bore hole is ready to receive the bore casing or cable. At that time sediment and turbid water will be pumped out of the shaft into holding tanks on the lay barge, and the shaft removed.

Previous water quality modeling studies have estimated the potential dispersion of sediment and other constituents during the cable installation processes (HDR 2010; 2011). A three-dimensional hydrodynamic and water quality model of Lake Champlain was developed to simulate the dispersion of 10 contaminants: copper, zinc, lead, cadmium, benz(a)anthracene, nickel, chromium, mercury, arsenic, and pyrene. The model predicted compliance with the New York State and Vermont water quality standards for all of the 10 modeled contaminants. TSS concentrations associated with cable installation were also assessed in these studies and depth-averaged TSS concentrations (the average of concentrations from depths at a single point) associated with cable installation are expected to be less than 200 mg/L.

Floodplains. With respect to floodplains, Lake Champlain is classified as a 100-year floodplain by FEMA (Zone AE, defined as a “High-Risk Area”). Zone AE is a 100-year floodplain that has an established base flood elevation. While the cables will be located within the floodplain within Lake Champlain and at the property in Alburgh where the HDD will transition into the lake, the cables will be buried or lay on the bottom of the lakebed. Therefore, no effects on its floodplain will be anticipated from construction of the Project transmission line.

Groundwater. No impacts on groundwater will be anticipated during installation of the transmission line because the area to be disturbed during construction activities will be beneath Lake Champlain where no groundwater uses are present.

Impacts from Operations, Maintenance, and Emergency Repairs

When electric energy is transported, a certain amount is lost as heat, leading to an increased temperature of the transmission cable surface and subsequent warming of the surrounding environment. However, the operation of the transmission line does not result in significant impacts on water temperature. The cable generally will be installed to approximately 4 feet (1.2 meters) below the sediment surface. A previous study calculated thermal impacts on water quality from operation of the transmission line in Lake Champlain (Exponent 2011). The predicted increase in sediment temperature at the sediment surface directly above the cables, assuming burial to a depth of 4 feet (1.2 meters) and the cables installed side by side (i.e. no separation), was estimated to be 1.8 degrees Fahrenheit (°F)(1.0 degree Celsius (°C)), and the temperature change in the water column above the cable was less than 0.01 °F (0.004 °C). A slightly greater impact, but still negligible, will be expected in a few places where the transmission line is not buried because it crosses other utility infrastructure and is therefore covered with rip-rap or concrete mattresses or where it is laid on the bottom of the deeper waters of Lake Champlain. Because the transmission line will be buried to a shallower depth under the mattresses, the temperature increase will occur above the sediment surface, but any heat generated will still be quickly dissipated. No significant impacts on other water quality parameters are anticipated to occur during operation of the transmission line.

Inspection activities will be non-intrusive; therefore, no impacts to water quality from inspection of the transmission line will be expected. During potential emergency repair activities, the cable will have to be exposed, pulled up onto a repair barge, a repair section spliced in, and then lowered to the bottom and reburied. Impacts on water quality will include localized increases in turbidity and resuspension of sediments. While the frequency of emergency repairs cannot be predicted and the repair time will vary, repairs will be short-term and limited to the immediate vicinity of the repair site. The impacts will be similar to those experienced during the original installation, but with a shorter duration and smaller overall area of disturbance.

3.3.2.2 Overland Segment

Impacts from Construction

Surface Water and Water Quality. In this segment, the terrestrial transmission cables will be buried beneath the ground in roadway ROWs. Ground disturbance from trenching and soil stockpiling could lead to the potential for a temporary increase in erosion and runoff into surface waters in the absence of control measures. The Project will implement appropriate measures to address the potential for soil erosion. The proposed Project route will cross several streams and rivers. Installation methods proposed include trenching and HDD. For intermittent and ephemeral streams that are dry at the time of construction, it is proposed that an open cut will be excavated through the dry streambed. Where perennial or other substantial stream flows are present, a dry-ditch method could be used to isolate the work area from the flow of water. These dry-ditch crossings will typically be completed by installing cofferdams upstream of the work area, and either pumping water around the construction area, or diverting the stream flow into one or more flume pipes. This diversion will temporarily impact the natural water course of the surface water.

HDD could be used at other locations along the transmission line route depending on site-specific requirements and constraints to minimize environmental impacts on sensitive resource areas. As mentioned previously, during the HDD process, drilling fluid will be used and has the potential for release into surface waters causing water quality impacts. An emergency response plan will be employed to contain any spills quickly. HDD is anticipated to result in lower impacts on water resources, including runoff from exposed soil in HDD staging areas, than other installation methods such as trenching and dry-ditch crossings because surface waters or stream channels will not be directly disturbed.

HDD operations do have the potential of unexpected releases, where drilling fluids could be released or dispersed and impact water quality. The Applicant will develop and implement an emergency response plan that will allow for timely cleanup of any bentonite leaks that might occur and ensure minimal impacts on the environment.

Vegetation clearing, ground disturbance, and trenching along the roadway ROWs will increase the potential for soil erosion, possibly resulting in water quality impacts on nearby surface waters during construction. Erosion and increased sedimentation in stormwater runoff will occur in active construction areas, but will be managed in place with BMPs included as part of the EPSC Plan. The EPSC Plan will incorporate State of Vermont standards and specifications for erosion prevention and sediment control. Storm water management features and strategies (e.g., French drains, inlet protection, dewatering, and site stabilization and reseeding) will be implemented in accordance with the EPSC plan. The EPSC Plan will contain detailed maps depicting contours, slopes, drainage patterns, and locations of erosion-control structures.

Floodplains. Project activities along the Overland Segment will result in temporary impacts on floodplains from construction activities related to burying the cables. The cable will be installed at least 3 feet (0.9 meters) below ground and the ground surface will be returned to its pre-existing level. Vegetation clearing, ground disturbance, trenching and soil stockpiling, and related construction activity will occur within the floodplains crossed by the Project. BMPs implemented during construction will include use of erosion and sedimentation controls, and prohibitions on storing construction equipment or conducting refueling in floodplains, and restoring pre-existing ground grading will minimize any impacts on flood flows, flood storage, or flood hazards during the construction period.

The Ludlow HVDC Converter Station is expected to be constructed and operated outside of the 100-year floodplain due to its elevation. Vegetation clearing, grading, and construction activity that will occur within this area is not expected to have any impacts on flood flows, flood storage, or flood hazards during the construction period.

Groundwater. At some discrete locations, the blasting of bedrock could be required to install the terrestrial transmission cable. Blasting may also occur to facilitate construction of the Ludlow HVDC Converter Station. Bedrock blasting has the potential to increase bedrock fracturing near the blasting zone. Blasting has the potential to create changes in local hydrology and temporarily increased levels of turbidity in nearby groundwater wells. Therefore, short-term localized impacts on groundwater quality could occur if blasting of bedrock is required. Blasting activities will be performed in strict adherence to all industry standards applicable to control of blasting and blast vibration limits as specified in a blasting plan to be developed by the Applicant and notification will be provided to potentially affected nearby landowners.

HDD could potentially be used at some locations within the Overland Segment to avoid environmental impacts on sensitive resource areas such as wetlands and other water bodies of importance. During the HDD process, drilling fluid will be used and has the potential to percolate to groundwater. Bentonite clay is a solid and is denser than the water with which it is mixed to make drilling fluid. As the drilling fluid percolates through the soil, the bentonite clay bonds with the water in the fluid through absorption and to seal the bore tunnel by moving to the porous areas in the soil as a result of the pressure of the fluid. Therefore, adverse impacts on groundwater are not anticipated from HDD operations.

Impacts from Operations, Maintenance, and Emergency Repairs

No impacts on water resources will be expected during operation of the terrestrial portion of the transmission line in this segment because there will be no change in water quality, water availability, or elevation changes in floodplains. No impacts from inspection of the transmission line will be expected, as inspection activities will be non-intrusive. During potential emergency repair activities, impacts on water quality related to ground disturbance to uncover and repair damaged lines could increase the potential for erosion and sedimentation to nearby surface waters. The cable will have to be exposed and then reburied. While the frequency of emergency repairs cannot be predicted and the repair time will vary, repairs likely will be infrequent and short-term in duration and will be limited to the immediate vicinity of the repair site. The impacts will be similar to those described for the original installation, but with a shorter duration and smaller area of disturbance. Permanent stormwater management practices at the Ludlow HVDC Converter Station will be designed and constructed to meet the VDEC Stormwater Management Rule and Manual to prevent similar concerns during the operational phase of the project.

3.4 Aquatic Habitat and Species

This section describes freshwater, estuarine, and marine ecosystems and aquatic animals and plants that occur in the Project area. Aquatic species protected under Endangered Species Act (ESA) and Migratory Bird Treaty Act (MBTA) are discussed in Section 3.5. Aquatic species not protected under those regulations and discussed in this section include submerged aquatic vegetation (SAV), shellfish, benthic resources, and fish.

The ROI for aquatic habitat and species for the Lake Champlain Segment of the Project includes Lake Champlain from Alburgh, Vermont (MP 0.5) south to Benson, Vermont (MP 98). The ROI for aquatic habitats in the Overland Segment is 100 feet (30 meters) centered on the transmission line centerline (50 feet (15 meters) on either side). This terrestrial ROI was selected based on an expectation that given the construction activities proposed and the impact minimization measures to be employed, any significant or measureable impacts to aquatic habitats and species could occur within this area.

3.4.1 Environmental Setting

3.4.1.1 Lake Champlain Segment

Aquatic Habitat and Vegetation. Lake Champlain provides littoral, pelagic, and demersal habitat for fish species. Littoral habitat includes nearshore habitats such as rock outcroppings, grassbeds, sediments, and debris that provide refuge and forage habitat. Because of the sunlight penetration, the littoral zone is very productive and supports minnows, younger fish, and lower species on the food chain. It also supports habitat for predatory fish. Pelagic habitat is open lake waters, which are typically colder and less productive than littoral habitat. Pelagic waters can be stratified during the summer, providing suitable temperatures for warmwater, coolwater, and coldwater fish. Pelagic fish spend most of their life cycle in the open lake except when spawning. Demersal habitat includes the bottom waters and benthic habitat beneath pelagic waters. Benthic habitat supports crustaceans, insect larvae, and burrowing worms that live on the rich accumulation of organic matter and are prey for the demersal fish species. The bottom of

Lake Champlain is composed of a variety of substrates including mud, clay, silt, sand, gravel, cobble, boulders, bedrock outcrops, logs, and organic material such as tree limbs or leaves. Aquatic vegetation is also considered substrate structure (Trzaskos and Malchoff 2006).

Historically, there have been numerous species of SAV present in Lake Champlain, along shoreline areas and in shallow embayments in the littoral habitats. Common native species include milfoils (*Myriophyllum* spp.*),* pondweeds (*Potamogeton* spp.), and water celery (*Vallisneria americana*). Water depths for the majority of the Project route in the Lake Champlain Segment generally north of Chimney Point, Vermont exceed those that support SAV.

Two nonindigenous, invasive plant species, Eurasian watermilfoil (*Myriophyllum spicatum*) and water chestnut (*Trapa natans*), are known to crowd out native species and impede recreational activities, such as fishing, boating, and swimming, by forming dense monotypic stands (LCBP et al. 2005). These two species are present in Lake Champlain, and are 2 of the 13 priority aquatic nuisance species listed for the Lake Champlain Basin. Eurasian watermilfoil and water chestnut cause significant adverse ecological and economic impacts and have a high potential to expand their range throughout the Lake Champlain Basin. Education and outreach efforts are being conducted in an effort to control these species (LCBP et al. 2005).

Essential Fish Habitat. There is no Essential Fish Habitat (EFH) designated in Lake Champlain.

Shellfish and Benthic Communities. The benthic invertebrate community of the Lake Champlain Basin includes native mussels, aquatic snails, crustaceans, oligochaetes, and insects that support a diverse ecosystem. The Lake Champlain Basin watershed supports 14 native freshwater mussel species (LCBP 2012).

Since the invasion of the nonnative zebra mussel (*Dreissena polymorpha*) in Lake Champlain in 1993, the benthic macroinvertebrate community of the lake has undergone substantial change (FTC 2009). Zebra mussels have heavily colonized the shallow-waters of the Main Lake, South Lake and parts of the Northeast Arm, leading to declines in native populations. Eight of the Basin's fourteen native mussel species are threatened or endangered, including the fragile papershell (*Leptodea fragilis*), pink heelsplitter (*Potamilus alatus*), and pocketbook (*Lampsilis ovate* mussels (LCBP 2012). Mussel distribution and abundance is generally reduced once the water depths are greater than 30 feet (9 meters).

Fish. Fish of Lake Champlain can be grouped by temperature preference, trophic level, habitat, and migration within the lake basin (FTC 2009). Fish in Lake Champlain are divided into three temperature groups: coldwater, coolwater, and warmwater species based on each species' summer temperature preferences for optimal health and efficient growth and reproduction. Warmwater fish prefer summer temperatures between 80 to 87 degrees Fahrenheit (°F) (27 to 30 °C); coolwater fish prefer summer temperatures between 69 to 77 °F (21 to 25 °C); and coldwater fish prefer summer temperatures below 59 °F (15 °C) (Trzaskos and Malchoff 2006). Most fish species in the lake are predatory whether or not they are nearshore or offshore residents or migratory (FTC 2009). Over 70 species of fish occur within the Lake Champlain Segment.

In 2014, the Vermont Fish and Wildlife Department (VFWD) plans to stock Lake Champlain with over 346,000 yearling Landlocked Salmon (*Salmo salar*), Steelhead (*Oncorhynchus mykiss*), Brown Trout (*Salmo trutta*), and Lake Trout (*Salvelinus namaycush*), and over 128,000 landlocked Salmon fry, and fingerlings (VFWD 2014a). The New York State Department of Environmental Conservation (NYSDEC) stocked landlocked salmon, lake trout, and brown trout in 2012 (NYSDEC 2013).

3.4.1.2 Overland Segment

Aquatic Habitat and Vegetation. The Overland Segment ROI crosses open water features such as rivers, intermittent and perennial streams, ditches, ponds, pools, and lakes. This ROI segment also crosses marshes dominated by emergent vegetation, shrub swamps, forested wetlands, areas with lacustrine and palustrine unconsolidated bottom habitat, floodplain forests, and riparian edges.

The portion of the proposed transmission line route within the Overland Segment crosses multiple waterways including Hubbardston River and Otter Creek, as well as many other named and unnamed perennial and intermittent streams.

Common submerged aquatic plants in Vermont are water marigold (*Bidens beckii*), coontail (*Ceratophyllum demersum*), muskgrass (*Chara sp. and Nitella sp*.), waterweed (*Elodea Canadensis*), pipewort (*Eriocaulon aquaticum*), variable-leaf watermilfoil (*Myriophyllum heterophyllum*), northern watermilfoil (*Myriophyllum sibiricum*), Eurasian watermilfoil (*Myriophyllum spicatum*),common naiad (*Najas flexilis*), big-leaf pondweed (*Potamogeton amplifolius*), curly pondweed (*Potamogeton crispus*), ribbonleaf pondweed (*Potamogeton epihydrus*), variable pondweed (*Potamogeton gramineus*), floating-leaved pondweed (*Potamogeton natans*), flatstem pondweed (*Potamogeton zosteriformis*), water buttercup (*Ranunculus sp.*), common bladderwort (*Utricularia macrorhiza*), wild celery (*Vallisneria Americana*), water stargrass (*Zosterella dubia*) (VDEC 2014b).

Shellfish and Benthic Communities. The shellfish and benthic communities that inhabit perennial water bodies are generally similar to those described in Section 3.1.4. There are perennial streams crossed by the Project within the Overland Segment that potentially support shellfish and benthic communities.

Benthic macroinvertebrates include aquatic insects, worms, clams, snails, and crustaceans. The composition of the macroinvertebrate community is determined by factors such as habitat, food source, flow regime, temperature, and water quality. Community composition can change with water quality. Macroinvertebrates associated with good water quality include mayflies, stoneflies, and caddisflies. Macroinvertebrates that are associated with poor water quality include midges, black fly larvae, annelids, and sowbugs. The VDEC Biomonitoring and Aquatic Studies staff routinely survey the macroinvertebrate and fish communities of lakes, wetlands, rivers, and streams to evaluate the biological health of the resource surveyed, as well as provide technical assistance (VDEC 2014c).

Fauna that inhabit intermittent streams are adapted to survive a wide range of hydrologic conditions. Conditions during a single growing season can range from a coursing stream to remnant ponded sections to completely dry beds. Some of the most common macroinvertebrates found in Vermont rivers include midges (*Chironomidae*), net-spinning caddisflies (*Hydropsychidae*), small minnow mayflies (*Baetidae*), riffle beetles (*Elmidae*), blackflies (*Simuliidae*), fingernet caddisflies (*Philopotamidae*), crane flies (*Tipulidae*), and flat-headed mayflies (*Heptageniidae*) (Saint Michael's College 2014). These macroinvertebrates will be expected in the water bodies crossed by the proposed transmission line route within the Overland Segment.

Fish. The Overland Segment crosses perennial streams that are sizeable enough to contain various fish species. Smaller, intermittent streams along the proposed Project route are unlikely to contain sizeable populations of fish species or habitat.

Essential Fish Habitat. There is no EFH designated in the Overland Segment.

3.4.2 Environmental Impacts

3.4.2.1 Lake Champlain Segment

Impacts from Construction

Lake Champlain is a dynamic environment where storms, water currents, wave action, and human activity disturb sediments. Installation of the transmission line is expected to result in a temporary disturbance of limited portions the lake bottom. The jet or shear plow will directly affect an area of approximately 15 feet (5 meters) in width, and sediment will be displaced during the cable installation causing disturbances on the lake bottom for up to an additional 15 feet (5 meters) on either side of the plow. Therefore, installation of the transmission line will result in up to 550 acres (223 hectares) of temporary lakebed disturbance in Lake Champlain. Depressions in the lake bottom over the installed cable are anticipated after installation, but the contours of the lake bottom are anticipated to return to pre-installation conditions through natural redeposition of the disturbed material into the trench depression. Impacts from sediment disturbance associated with aquatic transmission line burial will include the displacement of benthic and demersal (i.e., bottom-dwelling) species.

Installation of the underwater transmission lines will disturb sediment, increase turbidity in the water column, and disturb previously settled contaminants, resulting in temporarily increased turbidity in the vicinity of construction within the Lake Champlain Segment. TSS concentrations were previously estimated for jet plow and shear plow activities (HDR 2010, 2011). The model used to estimate TSS concentrations utilized very conservative assumptions and estimated concentrations based on a location directly above the installation at a single point in time. In addition, it assumed jet plowing, which generally releases more sediment compared to shear plowing. TSS concentrations produced by this model were expected to be less than 200 mg/L on average along the route in the northern portion of the lake. South of MP 74 (Chimney Point), where predicted turbidity levels associated with the jet plow were greater, modeling of a shear plow to install the transmission cable and minimize turbidity from sediment resuspension and transport resulted in modeling predictions of maximum TSS concentrations of less than 200 mg/L.

No contaminants are expected to exceed Vermont water quality standards as a result of Project construction. Previous studies simulated 10 common contaminants (copper, zinc, lead, cadmium, benz(a)anthracene, nickel, chromium, mercury, arsenic, and pyrene) during installation by jet plow and sheer plow in Lake Champlain and concluded that water quality standards were met for these constituents (HDR 2010, 2011).

Aquatic Habitats and Vegetation. Impacts on aquatic vegetation could result from sediment disturbance (including redeposition) that will cause a reduction of growth and primary production related to burial, coating of plants with fine sediments, and reduced light penetration. These impacts are expected to last just slightly longer than the duration of the plume because of the characteristics of burial and coating. Impacts will be limited because vegetation is primarily present along shoreline areas and in shallow embayments, while cable installation will only occur in deeper waters (greater than 20 feet (6 meters). Direct disturbance to SAV in the northern portion of Lake Champlain Segment (i.e., north of Chimney Point) will be minimal because the aquatic transmission line will be installed at depths greater than where vegetation generally grows. SAV is more prevalent in the southern portion of Lake Champlain where the lake is relatively shallow and sunlight can penetrate to the vegetation. Impacts such as crushing, injuring, and uprooting of SAV will occur during the transmission line installation in the southern portion of the Lake Champlain Segment. Other impacts could occur from increases in turbidity, which could reduce light availability and affect rates of photosynthesis, although impacts from sediment disturbance will be minimized through turbidity monitoring during installation.

Redeposition of sediments could result in burial of SAV, although different species have different tolerances for sediment accretion. As such, burial of SAV from redeposition of sediments can result in loss of SAV and changes in species composition. Additionally, any areas containing SAV where concrete mats or rip-rap will be installed could experience a long-term change in SAV species composition. However, these areas are expected to be limited in number and the impacts extremely localized.

Shellfish and Benthic Communities. Sediment disturbance from jet plow, shear plowing, and other cable-laying activities could result in crushing or injury of shellfish and other benthic invertebrates. The area directly affected by cable installation will be confined to the footprint of the jet plow and shear plow. Redeposition of disturbed sediment will eventually return lake bottom contours to their original conditions within the four foot (1.2 meter) area of trenching through the effect of bottom currents, and these areas will recolonize. Recolonization and community composition is dependent upon numerous factors such as the stability of disturbed areas, the tolerance of organisms to physical changes, and the availability of recruits. Recovery times for the benthic communities vary from several months to several years depending on the community composition, severity and frequency of disturbance (Newell et al. 2004, Carter et al. 2008).

Redeposition of sediments could also change the existing bottom composition if this composition consists of coarser grains on top of finer grains. The layering could be reversed after sediments are disturbed because finer grains will take longer to settle out of the water column. Such a change will affect the species composition of the benthic community, which will be composed of those that could survive and thrive in this sediment. Mobile species that prefer coarser sediment grains will likely relocate to areas with coarser grains. Sessile (immobile) species will likely die off if they could not adapt to the new sediment conditions (Germano and Cary 2005). These mortalities will not represent significant impacts because they will neither result in population-level impacts nor result in the inability of the species to survive.

Impacts on benthic resources will occur from the resuspension of sediments and increased turbidity. Although not significant, impacts on bivalve mollusks could be both physiological (e.g., reduction of filtering rates and rejection of excess filtered material) and physical (e.g., burial and a reduction in benthic organisms). Daphnids exposed to 50 to 100 mg/L of TSS for less than 18 days exhibited reduced feeding. Freshwater mussels exposed to 600 to 750 mg/L of TSS for 21 days exhibited a decreased ability to clear their filter feeding mechanisms.

Fish. Impacts on demersal and pelagic fish could result from temporary increases in turbidity, water quality degradation, noise, light, or from an unanticipated hazardous spill. Short-term sediment resuspension will occur from installation and burial of the transmission line and movement of construction vessels.

No significant impacts on spawning species is expected from installation activities. The sensitivity of spawning fish to impacts from suspended sediment is species and life-stage specific, and depends on abiotic factors of the sediment, sediment concentration, and duration of exposure (Berry et al. 2003). Larvae are more sensitive to suspended sediments than eggs, juveniles, or adult fish. Adult and juvenile fish will likely leave the area to avoid an increase in turbidity. Most spawning species either spawn in the shallow shoreline areas (e.g., 6 inches to 40 feet [0.2 to 12 meters] in depth) of Lake Champlain where their eggs can be camouflaged among vegetation and gravel beds or migrate to spawn in such habitats in the streams and rivers in the watershed. Installation of the transmission line will primarily transect the middle (deeper) portions of the lake away from the shoreline and streams and rivers associated with the watershed. Construction windows will be employed, with the portion of the Lake Champlain Segment from Alburgh to Chimney Point being anticipated to be installed from approximately May 1 through September 15, and the portion from Chimney Point to Benson to be installed from approximately September 15 through December 31. The use of HDD for the water-to-land transition of the transmission line out of Lake Champlain will avoid shallower water habitats and impacts on fish spawning are expected to be minimal. Therefore, no significant impacts on spawning species will be expected from installation activities.

Turbidity can have an effect on all life stages of fish. Suspended sediment could make pelagic eggs sink to the bottom. Demersal eggs could also be affected by sediment smothering. Planktonic larvae react to turbidity with reduced growth rates and increased mortalities. Increased mortality rates and reduced breeding success are possible impacts. Impacts from increased suspended sediment on adult fish can be classified as biological, physiological, or behavioral (Berry et al. 2003). Biological and physiological impacts could include abrasion of gill membranes resulting in a reduction in the ability to absorb oxygen, a decrease in dissolved oxygen concentrations in the surrounding waters, and effects on growth rate. Behavioral responses by fish to increased suspended sediment concentrations include impaired feeding, impaired ability to locate predators, and reduced breeding activity.

The resuspension of contaminated sediments from the installation of the transmission line could expose fish to contaminants that could be mobilized and become bioavailable. Bioavailability refers to the fraction of a contaminant that can be taken into any biological entity (e.g., plant, benthic invertebrate, or fish). If contaminated sediments become bioavailable or biotransferred within food chains, negative impacts could occur. Depending on the chemical form in which a contaminant occurs, the contaminant can range from being completely bioavailable to virtually unavailable. Previous water quality modeling studies (HDR 2010, 2011) indicate that no state water quality standards will be exceeded as a result of transmission line installation activities in Lake Champlain based on the contaminants modeled.

Impacts on fish may also occur due to lighting used during transmission line installation. Larval, juvenile, and adult fish could be attracted to lights, making them vulnerable to predation by other fish attracted to concentrated prey. During nighttime construction activities, vessels will be outfitted with identification lights, and working decks will be illuminated for safety. The cable-laying ship or barge will progress at an average rate of 1.5 miles (2.4 km) per day, so any temporary light illumination of waters around the work equipment will be of short duration in any given location, which will reduce impacts from lighting.

Continuous noise, as high as 80 A-weighted decibel (dBA) above the water, associated with operation of vessels and machinery will result from the installation of the transmission line during construction. However, cable laying is limited with respect to space and time and, therefore, impacts on aquatic fauna from noise will exist in any one location for only a few hours. Underwater noise generated by the construction vessels used for cable laying will be similar to that of other ships and boats (e.g., tug boats, ferries, fishing vessels, and pleasure boats) already operating in these areas.

Given the rate of transmission line installation through the lake during a single construction season, sound impacts will be either temporary or intermittent and only a few individuals will be affected relative to entire fish populations. Specifically, exposure of fish to continuous sound could result in a temporary, but not significant, impact (i.e., for the duration of installation activities) on auditory sensitivity by causing temporary hearing interference or loss, or a flight response. The duration of such effects will vary, but, by definition, generally there is recovery of full hearing over time (Hastings and Popper 2005). Other potential impacts of continuous sound exposure on fish include physiological stress responses; behavioral responses such as startle response, alarm response, and avoidance; lack of response due to masking of acoustic cues; and physical damage to the ear region. During installation of the aquatic transmission line, four vessels, a cable vessel, survey boat, crew boat, and tugboat with barge, will be employed. Each of these vessels contains fuel, hydraulic fluid, and other potentially hazardous materials and, therefore, has the potential for hazardous spills. As is true for all vessels on the Lake, minor releases of hydrocarbons (e.g., diesel fuel and lubricants) could result in impacts on fish species. The impacts of hydrocarbons are caused either by the physical nature of the fuel (physical contamination and smothering) or by its chemical components (toxic effects and bioaccumulation). It is anticipated that the immediate response of fish to water contaminated with hydrocarbons will be avoidance. Applicants have also committed to developing an emergency response plan to address these accidental spills, which will further minimize impacts.

Impacts from Operations, Maintenance, and Emergency Repairs

In the Lake Champlain Segment, the transmission line will be installed in a trench at a target depth of approximately 4 feet (1.3 meters) in waters of less than 150 feet in depth. The Applicant proposes to place the cable bipoles in a single trench, which will serve to reduce magnetic field levels. The sheathing and insulation around the transmission cables and the burial of the cables will effectively eliminate the electric field produced by the cables; therefore, no impacts on aquatic species will be expected. Deeper burial will reduce the magnetic field, but not eliminate it entirely. A previous study calculated the magnetic field deviation for cables buried to a depth of 4 feet (1.2 meters) to be approximately 164 milligauss (mG) within 1 foot (0.3 meters) above the lakebed directly over the transmission line and approximately 23 mG at 10 feet (3 meters) from the transmission line (Exponent, 2011). Although there will be a minor change in temperature in the sediment immediately surrounding the cables, the depth of the burial and insulating factors of the cable will minimize impacts on the benthic habitats in the immediate vicinity. This same study (Exponent 2011) calculated thermal impacts on water quality from operation of the transmission line in Lake Champlain. The predicted increase in sediment temperature at the sediment surface directly above the cables, assuming burial to a depth of 4 feet (1.2 meters) and the cables installed side by side (i.e. no separation), was estimated to be 1.8 °F (1.0 degree °C), and the temperature change in the water column above the cable was less than 0.01 °F (0.004 °C). A slightly greater impact, but still negligible, will be expected in a few places where the transmission line is not buried and is covered with rip-rap or concrete mattresses to cross other utility infrastructure. Because the transmission line will be buried to a shallower depth under the mattresses, the temperature increase will occur above the sediment surface, but any heat generated will still be quickly dissipated. Therefore, significant impacts on benthic resources from temperature during operation of the transmission line are not anticipated.

As the transmission line itself will be maintenance-free, no significant impacts on aquatic habitat and species are anticipated as no scheduled maintenance activities are proposed in the Lake Champlain Segment.

Impacts resulting during any emergency repairs of the aquatic transmission line from sediment disturbance and turbidity on aquatic vegetation, shellfish and benthic communities, and fish will be similar to those described during initial installation, but on a smaller scale and for a shorter duration. Impacts associated with emergency repairs, if required, will not be significant and will be localized and temporary, lasting only the duration of emergency repair activities.

Aquatic Habitat and Vegetation. Impacts on aquatic vegetation associated with operation of the transmission line are not likely to occur. The cables will be buried in deeper areas of the lake where SAV is generally not located. Magnetic fields at levels produced by the Project are not expected to impact aquatic plant species such as SAV, and temperature increases associated with operation of the transmission line will be small and restricted to the area directly above the transmission line.

Shellfish and Benthic Communities. Magnetic field impacts on shellfish behavior or reproduction will not be significant. According to studies, the survival and reproduction of benthic organisms are not thought to be affected by long-term exposure to static magnetic fields (Normandeau et al. 2011). Several marine benthic invertebrates, including the blue mussel (*Mytilus edulis*) and North Sea prawn (*Crangon crangon*), survived 37,000 mG with no apparent effects (Fisher and Slater 2010). However, physiological changes (20 percent decrease in hydration and a 15 percent decrease in amine nitrogen values) were detected in blue mussels exposed to magnetic fields of 58,000, 80,000, and 800,000 mG. Experiments that exposed two freshwater mollusks, the Asiatic clam (*Corbicula fluminea*) and the freshwater snail (*Elimia clavaeformis*), to 360,000 mG showed no evidence of changes in activity (Cada et al. 2011). In these cases, experimental values were much more intense by orders of magnitude than will be expected from the proposed transmission line in the Lake Champlain Segment, which previous studies have estimated to be less than 23 mG at 10 feet (3 meters) from the transmission line or 600 mG directly over the cables where concrete mats are used.

Temperature increases associated with operation of the transmission line will not have more than a negligible impact on shellfish and benthic communities. The temperature increase in the top 8 inches (20.3 cm) of sediment where most benthic infauna (bottom-dwelling aquatic animals) occur will be less than 9 °F (5.2 °C), diminishing 1.8 °F (1.0 °C) above ambient conditions directly above the cables. A previous study calculated thermal impacts on water quality from operation of the transmission line in Lake Champlain (Exponent 2011). The predicted increase in sediment temperature at the sediment surface directly above the cables, assuming burial to a depth of 4 feet (1.2 meters) and the cables installed side by side (i.e. no separation), was estimated to be 1.0 °C, and the temperature change in the water column above the cable was less than 0.01 °F (0.004 °C). The effect of this temperature increase will be extremely localized to the area directly above the cable.

Fish. As described in the following paragraphs, no significant impacts on fish associated with operation of the transmission line are expected due to induced electric fields, magnetic fields, and changes in temperature.

The movement of charges in a magnetic field can cause an induced electric current (Normandeau et al. 2011). Induced electric fields can be created by water currents such as waves and tides, or the movement of an organism through the Earth's naturally occurring geomagnetic field. Induced electric fields can be increased with the perpendicular movement of an organism or water current relative to a magnetic field associated with a DC transmission line. Induced electric fields can vary with sediment or substrate type (Normandeau et al. 2011). Increases in the induced electric currents will result from operation of the transmission line. A current or fish moving parallel or perpendicular to the proposed transmission line at a speed of 1.38 feet (0.4 meters) per second will increase the induced electric field 0.12 millivolts per centimeter (mV/cm) or less, diminishing to near zero levels at 50 feet (15 meters) from the centerline of the cables over that produced by the Earth's natural geomagnetic field alone (see Table 3.4-2). Evidence indicates that electrosensitive organisms such as sturgeon can detect induced electric fields (Normandeau et al. 2011). However, electric fields used in these experiments were orders of magnitude higher than induced electric fields that will be expected at the sediment bed for the Project transmission line.

TABLE 3.4-2
INDUCED CURRENTS AT VARIOUS DISTANCES FROM THE TRANSMISSION LINE

Distance from Transmission Line (feet)	Parallel Induced Current (mV/cm)*	Perpendicular Induced Current (mV/cm)*
0	0.12	0.12
10	0.03	0.01
25	0.009	0.008
50	0.002	0.002

Source: McCormick et al. 2008
*Note: Induced currents by fish assumed to be traveling at a speed of 1.38 feet (0.4 meters) per second.

The current state of knowledge about the potential impacts on fish from magnetic and electric fields emitted by underwater transmission lines has been categorized as variable and inconclusive (Fisher and Slater 2010, Cada et al. 2011). However, lake sturgeon exhibited temporarily altered swimming behaviors in response to AC-generated EMF that ranged from 35,100 mG to 1,657,800 mG, and EMF responses disappeared below 10,000–20,000 mG (Cada et al. 2011, Bevelhimer et al. 2013). These magnetic fields are much more intense than those that will be produced by the transmission line, which will be approximately 162 mG at the sediment-water interface or 600 mG at the surface of a concrete mat directly above the buried transmission cables. As such, significant impacts from magnetic field strengths generated from the Project transmission line on lake sturgeon are not expected.

It is not clear whether anthropogenic magnetic fields potentially affect salmonids, which are thought to use the Earth's magnetic field, and visual and olfactory cues, to navigate to natal streams to spawn (EPRI 2013). There is very little information on their responses, and no observations indicate an adverse impact (Gill and Bartlett 2010). American eels, which maintain a relatively small home range (approximately 7 acres [3 hectares]) in shallow water along lake shorelines, rely upon their acute senses of smell to find food and use their olfactory sense along with magnetic cues to navigate to feeding and spawning habitats (American Eel Development Team 2000, Fisheries and Oceans Canada 2013). Current knowledge suggests that magnetic and electric fields emitted from buried submarine transmission cables could influence temporary changes in the swimming direction of freshwater eels if their migration routes involved crossing over cables; this impact was especially evident in water depths of less than 66 feet (20 meters) (Gill and Bartlett 2010, Gill et al. 2012). Various field and laboratory studies on eels exposed to weak magnetic and electric fields showed some evidence that eels respond to stimuli by veering from the field source (Normandeau et al. 2011, Gill et al. 2012), but the implications of this altered behavior are not known. However, results from these studies provided little information to suggest that detection or a temporary veering response correlated further with inhibition of an eel's migrating, homing, or feeding capabilities, but the predicted magnetic fields for this project are below the thresholds at which fish behavioral effects have been observed so therefore no significant impacts are expected.

Experiments that exposed fathead minnows (*Pimephales promelas*), juvenile sunfish (*Lepomis spp.*), and juvenile channel catfish (*Ictalurus punctatus*), which occur in Lake Champlain, to 360,000 mG did not indicate changes in activity (Cada et al. 2011, Cada et al. 2012).

Temperature increases associated with operation of the transmission line are not expected to result in more than a negligible impact on fish. As described above, operation of the underwater cable is anticipated to result in an increase of 1.8 °F (1.0 °C) at the surface sediment above the cables, and the temperature change in the water column will be less than 0.01 °F (0.004 °C), which is within the range of water temperature fluctuations in Lake Champlain.

Therefore, no significant impacts on fish from heat emissions from the transmission line will be expected.

3.4.2.2 Overland Segment

Impacts from Construction

Aquatic Habitat and Vegetation. Significant impacts on SAV will not be expected because the transmission line will be installed underneath streambeds using ditch methods or HDD. Any crossings of SAV impacted from dry ditch methods will be expected to be recolonized following installation. Bentonite clay slurry used as a drilling lubricant during HDD could leak into the waterways and smother SAV. Development and implementation of an emergency response plan will allow for timely cleanup of any bentonite leaks that might occur and minimize impacts on the environment.

Shellfish and Benthic Communities. Impacts on shellfish and benthic communities at stream crossings in the Overland Segment will result from sediment disturbance, redeposition of sediments, trenching, water quality degradation, and release of hydrocarbons. These impacts are not expected to be significant because the transmission line will primarily be installed underneath streambeds through HDD or using dry ditch methods accompanied by the implementation of erosion prevention and sediment control measures. Any crossings involving communities impacted from dry ditch methods will be expected to be recolonized following installation. Development and implementation of a Contingency Plan will allow for timely cleanup of any bentonite leaks that might occur during HDD and minimize impacts on the environment.

Fish. Impacts on fish could result from sediment resuspension, turbidity, and hazardous spills. The impacts from turbidity will be minimized because the transmission line will primarily be installed underneath streambeds using dry ditch methods. Fish will be expected to vacate the site of the crossing at the initial stages of dry ditch installation. The proposed schedule and construction windows for conducting the stream crossings will be established in consultation with state and federal resource agencies.

Impacts from Operations, Maintenance, and Emergency Repairs

Significant impacts on aquatic habitat and species from maintenance activities are not expected because the periodic inspections will be of short duration and will use remote sensing equipment. However, if a fault occurs in a section of the cable crossing a waterbody where it is not installed by HDD, the cable might need to be excavated and repaired. Impacts from such emergency repairs, if required, are expected to be similar to those occurring during initial construction, but of a shorter duration and smaller area of impact.

Aquatic Habitat and Vegetation. Magnetic fields are not expected to significantly impact SAV in water bodies crossed by the proposed transmission line route and the sediment temperature increases associated with operation of the transmission line will be less than 1.8 °F (1 °C) at the sediment surface. The temperature change in the water column will be less than 0.004 °C. Such temperature increases will be negligible given the greater seasonal fluctuations in water temperatures. The area of sediments affected by this slight increase in temperature will be extremely localized (i.e., directly over the transmission line) and is expected to result in a negligible impact on any SAV that might be present.

Shellfish and Benthic Communities. Magnetic fields and temperature changes will potentially impact, but will not significantly impact, shellfish or benthic organisms. Additionally, the temperature increase at 8 inches (20.3 cm) below the sediment surface will be 5 °C, diminishing to 1.8 °F (1 °C) above ambient conditions at the sediment surface directly above the cables

(Exponent 2011). Impacts on shellfish and benthic communities will be the same as those described for Aquatic Habitat and Vegetation.

Fish. Potential impacts from operation of the transmission line at waterbody crossings will be associated with localized temperature increases and magnetic and induced electric fields and will generally be insignificant and the same as those described for the Lake Champlain Segment.

3.5 Aquatic Protected and Sensitive Species

Aquatic protected and sensitive species are freshwater animals and plants that occur in the ROI of each segment of the Project. Aquatic protected and sensitive species are those species that are afforded protection under the ESA (50 CFR Part 17), and Vermont statute (10 V.S.A. Chapter 123). Aquatic protected and sensitive species could include shellfish, finfish, marine reptiles, marine mammals and plants.

The potential presence of federally listed and state-listed aquatic species (including candidate listed species) within the ROI was determined through a review of available publications, and databases maintained by the VFWD and U.S. Fish and Wildlife Service (USFWS). Under 10 V.S.A. Chapter 123, the VFWD maintains a list of state-listed endangered and threatened species. The "take" (which includes harassment or harm) of a Vermont or federally-listed threatened or endangered species is prohibited unless permitted by the resource agency.

The ROI for aquatic protected and sensitive species for the Lake Champlain Segment of the Project includes Lake Champlain from Alburgh, (MP 0.5) south to Benson (MP 98). The ROI for aquatic protected and sensitive species in the terrestrial portions of the Project is 100 feet (30 meters) centered on the transmission line centerline (50 feet (15 meters) on either side); however the temporary construction area is expected to be 20' – 50' wide. This ROI was selected because habitat for aquatic protected and sensitive species could occur along predominantly terrestrial portions of the Project route, but, based on the proposed construction activities and Best Management Practice measures, the vast majority of impacts on aquatic habitats and species will likely occur within the ROI.

3.5.1 Environmental Setting

3.5.1.1 Lake Champlain Segment

Federally Listed Species. No federally ESA-listed aquatic threatened or endangered species are known to occur in the Lake Champlain Segment.

State-Listed Species. According to the Vermont Natural Heritage Inventory (VNHI), the state-listed fish species that occur in the Lake Champlain Segment are lake sturgeon (*Acipenser fulvescens*) (VFWD 2012a). Other Vermont ESA-listed fish species include Eastern sand darter (*Ammocrypta pellucid*) and stonecat (*Noturus flavus*) (VFWD 2012a), both of which are riverine species and are not expected to occur in Lake Champlain (Kart et al. 2005). Also, state-listed mussels with known occurrences documented within 0.25 mile of the centerline: fragile papershell (*Leptodea fragilis*), giant floater (*Pyganodon grandis*), pink heelsplitter (*Potamilus alatus*), and pocketbook (*Lampsilis ovate*). A summary of the state-listed species in the Lake Champlain Segment, including status and habitat, is provided in Table 3.5-1.

TABLE 3.5-1
STATE-LISTED SPECIES OF THE LAKE CHAMPLAIN SEGMENT

Common Name	Scientific Name	Vermont Status	Species Information
Lake sturgeon	*Acipenser fulvescens*	E	Inhabits mud, sand, and gravel. Spawns in the spring from May to June in areas of clean, large rubble such as along windswept, rocky island shores and in rapids in streams. Deep holes near spawning areas are also important for staging.
Fragile Papershell	*Leptodea fragilis*	E	A habitat generalist, this species is found in river habitat from small streams to large rivers and in lakes and reservoirs. It reaches greatest densities in shallow water with slow flow and firm substrates of sand, sand and gravel, and mud but can also occur in strong current with coarse gravel and sand substrates and often buries itself nearly completely within the substrate. It can occur at depths of up to 15 or 20 feet. A long-term brooder, L. fragilis is thought to spawn in the late summer and release glochidia (larvae) in June or July the following year.
Giant Floater	*Pyganodon grandis*	E	A habitat generalist, this species achieves greatest densities in pools, lakes and impoundments with fine substrates of sand, sand and gravel, silty sand and mud. It occurs at variable depths and is more tolerant of low oxygen levels than other unionid species. This is a long-term brooder that spawns in August and releases glochidia (larvae) the following May or June.
Pink Heelsplitter	*Potamilus alatus*	E	Inhabits slow to swiftly flowing rivers and adapts to shallow lake and river-lake habitats, typically are found nearly completely buried in a variety of substrates (clay, clay mixed with silt, sand, pea gravel and sand, and cobble/sand/silt). A long-term brooder, P. alatus is thought to spawn in the late summer and release glochidia (larvae) in late May-early July the following year.
Pocketbook	*Lampsilis ovata*	E	A habitat generalist, this species is found in river habitat from small streams to large rivers and in lakes and reservoirs. Preferred substrates include firmly packed sand or sand mixed with gravel or silt. It can occur at depths of up to 15 or 20 feet. L. ovata is thought to be a long-term brooder that releases glochidia (larvae) in July.

Sources: Kart et al. 2005, VFWD 2012a
Key: T = threatened; E = endangered

3.5.1.2 Overland Segment

Federally Listed Species

Although the Overland Segment route as proposed will cross freshwater streams in some locations, no ESA-listed aquatic threatened or endangered species are expected to occur in these water bodies. The dwarf wedgemussel (*Alasmidonta heterodon*) is an endangered freshwater mollusk species that occurs in Vermont and was listed as an endangered species in March of 1990 (USFWS 1993*a*). However, according to Kart et al. (2005), the distribution of the dwarf wedge mussel in Vermont is the main stem of the Connecticut River, and slightly upstream into some large tributaries. The species was historically found from Bloomfield to Brattleboro and more recently it is known from Hartland to Springfield, and from Guildhall to Lunenburg. Therefore, no ESA-listed aquatic species are known to occur in the Overland Segment. The dwarf wedge mussel is a large river species, and is typically found in stable mud, silty sand, sand, or gravel where the current is sufficient to keep the substrate free of surficial silt. Fish hosts may include the tessellated darter and slimy sculpin (Kart et al. 2005).

State-Listed Species

The fluted-shell (*Lasmigona costata*) is the only state-listed aquatic species that could be encountered in the aquatic portions of the Overland Segment. According to Kart et al. (2005), the fluted-shell is a Lake Champlain basin mussel species, reported from Lamoille River, Winooski River, Otter Creek, Lewis Creek, and Poultney River. Shells have been taken in the Missisquoi River, but no live specimens have been observed. This mussel species is found primarily in medium-sized creeks to larger rivers from Lake Champlain to the first major waterfall, but also occurs above this fall line in some streams. It inhabits a variety of substrates, including mud, sand, gravel, and aggregates of cobble, gravel, and sand (Kart et al. 2005). The Overland Segment ROI crosses an area mapped by the VFWD for the fluted-shell at MP 105.2.

3.5.2 Environmental Impacts

3.5.2.1 Lake Champlain Segment

Impacts from Construction

Federally Listed Species. As noted above, no federally listed aquatic threatened or endangered species are known to occur in the Lake Champlain Segment; therefore, there will be no effects on ESA-listed aquatic species.

State-Listed Species

Fish. As noted in above, the only state-listed fish species that occurs in the Lake Champlain Segment is the lake sturgeon. If any individual state-listed lake sturgeon are present during construction, they could temporarily be affected by sediment disturbance, temporary increases in turbidity and associated water quality degradation, sediment redeposition, temporary noise and vibration, and potential accidental releases of hazardous materials. Impacts on state-listed fish species from transmission line installation are not expected to be significant and are similar to those described for non-listed fish species in Section 3.4.2.

Increased turbidity resulting from transmission line installation could expose state-listed lake sturgeon to resuspended sediments. However, previous water quality modeling studies for installation activities in Lake Champlain found no exceedances of Vermont water quality standards for contaminants modeled using jet plow and shear plow installation methods (HDR 2010, 2011). Some individual state-listed fishes could be affected, but population-level impacts are not expected. If state-listed lake sturgeon are present in Lake Champlain near the installation activities, they will be expected to avoid the area where the plow is disturbing the sediments. The installation of the aquatic transmission line will cause a temporary disturbance on benthic habitat, which supports benthic prey items for state-listed lake sturgeon, but will remain usable as potential lake sturgeon foraging habitat. Temporary and localized reductions in available benthic food sources are anticipated because some mortality of benthic infaunal organisms that serve as prey for state-listed lake sturgeon will occur. As adults, state-listed sturgeon forage almost exclusively over soft-bottom areas of Lake Champlain.

Impacts on the state-listed lake sturgeon could occur from the installation of concrete mats or rip-rap; however, placement of mats or rip-rap will result in a very small area of overall affected habitat, and sturgeon will be able to utilize adjacent areas for foraging and other activities. Proposed installation activities could affect the state-listed lake sturgeon during its spawning season (May through June). However, because lake sturgeon prefers rocky bottom or flowing water habitat for spawning, they are not expected to be common in the vicinity of the proposed Project route as it will be sited in soft-bottom areas. In addition, the use of HDD for installing the cables to and from land to water will further avoid this species.

If any state-listed lake sturgeon are present in Lake Champlain near the installation activities, they will also be exposed to noise during installation of the aquatic transmission line. Most of these impacts will be either temporary or intermittent and it is expected that only a few individuals will be affected relative to the populations, and these individuals will react by moving away from noise sources. Exposure of fish to continuous sound could result in a temporary hearing loss. The duration of temporary loss varies depending on the nature of the stimulus, but, by definition, there is generally recovery of full hearing over time (Popper and Hastings 2009). Noise could also result from cavitations (i.e., the sudden formation and collapse of low-pressure bubbles in the water from rotation of the vessel propeller) during vessel starts and stops. As with other transmission line installation projects, the primary source of underwater noise during installation activities is expected to be operation of the cable-laying ship (Merck and Wasserthal 2009). Other potential impacts of continuous sound exposure on fish include physical damage to the ear region, physiological stress responses (e.g., as indicated by increased cortisol and glucose levels or behavioral response such as crowding), and behavioral responses such as startle response, alarm response, avoidance, and a potential lack of response due to masking of acoustic cues. In limited areas, transmission cables will be laid atop the lakebed and will be covered with sloping stone rip-rap or articulated concrete mats for protection. Installation of these structures could cause a permanent change in benthic habitat type from soft sediments to the hard substrate of the concrete mats or rip-rap equal to the area of the footprint of the concrete mats or rip-rap. There are a limited number of utility crossings requiring concrete mats or rip-rap placement resulting in a very small area of overall habitat that will be affected. Impacts on the state-listed sturgeon, which is demersal bottom feeder, could occur from the installation of concrete mats or rip-rap. Stone used in rip-rap structures provides hard substrate habitat, and spaces between rip-rap stones provide velocity refuge and cover for aquatic invertebrates and small fishes (Fischenich 2003), which could include prey for state-listed lake sturgeon. State-listed lake sturgeon, however, will be able to utilize adjacent areas for foraging and other activities. The overall change in bottom topography will be negligible because the mats will extend only a limited distance above the bottom and functional benthic habitat will develop. The areal extent of the mats is small relative to the sediment layer and bottom hydrography of the lake, and the effect of the mats on bathymetry will not be significant relative to natural levels of fluctuation due to currents, storms, navigational traffic, and other pre-existing factors.

Minor releases of hydrocarbons are not anticipated; however, if they occur, spill remediation will be undertaken in accordance with the Project's emergency response plan and Best Management Practices. Releases (e.g., diesel fuel, lubricants) could result in impacts on state-listed fish species. It is anticipated that the immediate response reaction of state-listed fish to water contaminated with hydrocarbon will be avoidance. Oil has the potential to impact spawning success because of the physical smothering and the toxic effects on eggs and larvae (USFWS 2010). Although not anticipated, HDD installation at the shoreline could also result in the spilling of drill fluid into the water. The impacts from HDD will be increased turbidity (composed of inorganic materials) and associated decreased water quality. The Applicant will develop and implement a contingency plan that will allow for timely cleanup of any bentonite leaks that might occur and ensure minimal impacts on the environment.

Mussels. As noted above, state-listed mussels with known occurrences within proximity to the Project route are fragile papershell, giant floater, pink heelsplitter, and pocketbook. Mussel species distribution and abundance is generally reduced once the water depths are greater than 30 feet (9 meters). Individual state-listed species could be impacted during installation of the proposed aquatic transmission line in the immediate vicinity of water jetting, dynamic positioning vessels or mooring locations of the cable barge, and anchor locations of other vessels Surveys completed in 2009 (VFWD 2014b) of known state-listed mussel occurrences in the vicinity of the Project ROI resulted in no live state-listed mussel observations and a noted prevalence of zebra mussels. Based on a review of known occurrences, previous survey results, and consideration of the pre-existing zebra mussel infestation and habitat degradation, impacts to state-listed mussel species are not likely to occur. No significant impacts will be associated with increases in turbidity and associated water quality degradation, sediment redeposition, and potential accidental releases of hazardous materials. HDD at shoreline approaches will avoid preferred littoral zone habitat.

Impacts from Operations, Maintenance, and Emergency Repairs

Federally Listed Species. As noted above, no federally listed aquatic species are known to be present in the Lake Champlain Segment; therefore, there will be no effects on federally listed aquatic species.

State-Listed Species

Fish. State-listed lake sturgeon occur in the Lake Champlain Segment. Effects from magnetic fields and increases in temperature could occur during operation of the Project, but these effects are not expected to be significant. No effects are anticipated from maintenance because the transmission line itself will generally be maintenance-free due to its solid state. Periodic inspection of the aquatic transmission cables using ship-mounted instruments will not result in any effects on state-listed fish because the activities will be non-intrusive. Impacts associated with emergency repairs, if necessary, will include sediment disturbance resulting in temporarily increased turbidity that will include biological, physiological, or behavioral impacts, including abrasion of gill membranes resulting in a reduction in the ability to absorb oxygen, a decrease in dissolved oxygen concentrations in the surrounding waters, impairment of feeding, and impaired ability to locate predators (Berry et al. 2003). Sediment disturbance will result in decreased water quality due to disturbance of contaminated sediments, and behavioral responses due to noise, such as temporarily swimming away from the activity. These effects on state-listed sturgeon will not be significant and will be similar to those described for construction but on a smaller scale and over a shorter duration.

The transmission cables will be shielded and buried, which will reduce the strength of the electric field from the cables, and avoid potential impacts of heat emanating from the transmission cables. For the Lake Champlain Segment, the depth of the transmission line trench is proposed to be 4 feet (1.2 meters) with 1 foot (0.3 meter) or less of horizontal separation between the two cables, which will be collocated in the same trench. Magnetic field levels at the Lake Champlain lakebed above the centerline of the transmission cables will be approximately 162 mG or up to 600 mG where concrete mats are used. Because the magnetic field is strongest at the transmission line itself and declines rapidly with distance, deeper burial will reduce the magnetic field, but not eliminate it entirely (CMACS 2003, Normandeau et al. 2011). The transmission line will emit magnetic fields, and induced electric fields could be created by water currents or the movement of an animal through the magnetic field. The likelihood of the creation of induced electric fields could increase with the perpendicular movement of an organism or water current relative to a magnetic field associated with a DC transmission line. However, there are uncertainties regarding the effects of magnetic and electric fields on aquatic species, including the state-listed lake sturgeon. The current state of knowledge about the magnetic fields emitted by aquatic transmission lines and induced electric fields is sometimes considered too variable and inconclusive to make an informed assessment of the effects on these species (Cada et al. 2011). Research indicates that sturgeon species have an advanced electrosensory system, and use electrical information for navigation and determination of the positions of their prey and location of conspecifics (i.e., the same species) and predators.

Experiments were conducted to test freshwater sturgeon (i.e., sterlet sturgeon [*Acipenser ruthenus*] and Russian sturgeon [*Acipenser gueldenstaedtii*]) responses to AC-generated electromagnetic fields. These freshwater sturgeon species exhibited temporarily altered swimming behaviors to AC-generated electromagnetic fields that ranged from 35,100 mG to 1,657,800 mG (Cada et al. 2011). Juvenile state-listed lake sturgeon displayed temporarily altered swimming behavior in response to variable magnetic fields produced using an AC electromagnet (maximum value of the field at full power was approximately 1,658,000 mG), suggesting a momentary attraction to the variable magnetic field (Cada et al. 2012). However, the electromagnetic fields in these studies that triggered a reaction in the freshwater sturgeon species were much more intense than the magnetic fields that will be produced by the proposed transmission line, which will be approximately 162 mG at the lake bottom (or up to 600 mG where concrete mats are used). Demersal fish (in this case, the state-listed lake sturgeon) are more likely to be exposed to higher field strengths, which are closer to the lake bottom where the proposed transmission cables will be buried, as compared to a pelagic species) which are found higher in the water column (Normandeau et al. 2011). No observable changes in activity levels or distribution of fathead minnows (*Pimephales promelas*), juvenile sunfish (*Lepomis spp.),* juvenile channel catfish (Ictalurus punctatus), and juvenile striped bass (*Morone saxatilis*) were observed in response to static (DC) fields using a permanent bar magnet (360,000 mG at the magnet surface) (Cada et al. 2011, Cada et al. 2012). The minnows and sunfish are positioned higher in the water column and, therefore, at a greater distance from the lake bottom where the proposed cable will be buried, than the state-listed lake sturgeon. Based on the foregoing, impacts from magnetic field strengths generated from the Project transmission line on these species are not expected to be significant.

Electrosensitive organisms, including the state-listed sturgeon, can detect induced electric fields, and respond by attraction (i.e., temporary investigative behavior) or avoidance (CMACS 2003, Normandeau et al. 2011). There is little information on the responses of fish to magnetic fields, but the anticipated magnetic fields for this project are below the thresholds at which fish behavioral effects have been observed so no significant impacts are expected. Additionally, given the relatively narrow area within which the induced electric field will be detected by fish and the available information of how induced currents affect fish, no impacts on state-listed fish will be expected.

Any increase in temperature will be negligible and within a normal range of variability. Therefore, increases in temperature associated with the operation of the transmission line at the sediment-water interface will not be expected to affect pelagic fish but could locally affect demersal fish (such as the state-listed lake sturgeon), which will be closer to the bottom. When electric energy is transported, a certain amount is lost as heat, leading to an increased temperature of the transmission cable surface and subsequent warming of the surrounding environment. Important factors determining the degree of temperature rise are cable characteristics (i.e., the type of cable), transmission rates, and characteristics of the surrounding environment (e.g., thermal conductivity, thermal resistance of the sediment). The proposed transmission line installation will generally be at a depth of about 4 feet (1.2 meters) in the Lake Champlain Segment. A previous study calculated thermal impacts on water quality from operation of the transmission line in Lake Champlain (Exponent 2011). The predicted increase in sediment temperature at the sediment surface directly above the cables, assuming burial to a depth of 4 feet (1.2 meters) and the cables installed side by side (i.e. no separation), was estimated to be 1.8 °F (1 °C), and the temperature change in the water column above the cable was less than 0.01 °F (0.004 °C). While state-listed lake sturgeon use and prefer rocky bottom or flowing water habitat, they are not expected to be as common in the vicinity of the proposed aquatic transmission line route, which will be sited in soft-bottom areas of the lake. Operation of the underwater cable will result in only a negligible increase in water temperature (01 °F (0.004 °C)) in the water column. Any measurable amount of local heat generation will not pose a physical barrier to fish passage, and will allow benthic organisms to colonize and demersal fish species (including demersal eggs and larvae) to use surface sediments without being affected. Since demersal fish (such as the lake sturgeon) will continue to have unimpeded access to surface waters and sediments, lower reproduction rates or feeding is not anticipated. Therefore, temperature increases of the sediment and water column will not significantly affect this state-listed species.

Mussels. State-listed mussels with known occurrences within proximity to the Project route are fragile papershell, giant floater, pink heelsplitter, and pocketbook. Impacts from magnetic fields and increases in temperature could occur during operation of the Project. According to studies, however, survival and reproduction of benthic organisms are not thought to be affected by long-term exposure to static magnetic fields (Normandeau et al. 2011). No impacts to mussels are anticipated from maintenance because the transmission line itself will generally be maintenance-free due to its solid state. Periodic inspection of the aquatic transmission cables using ship-mounted instruments will not result in any impacts on state-listed mussels because the activities will be non-intrusive.

Impacts associated with sediment disturbance, turbidity, and decreased water quality during emergency repairs, if required, could include localized and temporary biological, physiological, or behavioral impacts, including abrasion of gill membranes resulting in a reduction in the ability to absorb oxygen, a decrease in dissolved oxygen concentrations in the surrounding waters, impairment of feeding, temporarily swimming away from the activity, and impaired ability to locate predators. These impacts will be similar to those described for construction but on a smaller scale and over a shorter duration.

3.5.2.2 Overland Segment

Impacts from Construction

No federally threatened and endangered aquatic species are known to be present within the Overland Segment; therefore, no effects on those species are anticipated from construction activities related to the Project.

The fluted-shell (*Lasmigona costata*) is the only state-listed aquatic species that could be encountered in the aquatic portions of the Overland Segment. The Applicant will coordinate with state resource agencies to determine the appropriate means of avoiding and/or minimizing impacts, which might include HDD installations under the waters along the Overland Segment which could support this species.

Impacts from Operations, Maintenance, and Emergency Repairs

No federally threatened and endangered aquatic species will be present within the Overland Segment; therefore, no effects on those species is anticipated from operation, inspection, and potential emergency repair activities.

As the NECPL Project will employ measures developed in consultation with state resource agencies to avoid and/or minimize impacts to the only state-listed aquatic species that is potentially present within the Overland Segment, no effects on that species is anticipated from operation, inspection, and potential emergency repair activities.

3.6 Terrestrial Habitat and Species

This section describes the affected terrestrial environment occurring along the proposed Project transmission line route. As discussed previously, the cable is proposed to be installed within existing road right of ways and parallel or under roads and highways. The Applicant identified and mapped habitat along the terrestrial portions of the Project construction corridor using aerial photography and available databases. Some primary literature and database sources used to describe terrestrial habitats and species include:

- Thompson and Sorenson's *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont* (2005);
- Vermont Natural Resources Atlas (VANR 2013);
- The Vermont Wildlife Action Plan (Kart et al. 2005); and
- *New England Wildlife: Habitat, Natural History, and Distribution* (DeGraaf and Yamasaki 2001).

Terrestrial biological resources include plant and animal species and their habitats. The Vermont Natural Heritage Inventory (Vermont NHI) has identified significant natural communities, which are locations of rare or high-quality wetlands, forests, grasslands, streams, and other types of habitats, ecosystems, and ecological areas. Terrestrial species within the ROI include upland and wetland plants, invertebrates, amphibians, reptiles, birds, and mammals.

Because some terrestrial species (e.g., birds and bats) use aquatic environments as a source of food, the ROI for terrestrial habitats and species for the aquatic portion of the Lake Champlain Segment of the Project includes Lake Champlain from Alburgh, Vermont (MP 0.5) south to Benson, Vermont (MP 98).

The ROI for terrestrial habitats and species along the Lake Champlain Segment (i.e. Alburgh) and the Overland Segment of the Project is 100 feet (30 meters) centered on the transmission line centerline (50 feet (15 meters) on either side). This area includes the temporary construction corridor, which is expected to be 20 to 50 feet (6 to 15 meters) in which impacts on terrestrial habitats and species will primarily occur. Outside the ROI, potential impacts will be avoided by implementation of Applicant-proposed measures consisting of BMPs that will be used during construction and operation of the Project. However, more mobile species that occur within the ROI could have habitat refuges outside of the ROI. Therefore, habitat communities within 0.25 miles (0.4 km) of the centerline of the transmission line are described to provide context for species that could periodically immigrate from these habitats into the ROI.

3.6.1 Environmental Setting

3.6.1.1 Lake Champlain Segment

Vegetation and Habitat. Within the aquatic portion of the Lake Champlain Segment, the only terrestrial species that could be impacted by the Project are avian (bird) and chiropteran (bat) species. WMAs and Bird Conservation Areas (BCAs) along the Lake Champlain shoreline are discussed in Section 3.1.8. No habitats are present in existing port facilities that will be used as staging areas for the Project.

The Alburgh portion of the Lake Champlain Segment occurs in the Champlain Valley, which is a transition zone between the boreal forest and broadleaf deciduous climatic zones of eastern North America. Forests in the Champlain Valley are characterized by conifers such as hemlock (*Tsuga canadensis*) and pine (*Pinus spp*.), and varieties of deciduous species such as birch (*Betula spp*.), American beech (*Fagus grandifola*), maple (*Acer spp*.), and, to a lesser extent, oak (*Quercus spp*.). The Champlain Valley represents the northern extent of the range of tree species such as shagbark hickory (*Carya ovata*), red and white oak (*Q. rubra and Q. alba*), and hop hornbeam (*Ostrya virginiana*). Conifer or pine-dominated forests tend to be in less favorable habitats with poorer soils, whereas deciduous forest stands are found in locations with good soils.

Coniferous habitats include transitional areas between the Green Mountains and the Champlain Valley. Important grassland habitat in agricultural areas includes old fields, upland meadows, hayfields, and shrub-dominated fields. Because the transmission cables will be installed underground along the existing Bay Road, the available habitat along the ROI consists of shrubby forest edged habitat and open lawn areas in front of residential structures.

Wildlife. In the aquatic portion of the Lake Champlain Segment, the only terrestrial species that are anticipated to occur at the project site are bird and bat species that could fly over Lake Champlain. A wide variety of songbirds, hawks, and owls can be found along most of the proposed Project route, including various species of passerines, raptors, wading birds, and game birds that use upland, wetland, or riparian habitats. Examples of bird species representative of early successional forest/shrublands along the Lake Champlain shoreline include black-billed cuckoo (*Coccyzus erythropthalmus*), brown thrasher (*Toxostoma rufum*), and ruffed grouse (*Bonasa umbellus*). Mammals that could occur include Indiana bat (*Myotis sodalis*), eastern red bat (*Lasiurus borealis*), and hoary bat (*Lasiurus cinereus*).

For the Alburgh portion of the Lake Champlain Segment, potential terrestrial fauna are represented by a variety of mammal, amphibian, reptile, birds, and invertebrate species. Wildlife present in this section of the Lake Champlain Segment is limited by the amount of available habitat due the short length of the ROI. Successional areas, like residential yards and shrublands, support woodchuck (*Marmota monax*), deer mouse (*Peromyscus maniculatus*), meadow vole (*Microtus pennsylvanicus*), American toad (*Bufo americanus*), and the common garter snake (*Thamnophis sirtalis*). Forest edges near clearings and roadway ROWs typically support mammalian species such as white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), long-tailed shrew (*Sorex dispar*), eastern cottontail rabbit (*Sylvilagus floridanus*), and several bat species (*Myotis sp. and Lasiurus sp.).* Amphibians and reptiles also may occur in the area, although species diversity is relatively low when compared with other vertebrates. Reptiles and amphibians that may occur in the area include the common snapping turtle (*Chelydra serpentina*), garter snake (*Thamnophis sirtalis*), Eastern American toad (*Bufo a.americanus*), gray tree frog (*Hyla versicolor*), green frog (*Rana clamitans melanota*), bullfrog (*Rana catesbeiana*), and northern redback salamander (*Plethodon c. cinereus*). Typical bird species found along open or shrubby forest edges adjacent to residential lawns and roadway ROWs include blue-winged warbler (*Vermivora pinus*), brown thrasher, Eastern towhee *(Pipilo erythrophthalmus*), rose-breasted grosbeak (*Pheucticus ludovicianus*), black-billed cuckoo, and gray catbird (*Dumetella carolinensis*).

3.6.1.2 Overland Segment

Vegetation and Habitat. The proposed Project transmission line route in the Overland Segment supports a variety of habitat types and a diversity of land uses. Forested upland areas surrounding the Overland Segment are generally dominated by the Northern Hardwood Forest Formation, the Spruce-Fir-Northern Hardwood Forest Formation, and the Oak-Pine-Northern Hardwood Forest Formation (Thompson and Sorenson 2005; Kart et al. 2005), which support numerous plant and wildlife species (additional information describing these community types is provided below). In addition, hay and pasture lands create grassland habitats, located sporadically along the boundaries of the transmission line route. Agricultural activities of various types, urban/suburban development, including roads, form a significant component of the landscape and affect wildlife use along the proposed transmission line route in the Overland

Segment. Throughout the Project area, various types of disturbance and habitat edges create early successional habitats.

The Overland Segment traverses across the Champlain Valley, Taconic Mountains, Vermont Valley, and the Southern Green Mountains biophysical regions. Several natural vegetative communities are crossed by the Overland Segment and occur within the Northern Hardwood Forest Formation, the Spruce-Fir-Northern Hardwood Forest Formation, and the Oak-Pine-Northern Hardwood Forest Formation. The Northern Hardwood Forest Formation is Vermont's most abundant forest type. It blankets hills in every biophysical region of the state and creates a background setting for other community types. Northern Hardwood Forests are only uncommon in the lower elevations of the Champlain Valley, where clay and sand prevail as parent materials, and in other areas where soils are specialized. Such places can include alluvial soils along streams and rivers, glaciofluvial deposits of sand or gravel terraces, rocky or bedrock controlled soils, and wet soils in depressions. The variations within this community type are associated with differences in climate, slope, landscape position, chemistry of the underlying bedrock and till, stoniness, depth to basal till or bedrock, and past land use (Thompson and Sorenson 2005).

The Spruce-Fir-Northern Hardwood Forest Formation encompasses forest communities occurring where growing seasons are relatively short, summers are cool, and winters are harsh. Forests in this formation blanket Vermont's highest peaks above 2,500 feet, however, they also occur in small, cold lowland pockets within large areas of Northern Hardwood Forest (Thompson and Sorenson 2005; Kart et al. 2005). The Oak-Pine-Northern Hardwood Forest Formation is best developed in the warmer regions of Vermont (e.g., Champlain Valley and the lower elevations in the Taconic Mountains). These forest communities generally occur as large patches or locally as small patches within Northern Hardwood Forests and on dry, south-facing slopes and ridge tops (Kart et al. 2005). Characteristic trees occurring in these community types include sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), eastern hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), white pine (*Pinus strobus*), black cherry (*Prunus serotina*), yellow birch (*Betula alleghaniensis*), red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), and white spruce (*Picea glauca*). Characteristic shrubs can include hobblebush (*Viburnum alnifolium*), striped maple (*Acer pensylvanicum*), shadbush (*Amelanchier* spp), and wild raisin (*Viburnum nudum* var. *cassinoides*). Common herbaceous vegetation occurring in these community types include intermediate wood fern (*Dryopteris intermedia*), Christmas fern (*Polystichum acrostichoides*), shining clubmoss (*Lycopodium lucidulum*), sarsaparilla (*Aralia nudicaulis*), and common wood sorrel (*Oxalis acetosella*) (Thompson and Sorenson 2005; Kart et al. 2005).

Because the transmission cables will be installed underground in ROWs along local roads (in Alburgh, Benson, and Ludlow), and ROWs along state roads (Route 22A, Route 4, Route 7, Route 103, and Route 100), the majority of the habitat is managed areas which are regularly mowed. Any forested habitat along the ROI most commonly exists as successional or shrubby forest edge or urban areas. The proposed Project route will cross several streams and rivers and as a result, some riparian habitat is expected to occur within the ROI. Wetlands are described in detail in Section 3.8.

The Blueberry Hill Wildlife Management Area (WMA) is the only WMA located within 0.25 miles (0.4 km) of the Overland Segment, but does not appear to overlap with the Route 4 ROW in this location. The Blueberry Hill WMA is located within the towns of Castleton and Ira between MPs 117 and 120. This WMA contains steep mountainous terrain that ranges from about 500 feet near Route 4 to approximately 1,800 feet in elevation on the eastern boundary of the WMA. The forests within the WMA are a mixture of oaks (*Quercus*), birches (*Betula*), maples (*Acer*), aspen (*Populus*), hickories (*Carya*), and white pine (*Pinus strobus*). Old fields and apple orchards are scattered throughout the parcel. The oaks and hickories on the WMA produce excellent mast, which is an important wildlife food resource. There are also blueberries found on this WMA and they provide another good food source for wildlife. The entire WMA serves as critical deer wintering habitat (VFWD 2014c).

The Overland Segment ROI does not cross any VANR-mapped significant natural communities. However, the transmission line will be within 0.25 miles (0.4 km) of several significant natural communities that potentially host terrestrial species that could migrate into the ROI. Such natural communities include the following (VANR 2004):

- Dry Oak-Hickory-Hophornbeam Forest
- Transition Hardwood Talus Woodland
- Mesic Clayplain Forest
- Red Maple-Black Ash Seepage Swamp
- Red Maple-Sphagnum Acidic Basin Swamp

The Applicant identified deer wintering areas along the terrestrial portions of the Project construction corridor using available mapping and databases from the VANR (2004). According to VFWD (2014d), white-tailed deer in Vermont live near the northern limit of their range in eastern North America. To cope with severe climatic conditions, deer have developed a survival mechanism that relies upon the use, access, and availability of winter habitat. These habitat areas are generally known as deer wintering areas, deer winter habitat or, more commonly, deer yards. Deer winter habitat is defined as areas of mature or maturing softwood cover, with aspects tending towards the south, southeast, southwest, or even westerly and easterly facing slopes (VFWD 2014d). The softwood canopy in deer yards moderates the winter climate by maintaining warmer than average temperatures and greatly reducing wind velocity. The branches of trees within a deer yard typically provide a protective umbrella that prevents a rapid heat loss at night (LeeRue 1997).

The Project ROI is located within two agency-mapped deer wintering areas along the proposed Overland Segment. One area is located at MP 138.3 west of Roger Hill in Mt. Holly. This area has been designated as DWA1189 and encompasses an area of approximately 317 acres (VANR 2004). The second deer wintering area crossed by the proposed Overland Segment is located at MP 151.1 in Ludlow. This area has been designated as DWA1188 and encompasses an area of approximately 260 acres (VANR 2004). Considering that the Overland Segment is restricted to existing maintained road ROWs in these areas, the impacts to these mapped deer wintering areas as a result of constructing the Project are expected to be negligible to non-existent.

Land cover types that have been identified along the proposed transmission line within the Overland Segment are presented in Table 3.6-1. The data presented in this table can be considered representative and used to characterize the habitats and species occurring in the Project vicinity.

Open upland vegetation identified within the ROI includes successional lands (brush or transitional lands that are neither open or forested habitats). Forested upland habitats identified within the ROI include broadleaf forest types, coniferous forests, and mixed coniferous-broadleaf forests. Terrestrial agricultural communities and urban land include residential areas, commercial, services, and institutional lands, outdoor and other urban and built-up lands, row crops, hay, rotation, and permanent pasture lands, and other agricultural lands. Transportation, communication, and utilities land uses compose approximately 52.4 percent of the ROI. Open water composes approximately 3 percent of the ROI and areas of forested and non forested wetland compose approximately 1 percent of the ROI.

TABLE 3.6-1
HABITATS AND LAND COVER TYPES OCCURRING IN THE ROI OF THE OVERLAND SEGMENT

Habitat/Land Cover Type	Acreage of ROI	Percent of ROI
Brush or Transitional Between Open and Forested	1	0.1
Broadleaf Forest	199	14.6
Coniferous Forest	44	3.3
Mixed Coniferous-Broadleaf Forest	43	3.2
Forested Wetland	5	0.4
Non-Forested Wetland	8	0.6
Brush or Transitional Between Open and Forested	1	0.1
Row Crops	154	11.3
Hay/Rotation/Permanent Pasture	107	7.8
Other Agricultural Land	3	0.2
Residential	37	2.7
Commercial, Services, and Institutional	4	0.3
Transportation, Communication and Utilities	714	52.4
Outdoor and Other Urban and Built-up Land	1	0.0
Water	41	3.0

Source: VCGI 2014

Wildlife. Terrestrial fauna are represented by a variety of mammal, amphibian, reptile, birds, and invertebrate species. Wildlife present in the Overland Segment is limited by the amount of available habitat. Species using habitats of the Project area are for the most part generalists that are relatively common throughout their range and that use a wide variety of habitats for breeding, nesting and foraging activities. Old fields, successional shrubs, and agricultural habitats are common along the underground portions of the proposed Project route. Successional areas, like old fields and shrublands, support woodchuck (*Marmota monax*), house mouse (*Mus musculus*), meadow vole (*Microtus pennsylvanicus*), American toad (*Anaxyrus americanus*), and common garter snake (*Thamnophis sirtalis*). Forest edges near clearings, agricultural areas, and road ROWs typically support mammalian species such as white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), and several bat species (*Myotis* spp. and *Lasiurus* spp.) (DeGraaf and Yamasaki 2001; VFWD 2012*b*). Amphibians and reptiles also occur in the area, although species diversity is relatively low when compared with other vertebrates. Reptiles and amphibians that can occur in the area include the common snapping turtle (*Chelydra serpentina*), common garter snake, American toad, gray tree frog (*Hyla versicolor*), green frog (*Lithobates clamitans*), bullfrog (*Lithobates catesbeianus*), pickerel frog (*Lithobates palustris*), and eastern redback salamander (*Plethodon cinereus*) (DeGraaf and

Yamasaki 2001; VFWD 2013). Typical bird species found along open or shrubby forest edges adjacent to old fields; agricultural lands; or roadway and utility ROWs include blue-winged warbler (*Vermivora cyanoptera*), gray catbird (*Dumetella carolinensis*), Eastern towhee (*Pipilo erythrophthalmus*), rose-breasted grosbeak (*Pheucticus ludovicianus*), and mourning dove (*Zenaida macroura*) (DeGraaf and Yamasaki 2001; VFWD 2012*c*).

3.6.2 Environmental Impacts

3.6.2.1 Lake Champlain Segment

Vegetation and Habitat. No impacts on terrestrial habitat will occur in the lake portion of the Lake Champlain Segment because this portion of the Project is entirely aquatic. In Alburgh, there will be limited land use impacts which will be similar to those of the Overland Segment (see Section 3.6.2.2)

Wildlife. Because the Lake Champlain Segment is almost entirely aquatic, the only terrestrial species that could be impacted will be birds and bats and those species located along the short segment in Alburgh. Along the aquatic portion of Lake Champlain Segment, construction activities will occur at distances greater than 500 feet (152 meters) from shore except in a few locations. For example, construction will occur within approximately 300 feet (91 meters) from Chimney Point State Historic Park (MP 74). With an average installation rate of 1.5 miles (2.4 km) per day, noise levels are expected to increase over baseline noise levels for only a few hours at any one location. Therefore, noise impacts associated with construction are unlikely to result in significant avoidance of bird and bat forage areas and bird nests and bat roosts adjacent to the proposed Project route, reduce communication ranges, or interfere with predator/prey detection during the short time period that construction equipment will be operating in a particular area. Permanent displacement from the area also is unlikely because construction activities will occur in fringe habitats where vehicle noises are common.

Impacts to the Alburgh portion of the Lake Champlain Segment will be similar to those of the Overland Segment (see Section 3.6.2.2)

Impacts from Operations, Maintenance, and Emergency Repairs

Vegetation and Habitat. Because the aquatic portion of the transmission line will be buried within Lake Champlain rather than on land, no operational impacts on terrestrial vegetation and habitats will occur. Impacts to the Alburgh portion of the Lake Champlain Segment will be similar to those of the Overland Segment (see Section 3.6.2.2)

Wildlife. No significant impacts on terrestrial species will occur from operation of the transmission system. While not anticipated, emergency repairs could require localized vessel operation for a very short duration. Noise associated with these vessels is not anticipated to result in avoidance of bird and bat forage areas and bird nests and bat roosts adjacent to the proposed Project route. Impacts to the Alburgh portion of the Lake Champlain Segment will be similar to those of the Overland Segment (see Section 3.6.2.2)

3.6.2.2 Overland Segment

Impacts from Construction

Vegetation and Habitat. During construction activities in the Overland Segment, impacts on vegetation will include temporary and limited cases permanent removal of vegetation, vegetation trampling from heavy construction equipment, root damage associated with excavation, soil compaction, and generation of dust. Because the transmission cables will be installed and constructed within existing roadway ROWs, most vegetation along the Overland Segment route is previously disturbed and currently maintained on a periodic basis by town or VTrans maintenance operations. Some fringe forest habitat within and immediately adjacent to these ROWs may be converted to shrub habitat as a result of transmission line installation.

Construction of the Project corridor and installation of the transmission line is not expected to significantly impact the habitats in these areas. Existing forest cover could be temporarily disturbed or changed permanently to managed grasses or shrub habitat at discrete areas along the proposed Project route, primarily within the Overland Segment ROI, to accommodate proposed construction corridors and any necessary additional workspace. Construction of the Project is expected to result in localized and temporary changes in community composition (e.g., tree removal and possible displacement of wildlife). However, the presence of the transmission line corridor, which will primarily be a mixture of grasses and shrubs, will be consistent with previously existing vegetation in this area. Also, construction and habitat conversion will occur primarily in fringe habitat along existing ROWs, where noise, emissions from cars, and human activity already influence habitat suitability. Finally, corridor construction will impact only a small percentage of habitat available for wildlife, and mobile species that currently inhabit and prefer these areas likely will relocate to seek out similar habitat.

Soil compaction may have an effect on vegetation by decreasing the rate of water infiltration into the soil, resulting in changes to the soil moisture regime and porosity and potential changes in soil structural characteristics. Construction equipment and foot traffic have the potential to spread invasive plant species as a result of ground disturbance and the introduction of invasive seed stock carried on the boots, clothing, or equipment of construction workers. The movement of construction equipment and soil disturbance can increase the likelihood that invasive plant species that are potentially damaging to native biotic populations become established. Dust generated during construction could also have impacts on downwind vegetation due to interference with pollination and photosynthesis. These impacts will be restricted to the construction corridor and minimized through the use of Applicant-proposed Best Management Practices.

While the proposed Project route in the Overland Segment will cross several streams, rivers, and wetlands, the Applicant will implement measures to stabilize disturbed stream banks and re-establish vegetation, thus limiting potential effects on riparian habitat. The transmission line will cross water bodies and associated riparian areas via dry-ditch crossing methods or, in some cases, HDD. Use of HDD will avoid or minimize impacts on riparian areas. Dry ditch crossing methods may temporarily result in soil compaction, erosion, loss of vegetation, or change or loss of the physical structure of the ecological community in riparian habitat. Removal of vegetation along stream banks may reduce bank stability and increase erosion and the loss of vegetation may have an impact on plant communities because it will shift the dominant species. As noted above, measures will be taken to minimize such impacts.

Impacts from installation and construction activities associated with the Ludlow HVDC Converter Station will involve permanent removal of natural vegetation and native soils. Field investigation indicates that there are no significant natural communities at the proposed converter station location.

Wildlife. Proposed construction activities will primarily occur along road ROWs; therefore, species in the vicinity will be habituated to frequent disturbances associated with the operation of roadway traffic. However, noise associated with construction activities could result in reduced communication ranges for wildlife, interference with predator/prey detection, or habitat avoidance in the short term in some instances. Impacts could also be associated with blasting if required and include behavioral changes, disorientation, or hearing loss. Wildlife response to noise can be dependent on noise type (i.e., continuous or intermittent), prior exposure to noise, proximity to a noise source, stage in the breeding cycle, activity (e.g., foraging), age, and gender. Prior exposure to noise is the most important factor in the response of wildlife to noise because wildlife can become accustomed (or habituate) to the noise. The rate of habituation to short-term construction noise is not known, but the proposed construction activities will primarily occur where there is already a high level of ambient noise. Wildlife that could be affected include grassland bird species, forest bird species, reptiles, amphibians, and mammals.

Vegetation removal if necessary to install the cable and the reduction of habitat could result in the direct displacement of species, including grassland and forest birds, mammals, reptiles, and amphibians; however, habitat fragmentation and permanent displacement of entire breeding populations will not occur because construction activities will be within previously disturbed habitat or habitat fringes along existing road ROWs. Wildlife that could be temporarily displaced include birds, burrowing animals, and other species that use forests for foraging, breeding, and nesting. However, studies have indicated that forest wildlife exposed to relatively narrow corridors, similar to the Project corridor, did not experience significant fragmentation impacts (e.g., permanent displacement or isolation) or have significantly reduced abundances along the corridor (Rich et al. 1994). Also, the presence of the corridor will not preclude wildlife from crossing the corridor to reach habitat on the other side. Therefore, no fragmentation impacts are expected. Mortality of some less mobile species could occur as a result of the inability to avoid construction equipment.

Impacts from Operations, Maintenance, and Emergency Repairs

Vegetation and Habitat. Magnetic and electric fields generated by transmission lines have the potential to enhance growth responses in certain plant species; however, the nature of this potential impact on plants is inconclusive (AUC 2011). Operation of the transmission line will increase the temperature of the soil in the upper 8 inches (20.3 cm) above the transmission line by 1.8 to 9 °F (1 to 5.2 °C), which could alter the composition of the terrestrial vegetation and habitat directly above the cables; however, temperature will quickly dissipate with increasing distance from the transmission line (Burges et al. 2008) and the area affected will be within the maintained transmission line ROW.

Consistent with current vegetative management activities within roadway ROWs, the permanent transmission line ROW will be periodically inspected and maintained (i.e., woody vegetation will be trimmed or removed) to protect the buried cables from damage caused by tree roots, maintain the function of access control features, and replace location and identification markers, as necessary. The goal of vegetation management in the ROW will be to establish stable low-growing vegetation with shallow root systems that will not interfere with the transmission line, minimize spread of invasive species, and allow for visual inspections of the ROW. Vegetation clearing and selective cutting of large trees or branches will occur on an as-needed basis. Such maintenance activities will be short-term, but will occur periodically over the operating life of the Project. For most of the Overland Segment, vegetation that will be permanently removed has been previously disturbed or is successional or forest fringe. Much of this habitat is expected to be highly disturbed due to its proximity with roadway ROWs.

Vegetation adjacent to the proposed Ludlow HVDC Converter Station will be maintained as required, to protect the facility from damage caused by tree roots, maintain the function access control features, and replace location and identification markers as necessary. Periodic inspections will not result in significant impacts on terrestrial vegetation and habitats.

Emergency repairs of the transmission line, if required, could result in the removal of vegetation and vegetation crushing from repair equipment. Vegetation will only be disturbed in the area of the repair site, the ROW will be restored following completion of the repairs, and vegetation will be allowed to return to its prior state. Any emergency repairs undertaken will occur within areas previously disturbed by the original transmission line installation.

Wildlife. Buried cables, such as those proposed for the NECPL Project, will have no electric fields at the ground surface, and the constant magnetic field will decrease with distance from the cable centerline (WHO 2012). While there is evidence that wildlife can detect magnetic fields, species' behaviors are not expected to be affected by relatively small, very localized changes in magnetic fields (AUC 2011). Previous studies have found that magnetic and electric fields associated with transmission lines do not cause any adverse health, behavioral, or productivity effects in animals, including both wildlife and livestock (BPA 2010).

Operation of the transmission line will increase the soil temperature in a very localized area, which could slightly alter terrestrial vegetation and habitat thereby affecting foraging, nesting, and avoidance behavior in wildlife that use that habitat directly above the transmission line; however, temperature will quickly dissipate within increasing distance from the transmission line (Burges et al. 2008) and will be restricted to the maintained transmission line ROW.

The transmission line ROW, which has been previously disturbed by past activities, will be permanently maintained at a minimum as scrub-shrub habitat with woody vegetation less than 20 feet (6 meters) tall. On-going maintenance practices associated with roadway ROWs may result in the transmission line ROW being kept in a mowed state. Potential non-significant impacts from mowing and vegetation maintenance activities on grassland bird species, forest bird species, reptiles, amphibians, and mammals will be temporary, but will occur periodically over the operating life of the transmission line. The use of heavy equipment will result in permanent damage to the vegetation as a result of crushing, ground disturbance, and root damage to grasses and other plants occurring in the area. Soil compaction and erosion may result in disturbances to burrowing species and effects related to an associated decrease in vegetation cover. Any decrease in vegetative cover may result in potential impacts on species that use that habitat type, due to habitat reduction.

Vegetation maintenance activities may also displace birds, mammals, and other species that use the area for foraging, but use of the transmission line ROW by these species will be limited because the vegetation in the ROW will be regularly maintained and existing disturbance from the adjacent roadway operations will continue unchanged. The affected habitat is only composed of a small percentage of the habitat available in the region. Much of this habitat is already highly disturbed due to its proximity to roadway ROWs. Additionally, significant habitat fragmentation impacts on wildlife species is not expected because the Project corridor will be relatively narrow and will be constructed primarily in fringe habitats within or adjacent to existing roadway ROWs. Therefore, significant fragmentation impacts in forested deviation areas will not be expected.

The Ludlow HVDC Converter Station will be designed to meet Vermont PSB noise limits. Noise from operations could potentially result in avoidance of the area by some wildlife species. However, the operation of the converter station will be in an area where there is already a high level of available habitat.

Emergency repairs of the transmission line, if required, could temporarily result in reduced communication ranges, interference with predator/prey detection, or habitat avoidance by wildlife because of noise disturbance. Vegetation removal and the reduction of habitat could result in the direct displacement of species; however, the areas that will be potentially impacted by emergency repairs will have been previously disturbed during the original construction of the Project.

3.7 Terrestrial Protected and Sensitive Species

Terrestrial protected and sensitive species are animals and plants that occur in the ROI of each segment of the Project. Terrestrial protected and sensitive species are those species that are afforded protection under the ESA (50 CFR Part 17), and Vermont’s Endangered Species law (10 V.S.A. Chapter 123).

The potential presence of federally-listed (and candidate) and state-listed terrestrial species within the ROI was determined through a review of available publications, and databases maintained by the VFWD and USFWS. Under Vermont Statutes, the VFWD maintains a list of state-listed endangered and threatened species. The “take” (which includes harassment or harm) of a Vermont or federally-listed threatened or endangered species is prohibited unless permitted by the resource agency.

Because terrestrial species (e.g., birds and bats) use aquatic environments, the ROI for terrestrial protected and sensitive species for aquatic portion of the Lake Champlain Segment of the Project includes Lake Champlain from Alburgh, Vermont (MP 0.5) south to Benson, Vermont (MP 98).

The ROI for terrestrial protected and sensitive species along the Lake Champlain and Overland Segment of the Project is 100 feet (30 meters) centered on the transmission line centerline (50 feet (15 meters) on either side). This area was selected because it encompasses the construction corridors and areas immediately adjacent that will be most affected during installation and construction activities. Outside of this distance, potential impacts will be avoided by implementation of Applicant-proposed measures incorporated into the project design. Background information on issues associated with terrestrial protected and sensitive species are discussed in Section 3.1.7.

3.7.1 Environmental Setting

3.7.1.1 Lake Champlain Segment

Federally-listed terrestrial species that could occur within or adjacent to the Lake Champlain Segment ROI include the Indiana bat (*Myotis sodalis*) and breeding bald eagles (*Haliaeetus leucocephalus)*, although eagles are no longer listed but are protected as part of a post-delisting monitoring plan. There is no critical habitat designated for these species within the ROI for this segment.

Indiana bat. The Indiana bat is currently listed as endangered under the ESA, as amended (USFWS 2007a). According to VFWD (2014e) and the VANR (2013), portions of northwestern Rutland County within the Overland Segment are mapped as potential and known Indiana bat summer range. The summer range of this species extends well beyond the wintering locations since the animals disperse to breeding areas and other habitats to feed and raise their young. In the immediate vicinity of the road ROWs, much of the habitat consists of disturbed open lands and secondary forest lacking suitable habitat for bat roosts; however, trees with the potential to serve as maternity or roost trees may exist along the terrestrial portions of the proposed transmission line route.

Indiana bats can travel hundreds of miles after dispersing from hibernacula in the spring, which could bring this species into the range of the Lake Champlain Segment. Groups of female bats form maternity colonies in the crevices of trees or under the loose bark of dead trees. During the fall breeding season, female bats can number from 50 to 100 individuals in a single tree (NYSDEC 2012). Maternity colonies typically roost during the day, but little is known about the foraging or roosting behavior of Indiana bats at night (Murray and Kurta 2004).

Bat roost and maternity colonies could be associated with a variety of forested community types adjacent to the Lake Champlain Segment ROI, including Appalachian oak-hickory, beech-maple mesic, floodplains, and hemlock-northern hardwood forests. Bats forage on flying insects along river and lake shorelines, in the crowns of trees in floodplains, and in upland forests. Indiana bats prefer to forage and travel along the forest-air interface of the forest canopy or along forest edges/hedgerows (USFWS 2007a). Roosting and foraging habitat for Indiana bats could occur adjacent to, and in a few areas in, the Lake Champlain Segment ROI.

Bald eagle. The bald eagle was delisted by the USFWS in 2007; however, there is a post-delisting monitoring plan in place for the species, as required by the ESA (Section 4(g)(1)). Bald eagles are federally protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c) (1940), the Migratory Bird Treaty Act (1918), the Lacey Act (1900), and state-listed as Endangered in Vermont. Vermont's 2010 *Bald Eagle Recovery Plan* emphasizes monitoring, management and education to reach the state's goal of ultimately delisting the species (VFWD 2010).

During the winter, bald eagles move from nesting sites to coastal sites and inland locations with sufficient open water (DeGraaf and Yamasaki 2001). Roosting sites generally consist of dense stands of east-facing softwood trees for optimal cover and morning sun exposure. Bald eagles choose their nesting sites based on the proximity of large bodies of water with abundant fish resources, large trees for nest building, and minimal human disturbance (DeGraaf and Yamasaki 2001).

According to VFWD (2010), in August 2008, a successful nest and fledging was confirmed in Concord, VT for the first time since the 1940s, and two more nests were confirmed in 2009. Based on annual mid-winter bald eagle surveys, there are three areas where wintering bald eagles congregate in Vermont: (1) Lake Champlain: Charlotte Ferry south to the Champlain Bridge; (2) Lake Champlain: Charlotte Ferry north to Shelburne Point; and (3) Connecticut River: McIndoes Falls north to Moore Reservoir. Actual occurrences of eagles at these sites vary each year depending upon ice-over conditions (VFWD 2010). Based on a crude habitat evaluation of potential bald eagle habitat in Vermont conducted by VFWD, a list of warm water lakes and ponds ranked as potentially suitable habitat for breeding bald eagles was developed. Review of this information reveals that four water bodies with potentially suitable habitat for breeding bald eagles occurs in the vicinity of the Overland Segment: Old Marsh Pond (Fair Haven), Lake Bomoseen (Castleton), Lake Ninevah (Mt. Holly), and Rescue Lake (Ludlow) (VFWD 2010).

State-Listed Species

Because the Lake Champlain Segment is almost entirely aquatic, the only terrestrial species expected to occur within the ROI are bird and bat species. The Indiana bat and bald eagle are also state-listed and could occur in the Lake Champlain Segment. Other potential state-listed species are described below.

Little brown bat. The little brown myotis (*Myotis lucifugus*) has historically occurred throughout forested areas of the U.S. as far north as Alaska. It ranges from Alaska to Labrador and Newfoundland (Canada), south to southern California, northern Arizona, and northern New Mexico. This species is especially associated with humans, often forming nursery colonies containing hundreds, sometimes thousands of individuals in buildings, attics, and other man-made structures. In addition to day roosts in tree cavities and crevices, little brown myotis seem quite dependent upon roosts which provide safe havens from predators that are close to foraging grounds. Little brown myotis forage over water where their diet consists of aquatic insects, mainly midges, mosquitoes, mayflies, and caddisflies. They also feed over forest trails, cliff faces, meadows, and farmland where they consume a wide variety of insects, from moths and beetles to crane flies (Bat Conservation International 2014). The VANR listed the little brown bat as an endangered species due to the high mortality of this species caused by White Nose Syndrome. According to the VFWD (2014f), current research indicates that populations of this species have been reduced by 90% in the past three years, and the once very common little brown bat may be extirpated within 15 years.

Northern long-eared bat. According to the USFWS (2014a), the northern long-eared bat (*Myotis septentrionalis*) is found in the United States from Maine to North Carolina on the Atlantic Coast, westward to eastern Oklahoma and north through the Dakotas, even reaching into eastern Montana and Wyoming. On January 21, 2010, the USFWS received a petition from the

Center for Biological Diversity requesting that the northern long-eared bat be listed as threatened or endangered. After reviewing all available information on this bat species, the USFWS determined that listing the northern long-eared bat was warranted. Therefore on October 2, 2013, the USFWS published in the Federal Register (FR) a proposal to list the northern long-eared bat as endangered throughout its range under the Endangered Species Act (USFWS 2014a). According to the VFWD (2012), the northern long-eared bat is listed as an endangered species in Vermont. Northern long-eared bats spend winter hibernating in caves and abandoned mines, collectively call hibernacula. During summer, they roost alone or in small colonies underneath bark or in cavities or crevices of both live trees and snags (dead trees). As its name suggests, the northern long-eared bat is distinguished by its long ears, particularly as compared to other bats in its genus, Myotis. Northern long-eared bats eat insects and emerge at dusk to fly through the understory of forested hillsides and ridges feeding on moths, flies, leafhoppers, caddisflies, and beetles, which it catches while in flight using echolocation. This bat also feeds by gleaning behavior, which means catching motionless insects from vegetation or the surface of water bodies (USFWS 2014b).

Migratory Birds

Most of the State of Vermont is overlapped by migration flyways for waterfowl, shorebirds, and birds of prey. Warblers and other songbirds generally pass through the state in high numbers as well. According to the EPA (2011), the Lake Champlain Valley is part of the North Atlantic Flyway, a migratory bird corridor. Between 20,000 and 40,000 birds have been counted during fall migration. The Lake Champlain Valley is also part of an international, multi-state Bird Conservation Region 13, which extends from the lower Great Lakes through the St. Lawrence River Valley and west to the Lake Champlain Basin. It contains some of the most important grassland, shrubland and wetland bird habitat in the East. This physiographic area is extremely important to stopover migrants, attracting some of the largest concentrations of migrant passerines, hawks, shorebirds, and waterbirds in eastern North America (Audubon Vermont 2013).

Over 250 species of birds can be found within the Lake Champlain Basin in a given year (Lake Champlain Committee 2014). According to the Lake Champlain Committee (2014), some of the bird species that may be observed on Lake Champlain include ring-billed gull (*Larus delawarensis*), herring gull (*L. argentatus*), great black-backed gull (*L. fuscus*), Bonaparte's gull (*L. philadelphia*), double-crested cormorant (*Phalacrocorax auritus*), bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), common tern (*Sterna hirundo*), Caspian tern (*Hydroprogne caspia*), great blue heron (*Ardea herodias*), green heron (*Butorides virescens*), American bittern (*Botaurus lentiginosus*), black-crowned night heron (*Nycticorax nycticorax*), great egret (*Ardea alba*), common merganser (*Mergus merganser*), mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), and common goldeneye (*Bucephala clangula*).

Migrating birds of prey that could pass over the Lake Champlain Segment during the daytime include osprey, bald eagle, northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipiter striatus*), Cooper’s hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), broad-winged hawk (*B. platypterus*), red-tailed hawk (*B. jamaicensis*), American kestrel (*Falco sparverius*), peregrine falcon (*F. peregrinus*), and northern goshawk (*Accipiter gentilis*) (Vermont Center for Ecostudies 2013). On rare occasions, golden eagles (*Aquila chrysaetos*) could also pass through the ROI.

According to the VFWD's Natural Heritage Inventory[1], the only state-listed bird species that occurs within 0.25 miles (0.4 km) of the Lake Champlain Segment is the grasshopper sparrow (*Ammodramus savannarum*). According to Kart et al. (2005), this species is currently listed as threatened in Vermont and has declined throughout the region due primarily to loss of grassland habitat and agricultural intensification (early mowing regimes). Habitat for this species includes grasslands, pastures, old fields and airports with minimal grass and litter cover and patches of bare ground (Kart et al. 2005).

3.7.1.2 Overland Segment

Federally Listed Species

Federally listed terrestrial species that could be encountered in the terrestrial portions of the Overland Segment include the Indiana bat (*Myotis sodalis*), Jesup's milk-vetch (*Astragalus* robbinsii var. jesupi), and northeastern bulrush (Scirpus ancistrochaetus) (USFWS 2014c; USFWS 2014d) (see Table 3.7-2). There is also a known breeding bald eagle (Haliaeetus leucocephalus) record from the 1940s on Lake Bomoseen located at MP 113 in this segment. There is no critical habitat designated within the ROI for the Overland Segment (USFWS 2014e).

TABLE 3.7-2
FEDERALLY LISTED TERRESTRIAL SPECIES OCCURRING WITHIN RUTLAND AND WINDSOR COUNTIES

Common Name	Scientific Name	Federal Status
Indiana bat	*Myotis sodalis*	E
Jesup's milk-vetch	*Astragalus robbinsii* var. *jesupi*	E
Northeastern bulrush	*Scirpus ancistrochaetus*	E
Bald eagle	*Haliaeetus leucocephalus*	D

Source: USFWS 2014c; USFWS 2014d
Key: E = endangered D = delisted

Indiana bat. Indiana bat life history information is provided in the Lake Champlain Segment above.

Jesup's milk-vetch. Jesup's milk-vetch is a plant that is a member of the pea family (Fabaceae), and has long been recognized as one of the rarest plants in New England and was listed as federally endangered under the ESA in 1987 (USFWS 1989). According to the USFWS (2014f), Jesup's milk-vetch is found in only three locations along the Connecticut River in New Hampshire and Vermont. The species is found primarily on calcareous bedrock outcrops composed of chlorite or phyllite schist, which are ice-scoured annually. The majority of plants occur at the ice-scour line which constitutes the ecotone between barren rock and the vegetated

[1] Listings of state-listed rare species and significant natural community element occurrence records were obtained by request from database information provided by the Vermont Fish and Wildlife Department, Natural Heritage Inventory. The request included lands within a one mile buffer centered on the proposed transmission line.

upper areas of the bank (USFWS 1989). According to the USFWS (2014d), Jesup's milk-vetch is currently known or is believed to occur in Windsor County. Considering that the known habitat for Jesup's milk-vetch is confined to a specific ecological niche located along the Connecticut River, it is extremely unlikely to occur in the project area. Therefore, this species is not discussed further.

Northeastern bulrush. Northeastern bulrush is a plant that is a member of the sedge family (Cyperaceae) and was listed as federally endangered under the ESA in 1991 (USFWS 1993). While the specifics of its habitat preferences are unknown, USFWS describes its typical habitat as "open seasonal pools surrounded by woodland" (USFWS 2008). The species appears to flourish in small ponded areas with full light availability, and relatively stable water levels, although many seemingly suitable habitats are unoccupied by northeastern bulrush. Northeastern bulrush habitat in Vermont is described by the USFWS (2008a) as:

> *Northeastern bulrush habitat in Vermont can be most commonly characterized as emergent marshes (sometimes along streams) whose hydrology is influenced by beaver activity. However, there are a few sites that have no beaver influences, but contain small, perched hemlock or buttonbush swamps.*

In the first 14 years since this species was listed by the USFWS, the number of known populations nationwide increased from 33 to 113, including from 2 to 22 in Vermont (USFWS 2008a). Northeastern Bulrush is not documented in the towns traversed by the Project. In Windsor County, it is east and south of the Project. As such, there are not likely to be any adverse impacts.

Bald eagle. Bald eagle life history information is provided in the Lake Champlain Segment above.

State-Listed Species

In addition to their Federal listing, the Indiana bat, Jesup's milk-vetch, and northeastern bulrush are also state-listed as endangered. These species have been discussed in detail previously. Other state-listed species identified within proximity to the proposed Project route are described below.

Little brown bat. Little brown bat life history information is provided in the Lake Champlain Segment above.

Northern long-eared bat. Northern long-eared bat life history information is provided in the Lake Champlain Segment above.

Eastern Rat Snake. The eastern rat snake (*Elaphe obsoleta*) is a state-listed threatened reptile species known from only two regions of Vermont. One meta-population can be found in western Rutland County and extending into southwestern Addison County. The second population is very localized on the border of Monkton, Bristol, and New Haven. This species dens in rocky talus slopes and possibly in rocky woodlands and along ledges at low elevation (<400m) with a southern or southwestern exposure. Summer foraging areas for this species may be interior woodlands, edges, or wetland margins and abandoned and low use buildings may also be used

(Kart et al. 2005). The Overland Segment ROI crosses an area mapped by the VNHI for the eastern rat snake at MP 100.6.

Upland Sandpiper. The upland sandpiper (*Bartramia longicauda*) is a state-listed endangered bird species currently found in the Champlain Valley with highest concentrations in Addison and Alburgh. Upland sandpipers prefer large grassland areas (50-100 acres) with a mosaic of grassland habitat types for nesting and brood rearing (e.g., pasture, hayfields, etc.) (Kart et al. 2005). The Overland Segment ROI crosses areas mapped by the VNHI for occurrences of upland sandpiper at approximate MPs 104 and 106.1.

Timber Rattlesnake. The timber rattlesnake (*Crotalus horridus*) is a state-listed endangered reptile species. According to Kart et al. (2005), extant populations of timber rattlesnake are restricted to areas near the southern portion of Lake Champlain in western Rutland County and populations in other parts of the state have been lost. This species is known to den on south or southwest facing talus slopes which are near rocky ridges with exposed ledge and large undeveloped or sparsely developed areas of oak-hickory woods (Kart et al. 2005). The Overland Segment ROI crosses an area mapped by the VFWDNHI for the timber rattlesnake at MP 106.9.

White Adder's Mouth. White adder's mouth (*Malaxis monophyllos var. brachypoda*) is a state-listed threatened plant species. According to Schultz (2003), there are at least 7 occurrences (in 7 counties) of this species in Vermont. Fernald (1950 *as cited in* Schultz 2003) describes the habitat of this species in the northeastern U.S. as "damp calcareous gravels, talus, peats, swales, and bogs". Chapman (1997 *as cited in* Schultz 2003) notes the habitat of white adder's mouth in the northeastern U.S. as "moist and shaded woodlands, often near flowing water." The Overland Segment ROI crosses an area mapped by the VNHI for white adder's mouth at MP 144.1.

Migratory Birds

Typical bird species found along open or shrubby forest edges adjacent to old fields, agricultural lands, or ROWs along the Overland Segment ROI include blue-winged warbler, brown thrasher (*Toxostoma rufum*), Eastern towhee, rose-breasted grosbeak, black-billed cuckoo (*Coccyzus erythropthalmus*), and gray catbird, which are all covered under the MBTA (Vermont Center for Ecostudies 2013; USFWS 2013). The ROI offers little habitat for species that are intolerant of degradation and disturbance.

3.7.2 Environmental Impacts

3.7.2.1 Lake Champlain Segment

Because there is no designated or proposed designated critical habitat in the ROI, the Project will have no effect on designated or proposed designated critical habitat.

Impacts from Construction

Federally Listed Species

Indiana bat. Suitable foraging habitat for the Indiana bat occurs within and adjacent to the Lake Champlain Segment ROI. Construction activities along the Lake Champlain Segment will generally occur at distances greater than 500 feet (152 meters) from land although, in a few places, construction will occur closer to shore. At these distances, the noise level will be less than 60 dBA. With an average installation rate of 1.5 miles (2.4 km) per day, noise levels will be increased over baseline for only a few hours at any one location. Consequently, noises associated with construction activities are not likely to adversely affect Indiana bats using forage areas in the ROI in the Lake Champlain Segment.

Bald eagle. Based on the USFWS list of known or likely county occurrences of federally listed species in Vermont, there is a potential that bald eagles could winter along Lake Champlain. Because this segment is aquatic, there will be no impacts on perch or nest sites; however, there could be some minor impacts to nearby eagles during construction activities. Noise impacts resulting in temporary, non-significant avoidance of foraging near construction will be the same as described for non-listed birds.

State-Listed Species

Because the Lake Champlain Segment is almost completely aquatic, the only terrestrial species expected to occur within the ROI are bird and bat species. Noise associated with construction may affect state-listed bird species using forage areas and nests adjacent to the transmission line route in the Lake Champlain Segment. These impacts could result in avoidance of these areas; however, this effect will be temporary and not significant. Noise impacts resulting in temporary avoidance of foraging areas near construction could be the same as described for non-listed birds.

Migratory Birds

Temporary, but not significant, impacts on migratory birds could result from the installation of the transmission line in the Lake Champlain Segment. Waterfowl, gulls, and terns using aquatic habitats along the ROI could temporarily be displaced from foraging habitats due to noise from underwater cable installation techniques and construction vessel traffic. Generally, these birds will be expected to avoid the construction area and move to similar habitats nearby; however, impacts could occur if noise result in increased stress, increased travel time to foraging areas from roosts or nest sites, or lower foraging success. Generally, noise impacts resulting in temporary avoidance of foraging areas near construction will be the same as described for non-listed birds.

Impacts from Operations, Maintenance, and Emergency Repairs

Inspection activities will consist of underwater instrument surveys using a small vessel operating at least 300 feet (91 meters) from shore and, therefore, will not result in significant adverse effects on terrestrial protected or sensitive species.

3.7.2.2 Overland Segment

Impacts from Construction

The federally and state-listed threatened and endangered species and other protected species that could occur within the Project ROI are identified above.

Federally Listed Species

Indiana bat. According to the VFWD (2014b) and the VANR (2004), portions of northwestern Rutland County within the Overland Segment are mapped as potential and known Indiana bat summer range. Construction noise will occur in the area adjacent to the Overland Segment ROI; however, since these bats occur in proximity to active road corridors in the ROI, it is assumed that they are already habituated to noise level fluctuations.

In the immediate vicinity of the road ROWs, much of the habitat consists of disturbed open lands and secondary forest lacking suitable habitat for bat roosts. Forested or open woodland habitats occur adjacent to the proposed transmission line; however, vegetation clearing will be conducted primarily within the road ROWs. Review of aerial photography and multiple site visits of the proposed transmission line route indicates that there are few areas dominated by large trees within the construction corridor. Applicant-proposed measures to avoid or minimize impacts begin with attempting to avoid tree cutting to the greatest extent practical. If tree removal is required, the identification and avoidance of large live or dead trees with peeling bark (e.g., shagbark hickory) which could serve as maternity or roost trees for Indiana bats and site-specific prescriptions for clearing and selective retention of vegetative buffer zones, will be implemented. Based on the implementation of such measures, the Project may potentially affect, but is not likely to adversely affect, the Indiana bat.

Northeastern bulrush. No significant effects on northeastern bulrush are expected to occur as a result of the construction activities in the Overland Segment. Wetlands with the potential to serve as habitat for this species may exist along the proposed transmission line route in the Overland Segment. However, according to the USFWS (2012), occurrences of northeastern bulrush are known outside of the Project area in the towns of Springfield and Chester, Windsor County. Additionally, based on data obtained from the VNHI[2], there are no historic records of northeastern bulrush occurring within 0.25 miles (0.4 km) of the entire Project route. While habitat for northeastern bulrush in Vermont is commonly characterized as emergent marshes (sometimes along streams) whose hydrology is influenced by beaver activity (USFWS 2008a), that could occur along the ROI, these habitats are expected to be disturbed and not potentially suitable for northeastern bulrush. As such, impacts on northeastern bulrush from construction activities are highly unlikely.

Bald eagle. Breeding habitat has the potential to occur in the vicinity of the Overland Segment: Old Marsh Pond (Fair Haven), Lake Bomoseen (Castleton), Lake Ninevah (Mt. Holly), and Rescue Lake (Ludlow) (VFWD 2010). Bald eagles prefer tall, sturdy, live trees that provide easy access in and out of the nest (VFWD 2010). However, because the ROI will primarily occur within existing road ROWs where the vegetation is mostly low-lying herbaceous or scrub-shrub vegetation, and large deciduous or coniferous trees are generally not present, it is anticipated that bald eagles will not be present within the ROI. Although bald eagles might fly over the ROI when they are traveling among the large water bodies located in the surrounding areas, it is likely that they will not use the habitats within the ROI except on a transient basis.

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[2] Listings of state-listed rare species and significant natural community element occurrence records were obtained by request from database information provided by the Vermont Fish and Wildlife Department, Natural Heritage Inventory. The request included lands within a one mile buffer centered on the proposed transmission line.

The Applicant will work with federal and state agencies to implement impact avoidance and minimization measures specifically for bald eagles and their habitat. If construction will occur within 660 feet (201 meters) of an active nest during the nest-building or breeding season (December to August) per USFWS National Bald Eagle Management Guidelines (USFWS 2007b), the Applicant will contact USFWS and VFWD for guidance to avoid and minimize the potential for noise-related impacts. Additionally, construction personnel will be trained to identify eagles and nests, and instructed to report any sightings of potential nests not previously identified. The Applicant will work with federal and state agencies to establish measures to take if any previously unidentified eagle nests are discovered during construction. These measures could include that work be discontinue within 600 feet (183 meters) of the nest and/or the Applicant will report the findings to and consult with the VFWD and USFWS for guidance to avoid or minimize the potential for impacts.

State-Listed Species

Potential effects on state-listed plants, as a result of construction along the Overland Segment, will not be significant but could potentially include soil compaction, vegetation crushing, dust, and local potential loss of some plants. Soil compaction will decrease the rate of water permeating into the soil, resulting in decreased vegetation cover because of desiccation. Heavy equipment and foot traffic could damage plants within the ROI. The Applicant will implement measures to avoid or minimize impacts on protected species, including state-listed plants, such as identifying all known locations on design and construction maps and in the field where protected plants have been observed based on available data. Dust-control strategies (e.g., watering down disturbed soil) will be implemented to minimize impacts from interference with pollination and photosynthesis on downwind vegetation. Construction personnel will be trained to follow protection measures included in the construction plans for the Project. Habitat assessments, surveys and follow-up protection planning will be completed in consultation with VANR and USFWS.

Potential effects from construction on state-listed reptiles, specifically the eastern rat snake and the timber rattlesnake, will be similar because these two species have similar habitat requirements. These potential effects include habitat degradation and direct impacts or mortality. The Applicant will implement several measures to avoid or minimize impacts on protected species, including state-listed reptiles, such as identifying known or potential locations on construction maps and in the field where protected reptiles have been observed based on available data. Construction personnel will be trained to identify known and potential rare, threatened, and endangered reptiles and follow specific protection measures to be included in the construction plans.

Noise associated with construction of the approximately 20-foot (6-meter)-wide transmission corridor could potentially affect state-listed birds (i.e., upland sandpiper) on a temporary basis. Construction of the transmission line, however, will occur in previously disturbed roadway ROWs. Since bats and birds that occur in the ROWs will be habituated to noise and human disturbance and likely will not avoid the edge habitats created by the relatively narrow corridor, significant habitat alteration effects are not expected. Additionally, most vegetation along the proposed transmission line route is currently maintained in an early successional stage, therefore permanent conversion of habitat along the transmission line route is not likely to significantly effect the use of these habitats by upland sandpipers.

Migratory Birds

No significant effects on migratory birds are expected from installation of the transmission line. However, potential effects on migratory birds and their occupied habitats include those resulting from noise and vegetation clearing. Most birds along the Overland Segment are expected to move into similar adjacent habitats during a typical construction period of up to 2 weeks in any given location and return to the area after construction is completed. Impacts could also result in parental abandonment of eggs or young in nests built in habitats immediately adjacent to the construction activities. Permanent displacement of an entire breeding population is unlikely because vegetation clearing will largely occur along disturbed or fringe habitat (Alberta Utilities Commission [AUC] 2011).

Some limited loss of woodlands may occur due to any required tree clearing along the edge of the ROI in forested areas. The affected habitat only composes a small percentage of the habitat available to migratory bird species in the region. Additionally, significant habitat fragmentation impacts are not be expected because construction will occur within or adjacent to existing, previously disturbed ROWs. Most of the vegetation that will be impacted will be in fringe habitat that is subject to frequent mowing, noise, and vehicle emissions along roads. Applicant-proposed measures, including avoiding sensitive habitats, will be implemented to reduce impacts on migratory birds.

Impacts from Operations, Maintenance, and Emergency Repairs

Federally Listed Species

Indiana bat. No significant effects from magnetic fields will be anticipated from operation of the transmission line. Buried cables, such as those proposed for the NECPL Project, will have no electric fields at the ground surface and the constant magnetic field will decrease with distance from the cable centerline (World Health Organization [WHO] 2012). Studies for similarly buried HVDC transmission systems have predicted magnetic fields of approximately 200 mG at 1 foot (0.3 meters) above the ground over the cables. While there is evidence that wildlife can detect electromagnetic fields, species behaviors will not be affected by relatively small changes in magnetic fields (AUC 2011). Additionally, literature suggests that electromagnetic fields associated with transmission lines do not result in any adverse effects on the health, behavior, or productivity of animals (Exponent 2009). Indiana bats might be able to detect magnetic fields; however, there is no evidence to suggest that the magnetic fields that will be created by the NECPL Project will result in any negative effects on the species.

Most of the vegetation that will be impacted along the ROW during vegetation maintenance activities will consist of previously disturbed herbaceous and shrubby cover. Vegetation along the transmission line ROW will primarily be managed by brush hogging and mowing or hand cutting to maintain height of vegetation to less than 20 feet (6 meters). Potential effects from mowing on Indiana bats include noise and dust. Noise created by mowing could affect roosting bats in adjacent forests but several colonies of bats have been found near mowed ROWs of major roads and appear to not be affected by noise created by mowing and traffic (USFWS 2008b). In addition, noise and dust created by mowing will be experienced by roosting or foraging bats for a very short duration because mowers will pass quickly by any area having bats. Effects on the Indiana bat associated with emergency repairs of the transmission line in the Overland Segment, if necessary, will not be significant and will be similar to those occurring during construction, but will be for a shorter duration and impact a smaller area.

Northeastern bulrush. Impacts on northeastern bulrush could occur from vegetation clearing and other activities associated with vegetation maintenance along the transmission line ROW. Both vehicle and foot traffic during maintenance could damage or disturb habitat, and harm or crush individual northeastern bulrush plants or populations. Vegetation along the ROW will primarily be managed by brush hogging and mowing or hand cutting. A vegetation management plan for the operational period of the Project will be developed. No herbicides or pesticides will be used within occupied northeastern bulrush habitat, except as approved by the USFWS and VFWD. Any vegetation management, emergency repairs, or other activities required within known northeastern bulrush habitat will be implemented in accordance with the USFWS Recovery Plan for this species (USFWS 1993*b*).

Bald eagle. Buried cables, such as those proposed for the NECPL Project, will have no electric fields at the ground surface. No impacts on bald eagles from magnetic fields will be anticipated from operation of the transmission line because the field levels have been predicted to be approximately 200 mG at the surface directly over the cables and the magnetic field will decrease with distance from the cable centerline (WHO 2012). Research indicates that some species of animals, including birds, are able to detect magnetic fields at levels that might be associated with transmission lines such as those associated with the Project; however, detection does not imply that the fields could result in adverse impacts on the species' ability to forage, reproduce, and survive (AUC 2011).

Vegetation within the transmission line ROW will be maintained to a height of less than 20 feet (6 meters). This will be accomplished by occasional brush hogging and mowing or hand cutting. Because vegetation higher than 20 feet (6 meters) in height will not be allowed to establish itself on the ROW, the establishment of eagle nests will not occur. No significant impacts on bald eagle will be expected from any emergency repairs, which are not expected. If required, impacts from repairs of the transmission line will be similar to those that will have occurred during construction, but will be for a shorter duration and will impact a smaller area.

State-Listed Species

Operation of the transmission line will increase the soil temperature directly above the transmission line by 1.8 °F (1 °C), which could slightly alter terrestrial vegetation and habitat; however, temperature will quickly dissipate from the transmission line (Burges et al. 2008) and the area affected will be within the maintained ROW. No significant effects from magnetic fields will be anticipated from operation of the transmission line. Buried cables, such as those proposed for the NECPL Project, will have no electric fields at the ground surface (WHO 2012), and the predicted magnetic field level of 200 mG at the ground surface directly above the transmission line cables in the ROWs will decrease with distance from the cable centerline. Electromagnetic fields have the potential to enhance the growth response in certain plant species; however, the effects of such on plants are inconclusive. Research indicates that some species of animals are able to detect magnetic fields at levels that might be associated with transmission lines such as those associated with the Project; however, detection does not imply that the fields will cause adverse effects on a species' ability to forage, reproduce and survive (AUC 2011).

Vegetation clearing, vehicle and foot traffic, and the use of heavy equipment for vegetation maintenance activities or emergency repairs, if required, in the transmission line ROW can crush, kill, or damage state-listed plant and reptile species if they occur in the ROI. Vegetation along the ROW will primarily be managed by brush hogging and mowing or hand cutting. A vegetation management plan for the Project will be developed and provided for review by state and federal resource agencies.

Vehicle and foot traffic associated with vegetation maintenance in the ROW and emergency repairs, if necessary, could impact state-listed birds (i.e., upland sandpiper). No significant habitat fragmentation impacts or loss of available habitat will be expected because construction will occur within existing ROWs, which is fringe habitat primarily made up of previously disturbed vegetation. Habitat assessments, surveys and follow-up protection planning will be completed in consultation with VANR and USFWS.

Migratory Birds

Impacts on migratory birds could occur as a result of ROW vegetation maintenance and emergency repairs, if necessary. Vehicle and foot traffic and the occasional use of heavy equipment could impact birds. Vegetation maintenance activities could result in habitat loss. If vegetation maintenance or emergency repair activities in the Overland Segment occur during migratory bird breeding and nesting season (generally the spring and summer) migratory birds and nests could be impact. Applicant-proposed measures, including avoiding sensitive habitats, will be implemented to reduce impacts on migratory birds; therefore, no significant impacts will be expected.

3.8 Wetlands

The USACE and the USEPA jointly define wetlands as “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (USACE 1987). Wetlands can provide a variety of functions, including wildlife habitat, groundwater recharge or discharge, sediment and shoreline stabilization, flood storage, nutrient removal, sediment and toxicant retention and production export, and, in some cases, aesthetic and recreational value.

Wetlands are protected as “waters of the United States” under Section 404 of the CWA. The term “waters of the United States” incorporates deep water aquatic habitats and special aquatic habitats, including wetlands. Jurisdictional waters of the United States regulated under the CWA include coastal and inland waters, lakes, rivers, ponds, streams, intermittent streams, and “other” waters that, if degraded or destroyed, could affect interstate commerce.

Under the Vermont Wetland Rules (VWR), wetlands are classified into one of three classes, which rank wetlands according to their ability to perform wetland functions and provide wetland benefits. Class I wetlands have the highest rank, and the ranking descends through Classes II and III. These classifications are based on a variety of criteria, including vegetation cover type, special ecological associations, threatened or endangered species, hydrology of adjacent water bodies, the presence or absence of invasive species, wildlife, cultural significance, aesthetics, and landscape features. Class I and Class II wetlands, and associated buffer zones are regulated under VWR.

For the purposes of this analysis, the wetlands ROI consists of wetlands directly crossed by the transmission line and wetlands within 50 feet (15 meters) of either side of the transmission line centerline.

3.8.1 Environmental Setting

3.8.1.1 Lake Champlain Segment

No wetlands were identified in the majority of the Lake Champlain Segment because the lake is considered open water and the transmission line will be buried within the Lake Champlain lakebed. For the Alburgh section of the Lake Champlain Segment, the Project is routed along an existing roadway ROW and in a disturbed field so that the wetlands within the ROI are characterized by previous anthropogenic disturbance or the presence of invasive plant species.

3.8.1.2 Overland Segment

Wetland Physical Characteristics and Functions. The Applicant anticipates completing field delineations of wetlands along the proposed route in 2014. The National Wetland Inventory (NWI) and Vermont Significant Wetland Inventory (VSWI) maps show approximately 21.33 acres (8.6 hectares) and 35.34 acres (14.3 hectares), respectively, of wetlands within the ROI of the Overland Segment. NWI mapped wetlands were classified as Lacustrine Unconsolidated Bottom Class (LUB), Palustrine Unconsolidated Bottom Class (PUB), Palustrine Emergent Wetland Class (PEM), Palustrine Scrub-Shrub Wetland Class (PSS), Palustrine Forested Wetland Class (PFO), Riverine, or a mixture of these classifications (USFWS 2014g). A listing of NWI and VSWI wetlands within the Overland Segment ROI is provided in Appendix C.

Wetland Habitat and Species. Wetland habitats mapped within the Overland Segment include marshes dominated by emergent vegetation, shrub swamps, forested wetlands, areas with lacustrine and palustrine unconsolidated bottom habitat, floodplain forests, and riparian edges. Open water areas such as rivers, small streams, ponds, pools, and lakes also occur in the vicinity of the Project.

In general, because the Project is proposed to be routed along existing roadway ROWs, many wetlands within the ROI are characterized by previous anthropogenic disturbance. The Project is frequently routed along the edge of the disturbed roadway ROW and more natural vegetated wetland communities are located adjacent to the transmission line route.

From approximately MP 98.1 to 102.5, where the transmission line is proposed to be buried in Town of Benson roadway ROWs, mapped wetland communities in the ROI are associated with the Champlain Valley and Taconic Mountains Biophysical Regions and include marshes, forested wetlands, wetlands with lacustrine and palustrine unconsolidated bottom habitat, and riparian habitat associated with intermittent and perennial water bodies. Examples of wetland habitat and wildlife species may include red maple, black ash (*Fraxinus nigra*), yellow birch, bluejoint grass (*Calamagrostis canadensis*), cattails (*Typha* spp.), sedges (*Carex* spp.), rushes (*Juncus* spp.), bulrushes (*Scirpus* spp.), spike rushes (*Eleocharis* spp.), bullfrog, common garter snake, and painted turtle (*Chrysemys picta*) (Thompson and Sorenson 2005; Lichvar 2013; DeGraaf and Yamasaki 2001; VFWD 2103).

South of MP 102.5, where the transmission line will be buried primarily in the Route 22A, Route 4, Route 7, Route 103, Route 100, and local roads in Ludlow ROWs, mapped wetland communities in the ROI are associated with the Taconic Mountains, Vermont Valley, and Southern Green Mountains Biophysical Regions and include marshes, forested wetlands, scrub-shrub wetlands, pond edges, floodplains, and riparian habitat associated with intermittent and perennial water bodies, and may be associated with vegetation such as red maple, silver maple (*Acer saccharinum*), sensitive fern (*Onoclea sensibilis*), ostrich fern (*Matteuccia struthiopteris*), yellow birch, cattails, sedges, rushes, bulrushes, and spike rushes. These wetlands could support mammals including the northern short-tailed shrew (*Blarina brevicauda*), star-nosed mole (*Condylura cristata*), meadow vole, beaver (*Castor canadensis*), raccoon (*Procyon lotor*), and muskrat (*Ondatra zibethicus*) (Thompson and Sorenson 2005; Lichvar 2013; DeGraaf and Yamasaki 2001; VFWD 2012b).

A variety of amphibians typical of these wetland habitats include bullfrog, green frog, and northern leopard frog (*Lithobates pipiens*). Common garter snake, smooth green snake (*Opheodrys vernalis*), and northern water snake (*Nerodia sipedon*) may be associated with these wetland and aquatic habitats; deeper areas near lakes and ponds can also support painted turtle and snapping turtle (*Chelydra serpentina*) (DeGraaf and Yamasaki 2001; VFWD 2013).

Forested wetlands are dominated by species such as red maple, green ash (*Fraxinus pennsylvanica*), cottonwood (*Populus deltoides*), American elm (*Ulmus americana*), swamp white oak (*Quercus bicolor*), black ash, slippery elm (*Ulmus rubra)*, balsam fir, and northern white cedar (*Thuja occidentalis*). Some common shrubs and herbaceous vegetation that can occur in forested wetlands include winterberry holly (*Ilex verticillata*), speckled alder (*Alnus incana*), red-osier dogwood (*Cornus sericea*), poison ivy (*Toxicodendron radicans*), royal fern (*Osmunda regalis*), sensitive fern, cinnamon fern (*O. cinnamomea*), Canada mayflower (*Maianthemum canadensis*), and goldthread (*Coptis trifolia*). Wildlife in forested wetlands is often associated with areas of pools and sphagnum moss, thickets, damp leaf litter, floodplains, or river bottoms. Species using these habitats can include ermine (*Mustela erminea*), pickerel frog (*Lithobates palustris*), gray treefrog, and red-bellied snake (*Storeria occipitomaculata*) (Thompson and Sorenson 2005; Lichvar 2013; DeGraaf and Yamasaki 2001; VFWD 2013).

Seasonal or vernal pools in forested areas support a distinct community of breeding amphibians, which could include wood frog (*Lithobates sylvaticus*), spring peeper (*Pseudacris crucifer*), spotted salamander (*Ambystoma maculatum*), Jefferson's salamander (*A. jeffersonianum*), blue-spotted salamander (*A. laterale*), and eastern newt (*Notophthalmus viridescens*) (see Sections 3.2.5 and 3.2.7 for a detailed discussion on aquatic and terrestrial threatened and endangered species, respectively) (VFWD 2013; DeGraaf and Yamasaki 2001; Thompson and Sorenson 2005).

3.8.2 Environmental Impacts

3.8.2.1 Lake Champlain Segment

Impacts to any wetlands delineated along the Alburgh portion of the Lake Champlain Segment will be similar to those of the Overland Segment (see Section 3.8.2.2).

3.8.2.2 Overland Segment

Impacts from Construction

Wetland Physical Characteristics and Functions. The Overland Segment as well as the Alburgh section of the Lake Champlain Segment will traverse approximately 56 miles (90 km) of terrestrial areas and impacts will occur on freshwater wetlands from the transmission line construction activities. The National Wetland Inventory (NWI) and Vermont Significant Wetland Inventory (VSWI) maps show approximately 21.33 acres (8.6 hectares) and 35.34 acres (14.3 hectares), respectively, of wetlands within the ROI of the Overland Segment. The Project construction activities will result in direct temporary impacts of wetlands within the construction corridor of this segment. Surface hydrology in disturbed wetland areas will be re-established by backfilling the transmission line trench, restoring the surface to pre-construction contours, and re-establishing vegetative cover will represent temporary impacts

The construction sequence within wetlands along the Project route will typically consist of vegetation clearing within the construction corridor (tree stumps will only be removed from the trench line or where necessary), removal and stockpiling of the upper 18 inches (46 cm) of hydric soils, followed by excavation of a trench approximately 3.5 feet (1.1 meters) deep and up to 9 feet (2.7 meters) wide at the surface. The cables will then be placed in the trench, and then the trench will be backfilled. Land restoration will include placing the removed wetland topsoil back at the top of the excavated trench area to facilitate wetlands restoration, and the disturbed area will be mulched or hydroseeded. Restoration of wetlands will be completed within 24 hours after backfilling is finished.

During construction, wetlands will be impacted by vegetation clearing and alteration of upland and "wetland adjacent areas" within the construction corridor. Disturbance in and adjacent to wetlands will result in temporary, localized changes to wetland hydrology and water quality as local surface hydrology is altered during grading and trenching. Localized increases in turbidity or filling within the wetland could occur due to erosion of soils from disturbed areas being transported into adjacent wetlands. However, Applicant-proposed measures, including installation of silt fencing, minimization of disturbed areas, backfilling trenches and re-establishment of vegetative cover will be implemented to reduce the occurrence of erosion and sedimentation.

Replacement fill will be placed around the transmission cables when the surrounding soil does not have low thermal resistivity (i.e., areas with wet clay, silt, organic matter) or is otherwise physically unsuitable to be used as backfill (e.g., contains large rocks). In this situation, native soils will be excavated and replaced with appropriate backfill materials. The stockpiled native wetland topsoil will be placed on the surface of the excavated wetland area at the same grade and elevation as surrounding wetlands to match local surface hydrology and drainage patterns.

Hydrological impacts on wetlands could occur from changes in topography or compaction of the adjacent soils along the Project route. However, the restored ROW will be returned to approximately the same grade as existed prior to construction and long-term changes in surface hydrology will be minimal.

In general and whenever practical, construction equipment will operate primarily from the road ROW or other upland areas. Additional impacts could occur where heavy construction equipment might be required to operate within wetlands or is required to cross wetland areas to get from one location to another. If any construction equipment operates within wetlands, the Applicant will use equipment mats or low-ground-pressure tracked vehicles to minimize impacts on wetland soils. If dewatering is required within the excavated trench, water will be discharged to a well-vegetated upland area, a properly constructed dewatering structure, or a filter bag. Original surface hydrology in disturbed wetland areas will be re-established by backfilling the trench and grading the surface to original contours. Because most of the transmission line will be within existing roadway ROWs, there will be some flexibility to route equipment movement around wetlands rather than crossing through them. Groundwater hydrology will be maintained by use of trench plugs (i.e., sand bags permanently installed in the trench before backfilling at the base of any steep slopes adjacent to water bodies and wetlands) along the transmission line trench to prevent groundwater flow from flowing preferentially along the cables and through the thermal backfill (where used).

To minimize impacts on wetlands from accidental leaks and spills during construction, an emergency response plan will be developed. Construction crews will have sufficient supplies of absorbent and barrier materials on site to contain and clean up hazardous materials in the event of a spill. To reduce the likelihood of a spill entering wetland habitat, the Applicant will avoid storing hazardous materials, chemicals or lubricating oils, refueling vehicles and equipment, or parking vehicles overnight within 100 feet (30 meters) of the edge of a wetland, unless no reasonable alternative were available. If no alternative is available, the Applicant will adopt appropriate protection measures for spill prevention and control such as implementation of an emergency response plan.

The Project may result in a short-term diminishment of existing wetland functions which may include sediment, toxicant, and pathogen retention; nutrient removal, retention, and transformation; production (nutrient) export; and wildlife habitat due to the disturbance of wetland habitat and clearing of vegetation. Vegetation will be expected to quickly re-establish once the transmission line ROW has been stabilized and restored. Initially, the vegetation will be fast-growing herbaceous species over the course of the first growing season and woody species will re-establish over a longer period of time.

Due to their location along existing roadway ROWs, the wetlands values of recreation, education/scientific value, uniqueness/heritage, and visual quality will already be limited or non-existent because these wetlands occur in ROWs that have largely been previously disturbed. The wetland values of endangered species habitat, if present, may be impacted during and immediately following construction. In general, given that permanent impacts on wetlands already have occurred in relatively disturbed areas, and the Project will not result in a permanent loss of open space and physical, hydrologic, and ecological characteristics are expected to return to preconstruction conditions following the completion of construction and the restoration of the construction corridor, no long-term impacts on wetland values are expected. No impacts on wetlands will occur during construction of the aboveground facilities because wetlands are not anticipated to be present at the converter station location.

Wetland Habitat and Species. Impacts on wetland habitat is expected from temporary disturbances during construction activities (e.g., trenching, soil mixing and removal of vegetation) and from the permanent conversion of forested wetlands (PFO) to scrub-shrub wetlands (PSS). While the conversion of forested wetland to scrub-scrub is expected to be very minimal since the Project is proposed within road ROWs, any such conversion will alter the wetland vegetation from trees greater than 20 feet (6 meters) to woody vegetation less than 20 feet (6 meters), including true shrubs and young trees. No significant impacts on forest-dwelling wetland species will be expected once the wetland has been converted from a forested wetland to a scrub-shrub wetland from a reduction in forested wetland habitat. Mature trees will be removed from the area to be designated as the permanent transmission line ROW during construction and will reduce the canopy. Reduction of the tree canopy could temporarily increase the amount of sunlight reaching the wetland until a scrub-shrub cover establishes. This could temporarily result in a slight increase in summer water temperatures, growth rates of vegetation (including algae), and subsequent increases in BOD. In addition, there could be a reduction in the amount of organic matter, including tree leaves and other detritus falling or washing into wetland areas. The reduction in the tree canopy will result in a reduction in the organic matter used as food sources for bacteria, fungi, amphipods, and filter feeders.

Forested wetland wildlife, or species that prefer trees that are more than 20 feet (6 meters) in height, could remain on site, avoid the area, or relocate to other forested wetland areas. Once conversion to the scrub-shrub wetland has occurred, species that prefer forested wetlands with trees that are less than 20 feet (6 meters) in height will be expected to return to the area.

Following construction, the Applicant will conduct final grading to restore original contours, and will seed disturbed wetland areas with an appropriate seed mixture to stabilize soils and provide vegetation cover until native species can re-establish. Emergent wetland vegetation will be expected to re-establish quickly following construction, and woody species will return more slowly. Forested wetlands, where not maintained, will be expected to go through several stages of successional vegetation before returning to the preconstruction vegetation cover type. To assist in the recovery of woody species outside of the permanent transmission line ROW, the Applicant will avoid removing roots and stumps in cleared areas unless required for safety, to allow resprouting of woody species.

Potential impacts from storm water runoff and sedimentation will be avoided or minimized through the use of BMPs such as silt fences. Increased sedimentation and storm water runoff into wetlands could be detrimental to water quality by temporarily increasing turbidity levels. Impacts from degraded water quality and disturbed habitat may affect species such as small fish, filter feeders (animals that feed by straining suspended matter and food particles from water through their digestive systems), and other benthic organisms. In addition, any pollutants carried by storm water runoff could more easily enter wetlands because the reduction in vegetation cover will provide a less effective buffer between the wetlands and upland areas. If the original topsoil is used to backfill trenched areas within wetlands, and previous plant cover consisted of invasive species such as purple loosestrife and reed canary grass, then those invasive species will most likely become re-established in that area making establishment of native species difficult.

Invasive species control measures for construction will also be identified as part of the final design.

Significant impacts on wetland species will not be expected from temporary disturbances caused by noise and heavy equipment used during construction activities. Species in the vicinity will be habituated to frequent disturbances associated with the operation of roadway traffic. Most wetland plant species in the vicinity of construction activities will be expected to recover once construction activities have ceased. Some wildlife species will avoid the area during construction activities and return afterwards. However, many reptiles and amphibians use these wetland habitats and are not mobile enough to move out of the way of construction. Similarly, some fish species use wetlands, particularly the Palustrine System Emergent wetlands that occur along the proposed route. Direct mortality of these species will occur during construction. Most of these impacts will be either temporary or intermittent and, because of the small area affected, will not be expected to impact reptiles, amphibians, or fish at the population level (i.e., only a few individuals will be affected relative to the entire population).

As the Project may result in the permanent conversion of forested wetlands to palustrine scrub-shrub wetlands, a permanent loss of wildlife habitat value could result from the elimination of trees greater than 20 feet (6 meters) from these wetland areas. Because mature trees require a long period of time to re-establish, the temporary clearing of forested vegetation could represent a long-term impact on wildlife habitat until woody vegetation can be re-established. Also, because trees will not be allowed to establish directly over the transmission line following construction, this will also represent a permanent change in vegetation cover for the lifespan of the transmission line.

Clearing of forested wetlands will alter the wildlife habitat function of the wetland by replacing one habitat type with another. This habitat alteration could reduce the quality of the habitat for some wildlife species while increasing the value for others. Due to the distribution and availability of similar forested habitat types along the Project route that will be undisturbed, and the relatively small area of forested wetlands affected, construction of the transmission will not result in population-level impacts and will not affect the regional distribution or abundance of wildlife species.

Impacts from Operations, Maintenance, and Emergency Repairs

Wetland Physical Characteristics and Functions. Significant impacts will not be anticipated on wetlands during operation of the transmission line. Thermal changes to surface water or near-surface groundwater will be negligible, as the thermal backfill will dissipate any heat that will be generated well below the surface. Vegetation management activities as established in the Vegetation Management Plan will consist of periodically cutting woody vegetation by hand or by mechanical means. Following completion of the terrestrial transmission line, on-the-ground inspectors will survey and inspect the terrestrial transmission line ROW on approximately an annual basis. These maintenance activities will not be expected to alter wetland hydrology, compact wetland soils, or otherwise change the physical characteristics or functions of the wetlands in the transmission line ROW, since vegetation maintenance will only occur in currently identified wetlands that will be permanently impacted by construction activities.

The transmission line is designed to be maintenance-free; however, trenching or excavation could be required to conduct emergency repairs of defective cable segments located under wetlands. These activities will only occur as required and in accordance with applicable Federal, state, and local permits. Impacts from these emergency repairs will be similar to the initial construction but over a shorter duration and smaller area of impact.

Wetland Habitat and Species. Significant impacts on wetland habitat and species are not anticipated during operation or inspection of the transmission line because these activities will be generally non-intrusive. In accordance with the Vegetation Management Plan that will be developed, wetland vegetation will be maintained to prevent trees from growing taller than a predetermined height (e.g. 20 feet (6 meters). This activity is not expected to alter the habitat of the wetlands in the transmission line ROW, but it will prevent large trees from growing in the transmission line ROW. The wetland habitat that is established following completion of construction will be maintained over the operating life of the transmission line. No impacts on wetlands will occur during operation of the aboveground facilities because wetlands are not anticipated to be present at the converter station location.

Impacts on wetland habitat and species from emergency repairs, if required, will be similar to the initial construction but over a shorter duration and smaller area of impact. The disturbed area will be mulched and seeded, and vegetation and species will re-establish themselves in the repair area. The time between completion of the repairs and full habitat recovery could take up to 1 year or more depending on the season in which construction occurs, and, during that time, species use of the habitat will be limited.

3.9 Cultural Resources

The geographic areas within which the Project may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist, will include all areas along the proposed transmission line construction corridor where ground-disturbing activities will be conducted. It also includes those areas outside the proposed transmission corridor, including the Ludlow HVDC Converter Station site, laydown areas, access roads, and other locations that may be affected by the Project construction and operations. Additionally, the Area of Potential Effects (APE), which will be developed in consultation with the Vermont Division For Historic Preservation (DHP), and other stakeholders as appropriate, will take into account potential indirect effects (e.g. visual impacts) on standing historic properties (i.e., buildings, structures, objects, and districts) from the use of heavy equipment, particularly along the terrestrial sections of the Project route.

3.9.1 Environmental Setting

The Overland Segment extends eastward from Lake Champlain through the foothills of the Taconic Range and into the Vermont Valley. The Vermont Valley forms a narrow physiographic divide between the Taconic Range in the west and the abrupt escarpment of the western margin of the Green Mountains (Thompson and Sorenson 2005). The Overland Segment extends eastward from the Vermont Valley into the high plateau of the southern Green Mountains to the proposed converter station location in Ludlow, Vermont.

The Overland Segment follows an alignment that extends from the lowlands surrounding Lake Champlain to the rugged uplands of the Appalachian Mountains (Thompson and Sorenson 2005). Rivers and valleys that connect these regions served as important conduits of transportation, communication, and commerce for Native Americans and Euro-American populations.

Regional Prehistory

The precontact period in the northeastern United States and New England is generally divided into the Paleoindian, Archaic, and Woodland periods. The Paleoindian Period begins with the first human occupation of the region at least 11,500 years before present (B.P.). Paleoindian populations in the region were nomadic hunter-gatherers that lived in small, highly mobile groups (Hartgen Archeological Associates, Inc. [HAA, Inc.] 1999). Archaeological evidence suggests that Paleoindian populations in New England favored well-drained, sandy landforms along broad river valleys or pro-glacial lakes (HAA, Inc. 1999). Paleoindian artifacts are often made from high-quality lithic raw materials and include the diagnostic fluted projectile points, utilized flakes, and smaller bifacial tools such as scrapers or burins (HDR 2013).

The Archaic Period (9,000 – 3,000 B.P.) is characterized by human adaptations to changing climatic conditions and the extinction of Pleistocene megafauna that followed the last Ice Age (DOE 2013). The Archaic was a period of cultural fluorescence that saw rapid population growth and an expansion of the subsistence economy that centered on smaller game animals, aquatic resources, and the intensive processing of wild plants. Settlement patterns during the Archaic Period were focused on seasonal resource availability, with population aggregation occurring in larger river valleys and along the shorelines of lakes during the warmer months, and population dispersal of family groups into the uplands and smaller valleys during the winter (HDR 2013). By the end of the Archaic Period, mortuary ceremonialism and ritualized treatment of the dead became increasingly common. These traditions indicate a significant cultural change and would continue into the later Woodland Period (HAA, Inc. 1999).

The Woodland Period (3,000 B.P. – 350 B.P.) is marked by the widespread manufacture and use of ceramic vessels. Populations began to occupy more permanent villages and gradually adopted agricultural practices during this period. Maize, bean, and squash agriculture became an important source of subsistence during the Late Woodland period. Major sociopolitical changes accompanied the widespread adoption of agricultural practices, including increased territorialization and changes in residence patterns. Most Late Woodland villages in western Vermont were situated at the mouths of major streams along the east shore of Lake Champlain, namely along Otter Creek, and the Lamoille, Winooski, and Missisquoi rivers (HAA, Inc. 1999).

Regional History

Ephemeral contact between Native Americans and Europeans along the Atlantic Coast of North America may have begun as early as the 1490s. Archaeological evidence indicates that material items obtained through trade between coastal natives and European sailors working on fishing vessels at the mouth of the St. Lawrence River and off the Gaspe Peninsula travelled inland to Western Abenaki communities in Vermont (HAA, Inc. 1999; Grumet 1995). The first direct recorded contact with native people of the inner St. Lawrence/Lake Champlain area (some of whom may have been Western Abenaki from the Vermont area) was by Jacques Cartier in 1534 (HAA, Inc. 1999).

During the 17th century, the deep valleys and rugged uplands between the Merrimack River and Lake Champlain were generally regarded as a frontier or borderland region by European settlers. As a result, the Western Abenaki were able to limit European incursion during this period (Grumet 1995). By the late 1600s, however, many Western Abenaki had become embroiled in King Phillips War, and warfare would continue to ravage the frontier region as France, England, and the Iroquois struggled for control of the region (Grumet 1995).

The Western Abenaki largely sided with the French during the French and Indian War and were pressed by the British to give up their land when the war ended. As a result, many Western Abenaki moved north to Canada (Grumet 1995).

British settlement of western Vermont began in earnest in the mid-eighteenth century, and larger towns in areas with arable soils like Pittsford, Rutland, and Clarendon became the focus of settlement (HAA, Inc. 1999). Western Vermont served as an important transportation corridor during the American Revolution, and the northern edge of the defense in Vermont against the British Forces. Western Abenaki sided with the British during the American Revolution and participated in raids against colonists in New England during the conflict. At the end of the war, the remaining Western Abenaki that returned to Vermont found their homesites occupied by Americans. Marginalized and discouraged, few Western Abenaki chose to remain in the area, and many returned north to Canada (Grumet 1995).

By the end of the American Revolution, many western Vermont communities had developed a growing marble industry that would soon become a regional economic driver. While the surrounding communities would continue to maintain their agrarian roots, the marble industry would come to dominate the economy of Rutland and other communities until the twentieth century, and would spawn the growth of railroads and other commercial and industrial infrastructure (HAA, Inc. 1999).

Archaeological and Historic Resources

The Applicant has begun a cultural resource assessment to determine whether the following types of historic properties may be expected within the NECPL Project's APE:

- Terrestrial archaeological sites (prehistoric or historic sites containing physical evidence of human activity but no standing structures);
- Architectural properties (buildings or other structures or groups of structures, or designed landscapes that are of historic significance);
- Cemeteries; and
- Sites of traditional, religious, or cultural significance to Indian tribes.

A listing of sites on the National Register of Historic Places is provided in Appendix D.

3.9.2 Environmental Impacts

3.9.2.1 Lake Champlain Segment

Impacts from Construction

The installation of the Project could result in adverse effects on historic properties within the APE of the Lake Champlain Segment of the Project. Ground-disturbing activities associated with construction could damage archaeological or historic features and will disturb the context of those features located in the APE of the Lake Champlain Segment. The Applicant is consulting with the Lake Champlain Maritime Museum (LCMM) to identify archaeological sites and NRHP-listed architectural properties in the APE of the Lake Champlain Segment. LCMM has utilized their database of marine archaeological resources and has suggested minor adjustments to the proposed Lake Champlain segment to avoid these resources.

The Applicant anticipates development of a Cultural Resources Management Plan that would include an outline of the processes for resolving adverse effects on historic properties within the APE and determining the appropriate treatment, avoidance, or mitigation of any effects of the NECPL Project on these resources. Applicant-proposed measures will be implemented to mitigate the NECPL Project's adverse effects on known terrestrial archaeological sites found to extend into the APE. Mitigation measures might include minor rerouting to avoid the sites, Phase III data recoveries of terrestrial archaeological sites that are listed or eligible for listing in the NRHP and cannot be avoided, and documentation following Section 106 of the National Historic Preservation Act (NHPA) for NRHP-listed or -eligible architectural properties that cannot be avoided by project activities.

If there are no contributing elements in the APE, impacts from construction on the architectural properties will be limited to exposure to temporary noise and short-term visual impacts from the proximity of construction activities and equipment on Lake Champlain.

Impacts from Operations, Maintenance, and Emergency Repairs

The operation and inspection of the Lake Champlain Segment is not expected to have any impacts on cultural resources in the APE. Any emergency repairs will occur in areas previously disturbed by construction of the transmission line and, in some cases, in areas purposefully selected to avoid cultural resources; therefore, impacts are not expected from such activities.

3.9.2.2 Overland Segment

Impacts from Construction

The Applicant anticipates development of a Cultural Resources Management Plan that will include an outline of the processes for resolving adverse effects on historic properties within the APE and determining the appropriate treatment, avoidance, or mitigation of any effects of the NECPL Project on these resources. Applicant-proposed measures will be implemented to mitigate the NECPL Project's adverse effects on known terrestrial archaeological sites found to extend into the APE. Mitigation measures might include minor rerouting to avoid the sites, Phase III data recoveries of terrestrial archaeological sites that are listed or eligible for listing in the

NRHP and cannot be avoided, and documentation following Section 106 of the NHPA for NRHP-listed or -eligible architectural properties that cannot be avoided by project activities.

Impacts from Operations, Maintenance, and Emergency Repairs

The operation and inspection of the transmission line and maintenance activities in the Overland Segment of the Project are not anticipated to have adverse effects on terrestrial archaeological sites in the APE. Because the Overland Segment will involve an underground transmission line, operations is anticipated to have no adverse effects on architectural properties in the APE.

Vegetation maintenance activities and emergency repairs, if necessary, will occur in areas previously disturbed by construction of the transmission line and, in some cases, in areas purposefully selected to avoid cultural resources sites; therefore, such activities are not expected to cause adverse effects on these sites.

Section 4
Alternatives Analysis

TDI-NE evaluated several alternatives in relation to the NECPL Project's purpose, need, and geographic requirements, as well as the practicability and environmental consequences of each alternative. This section provides a brief description of practical alternatives to the Project and a discussion of the potential environmental impacts of each alternative.

4.1 Screening for Point of Interconnection and Converter Station Site

The Project will transport electricity from sources in Canada on a merchant basis for delivery into ISO-NE. As part of its initial system screening studies, the Applicant considered a number of different locations for interconnecting the proposed NECPL Project transmission system into the New England grid and for siting the DC to AC converter station that will be required for this interconnection.

4.1.1 Points of Interconnection Screening

To evaluate potential Points of Interconnection (POI) (i.e., existing substations) for the Project, the Applicant conducted initial system screening studies of the following existing 345kV substations in Vermont as potential POIs:

- New Haven 345 kV Substation in Addison County, Vermont
- West Rutland 345 kV Substation in Rutland County, Vermont
- Coolidge 345 kV Substation in Windsor County, Vermont

Each potential POI assessment was based on the following criteria:

- Availability of interconnection points (breaker positions) at the substation, or the capability to add interconnection points.
- Capability of existing circuits, connected to the substation, that could accommodate the additional capacity of the proposed Project, or the need for system upgrades.
- Proximity of a potential converter station site to the substation and an approximation of expected environmental impacts from a potential converter site; and
- Accessibility to the substation property for the HVAC transmission cables from the converter station.

The initial system screening studies indicated that the New Haven 345-kV Substation and West Rutland 345 kV Substation were not practical POI locations due to the fact that each of these substations is interconnected to only one existing 345 kV transmission line that could deliver the project's energy from Canada to load throughout New England, while the Coolidge 345 kV substation is interconnected to two existing 345 kV transmission lines. Interconnecting the project at the New Haven 345 kV substation or the West Rutland 345 kV substation would require an additional 345 kV overhead line from the POI to the Coolidge substation in order to effectively integrate the project into the New England grid, and, therefore, these two POIs were eliminated from further consideration.

4.1.2 Alternatives to Converter Station Location

In conjunction with the identification of feasible POIs in western Vermont, the Applicant identified possible sites for construction of the converter station in proximity to the POIs. Sites were identified and evaluated based on the following criteria:

- Sufficient land available for the converter station facility (approximately 4.5 acres (1.8 hectares)).
- Proximity to the HVDC transmission cable route to minimize environmental impacts, neighborhood disruption (i.e., disturbances, interruptions, or changes), and costs associated with the cable connections to the converter station.
- Consistency with, and potential impacts on, land uses in proximity to the converter station site.
- Potential environmental impacts associated with the transmission cable installation and the construction of the converter station.

Two properties identified by the Applicant as suitable based on these criteria were: 1) a property of 9.8 acres on Nelson Road owned by the Anderson Trust; and b) a property of 4.8 acres at 278 Nelson Road, both in the Town of Ludlow. The properties are adjacent to each other and located close to the VELCO Coolidge substation in the Town of Cavendish. Both properties would allow for interconnection to the Coolidge Substation through Nelson Road (a town unpaved road) and/or the VELCO ROW.

Both properties were brought under the control of the Applicant because of their proximity to the proposed Coolidge Substation POI, combined acreage, potential visual screening by existing vegetation, distance from residential structures, and the presence of only one small wetland on the site in a location that would not affect the siting of the converter station.

4.2 Routing Alternatives Considered

Below is a description of routing alternatives identified by the Applicant for the Project route.

4.2.1 Environmental Evaluation Criteria

For all practical alternatives which satisfied the Project's purpose and need, the Applicant completed a desktop analysis utilizing available Geographic Information System (GIS) data, combined with on the ground screening-level assessments to evaluate each alternative's potential impacts to aquatic and terrestrial resources and other sensitive resources such as rare, threatened and endangered (RTE) species, wildlife habitat or other resources. To conduct this analysis, TDI-NE employed the criteria presented in Table 4-1 below. The criteria were selected on their likely applicability to the Project's proposed construction and operation impacts as well as public availability of associated datasets.

TABLE 4-1
ASSESSMENT OF ROUTING ALTERNATIVES:
ENVIRONMENTAL IMPACT ANALYSIS CRITERIA

Criteria	
AQUATIC ECOSYSTEMS	
NWI and VSWI Wetlands	• Acres of wetlands within 100' of alternative • Acres of wetlands within 50' of alternative
Stream Crossings	• Number of stream crossings
NON-AQUATIC ECOSYSTEMS	
Rare, Threatened, and Endangered Species	• # of RTE species within 100' of alternative • # of RTE species within 50' of alternative • Acreage of RTE habitat within 100' of alternative • Acreage of RTE habitat within 50' of alternative
Uncommon Species	• # of Uncommon species within 100' of alternative • # of Uncommon species within 50' of alternative • Acreage of Uncommon species habitat within 100' of alternative • Acreage of Uncommon species habitat within 50' of alternative
Wildlife Habitat	• Acres of deer wintering areas within 100' of alternative • Acres of deer wintering areas within 50' of alternative
Anthropogenic Resources / Constraints	• # of Public Water sources within 500' of alternative • # of hazardous waste sites within 500' of alternative

These criteria are described as follows:

Wetlands

For the purposes of the desktop screening analysis, the Applicant analyzed both the National Wetlands Inventory (NWI) and the Vermont Significant Wetland Inventory (VSWI). These two datasets are described below.

NWI

The NWI was developed by the U.S. Fish and Wildlife Service (USFWS) and provides mapping of wetlands and deepwater habitats (streams, lakes, estuaries, etc.) on a USGS quad map base generally at a scale of 1:24,000. Only those wetlands and other waters that are visible on high altitude aerial photographs are mapped, and most maps date to the mid-1980s.

VSWI

The VSWI was developed by the Vermont Agency of Natural Resources (VANR) and provides the approximate location and configuration of wetlands. It is viewed as a slightly refined dataset in comparison to NWI for the State of Vermont.

While the wetland boundaries are not as accurate as one would expect for a field delineation, the datasets do provide an efficient means of comparing multiple alternatives. The analysis calculated acres of wetlands within 50 feet and 100 feet of the route alternatives.

Stream Crossings

River and stream crossings would be accomplished via trenching, HDD, or, if possible, attached to existing structures such as bridges. The specific design of each crossing would need to consider site-specific conditions and the Applicants would establish and implement a program whereby restoration would occur upon completion of the construction and stabilization activities. Clearing of existing vegetation in or near waterbodies would be limited to the area necessary to allow for completion of construction activities and to allow for reasonable access for long-term maintenance, but would represent an impact. This desktop analysis calculated the number of stream crossings for each of the route alternative, based on mapping developed by the U.S. Geological Survey.

Rare, Threatened and Endangered Species and Significant Natural Communities

The VFWD's Natural Heritage Inventory maintains a database of known rare, threatened and endangered species and natural (plant) communities in Vermont. In order to understand the potential impacts of the project on sensitive species and communities, the Applicant's desktop analysis evaluated not only the number of potential RTE species within proximity to the Project or an alternative (i.e. 50 feet and 100 feet) but also the approximate total acreage of the state-identified areas of potential occupancy for these species. The intent was to distinguish between, for example, an alternative that connected with the outer limits of the potential occupancy area of four species against one where the proposed Project would bisect the occupancy range of one species. For significant natural communities, the Applicants only evaluated the total acreage of these defined areas within proximity to the Project or an alternative.

Uncommon Species

The VFWD also maintains a database of known uncommon, rare, threatened and endangered animal and plant species and natural (plant) communities in Vermont. The data is described by VFWD as being "largely composed of uncommon species data (S3 Rank), but may also include poorly documented rare species (S1 or S2 Rank) or potentially significant natural communities". As with the RTE species, the Applicant's desktop analysis evaluated both the number of uncommon species within proximity to the Project or an alternative as well as the total acreage of the state-identified areas of potential occupancy for these species.

Wildlife Habitat

Deer wintering areas are utilized by white-tailed deer (*Odocoileus virginianus*) in Vermont. Being near the northern extreme of the white-tailed deer's range, functional winter habitats are considered essential to maintain stable populations of deer. Deer wintering areas are generally characterized by rather dense softwood (conifer) cover, such as hemlock, balsam fir, red spruce, or white pine. Occasionally deer wintering areas are found in mixed forest with a strong softwood component or even on west facing hardwood slopes in conjunction with softwood cover.

The original deer wintering areas mapping in Vermont was undertaken in the 1970s and early 1980s and was based on field visits and interviews with wildlife biologists and game wardens. In 2008, the boundaries of deer winter areas were refined by the VFWD using black and white leaf-off 1:5,000 scale orthophotography (1990-1999 and 1:24,000 scale 2003 NAIP (color, leaf-on)) imagery. VFWD District Biologists reviewed the areas from 2009 to 2010 for their concurrence from their knowledge of the site. The 2008 mapping project did not involve any fieldwork, but was based on aerial photography. The desktop analysis for potential routes calculated acres of mapped deer wintering areas within 50 feet and 100 feet of the Project route and the alternatives.

Public Water Source Protection Areas

To enhance regulatory protection in areas where groundwater resources are most productive and most vulnerable, Vermont has established Source Protection Areas (SPAs) for public drinking water sources. Zone 1 SPAs are defined as a 200-foot radius around a source, and Zones 2 and 3 for geologically delineated recharge areas. SPA boundaries have been located on USGS topographic maps by the Vermont Department of Environmental Conservation's Water Supply Division and historically by the Vermont Department of Health. The analysis calculated the number of public water sources within 500 feet of the route alternatives.

Hazardous Waste Sites

The VDEC maintains a point coverage database of known hazardous wastes sites or locations in Vermont where there has been hazardous materials released. Sites are located by comparing features on a paper map to features onscreen and estimating the correct location of the site relative to other features. VDEC staff knowledge of the location of each site is used to locate it on orthophotos. The analysis calculated the number of hazardous waste sites within 500 feet of the Project and route alternatives.

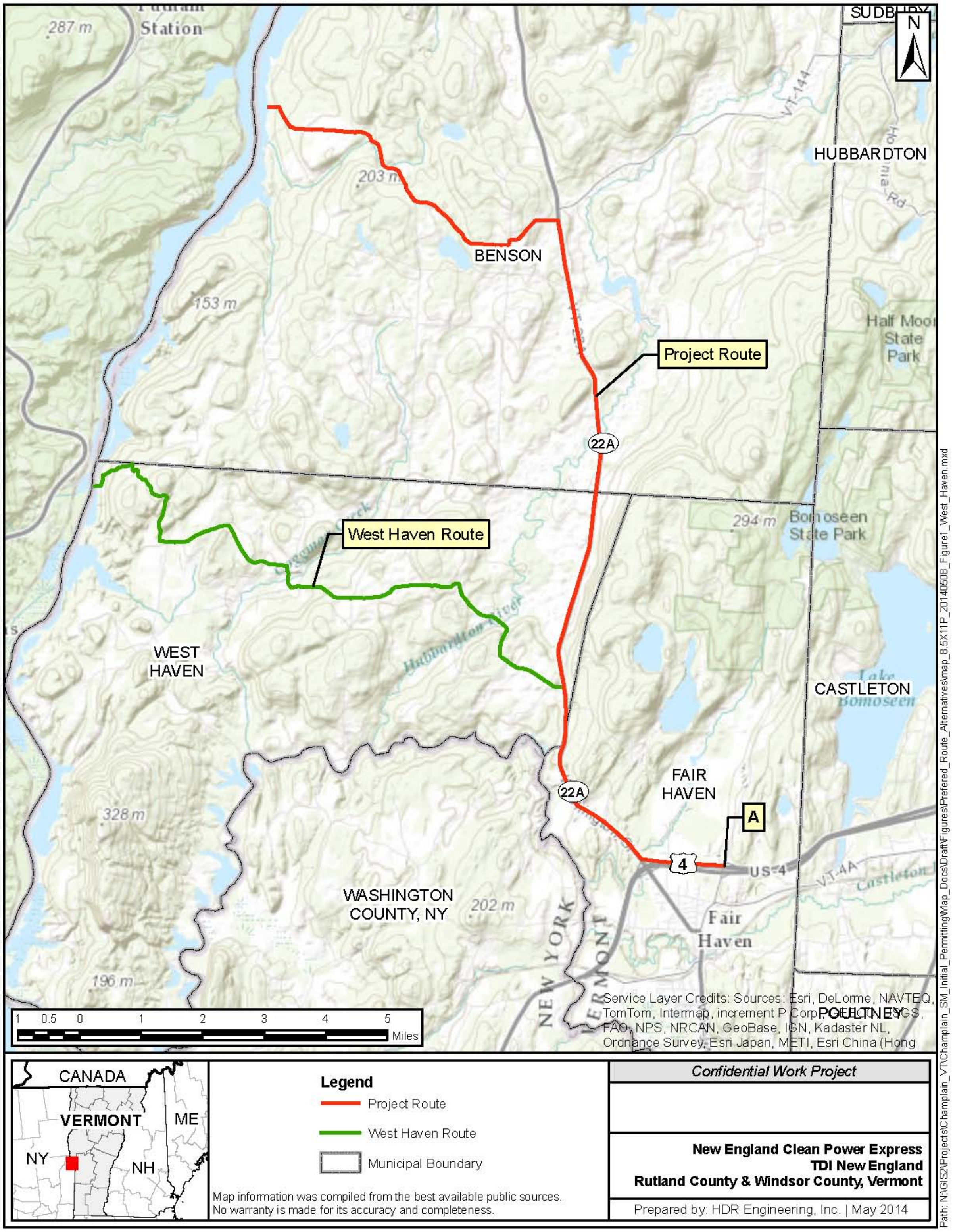
4.2.2 Routing Alternatives Considered

The Applicants evaluated the following routing alternatives to the Project route:

- Lake Segment Alternative - Lake Champlain to West Haven
- Western Segment Alternative – Railroad ROW
- Eastern Segment Alternative - Railroad / Roadway ROW
- Eastern Segment Alternative - VELCO ROW

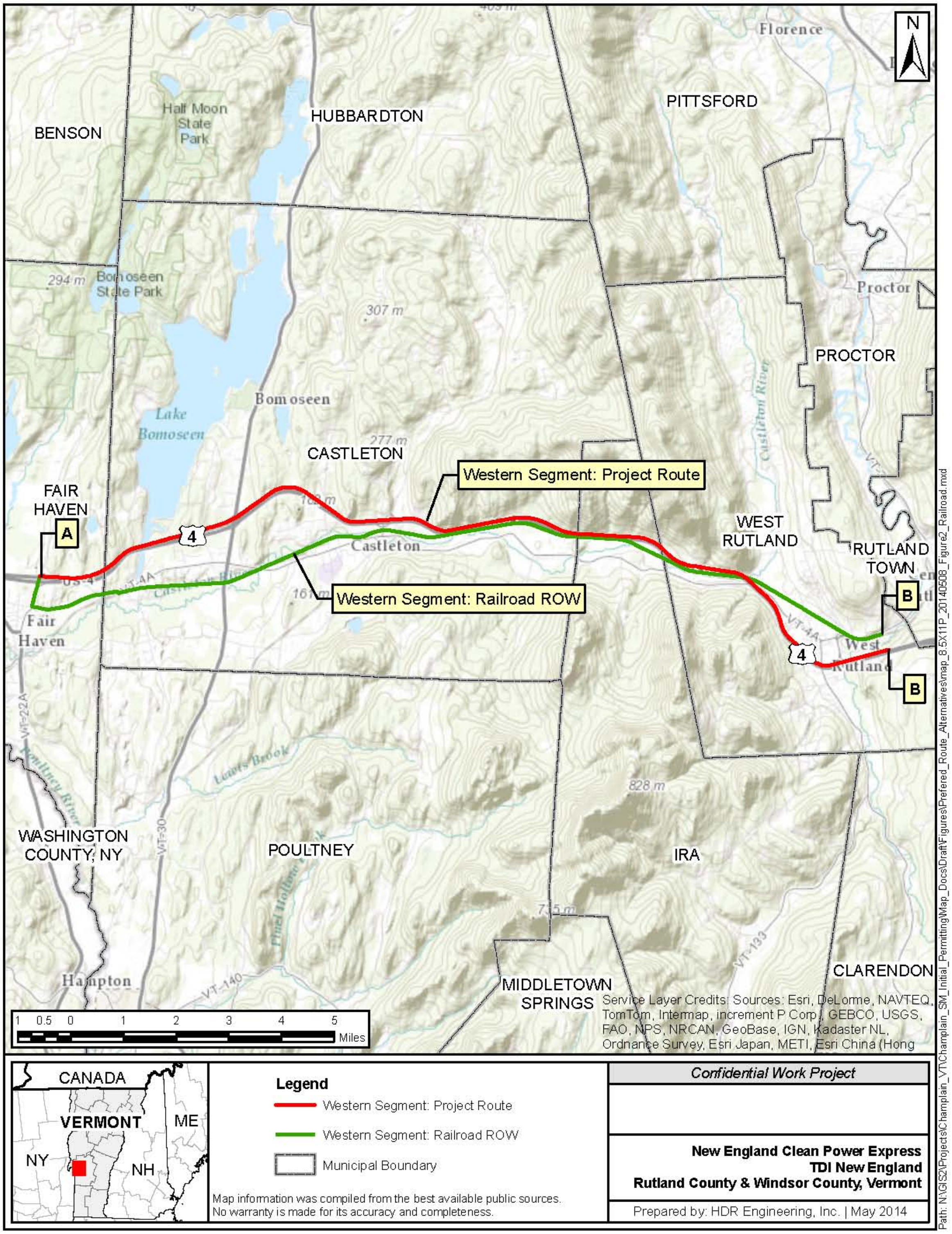
<u>Lake Segment Alternative - Lake Champlain to West Haven</u>: This alternative overlaps with the Project's proposed initial in-lake routing but would proceed for an additional 3 miles south in Lake Champlain to exit the lake via HDD in West Haven, Vermont rather than Benson, Vermont (see Figure 4-2). The alternative route would proceed east through West Haven undergrounded in town road ROWs for 8 miles before transferring to the Route 22A ROW and travelling south to Fair Haven for approximately 3.4 miles.

FIGURE 4-2
LAKE SEGMENT ALTERNATIVES



Western Segment Alternative – Railroad ROW: The Project route is compared to an alternative whereby the cables would leave Route 4 at the intersection with Route 4A and, after a short distance, enter the VTrans railroad ROW (see Figure 4-3). For this alternative, the cables would be laid within the railroad ROW for approximately 13 miles before intersecting with the Project route in West Rutland.

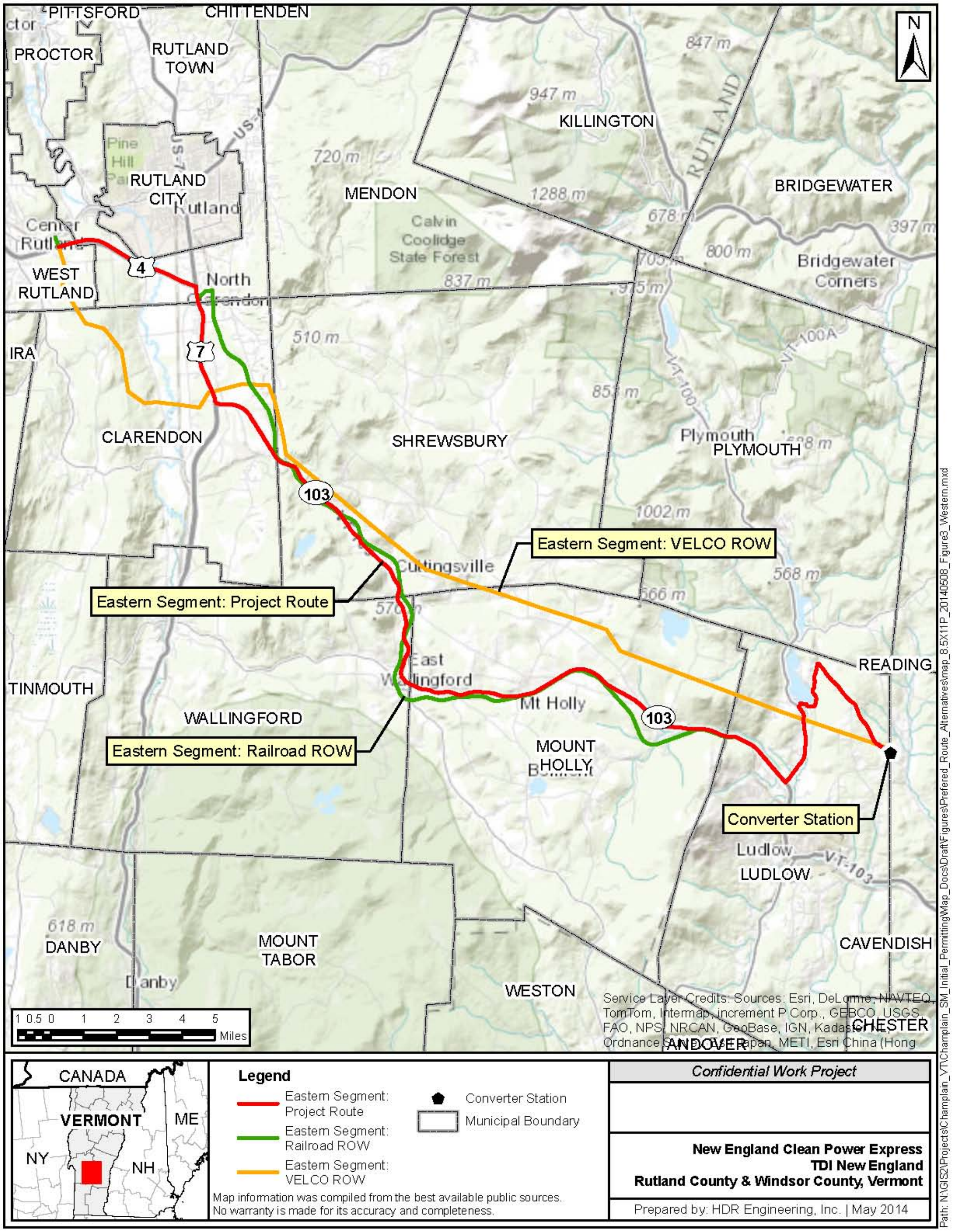
FIGURE 4-3
WESTERN SEGMENT ALTERNATIVES



Eastern Segment Alternative - Railroad / Roadway ROW: This alternative overlaps with the Project route within the Route 4 ROW in West Rutland to the east in the Town of North Clarendon (see Figure 4-4). The alternative would enter the railroad ROW and travel south, then east, to Route 103 in Ludlow, at which point it would overlap again with the Project route to reach the proposed converter station location. The total length of this alternative would be approximately 30.8 miles to the proposed converter station location, with approximately 23.3 miles in railroad ROW and 7.5 miles in roadway ROW.

Eastern Segment Alternative - VELCO ROW: This alternative would depart from the Project route in West Rutland and follows the VELCO ROW to the south / south east for approximately 24 miles to the proposed converter station location. See Figure 4-4.

FIGURE 4-4
EASTERN SECTION ALTERNATIVES



4.2.3 Impact Analysis

The results for the comparison of the impacts of the Project route against the identified alternatives are presented below.

4.2.3.1 Lake Segment Alternative

As shown in Table 4-2 below, the potential environmental impacts of the Project route are comparable to those of the Lake Champlain to West Haven alternative. The primary difference is the Project route exits Lake Champlain sooner, so that there are more overland impacts. While there is a greater acreage of wetlands in proximity to the Project route, TDI-NE is proposing to install the transmission system within unpaved local roads for the Project route to avoid or reduce the impact to wetlands and other nearby natural resources and other sensitive features. In addition, the three miles within Lake Champlain south of Benson include the Narrows of Lake Champlain Federal Navigation Channel. Construction in this area may require deeper burial (so as to locate the cable system below the authorized depth) and therefore a slower installation rate, which would increase the likely noise and visual impacts associated with construction.

TABLE 4-2
COMPARISON OF LAKE SEGMENT ALTERNATIVES

CRITERIA	PROJECT ROUTE	WEST HAVEN ALTERNATIVE
AQUATIC ECOSYSTEMS		
Acres of Wetlands within 50’ of route segment (VSWI)	2.7	0.8
Acres of Wetlands within 100’ of route segment (VSWI)	8.0	3.1
Acres of Wetlands within 50’ of route segment (NWI)	1.3	0.2
Acres of Wetlands within 100’ of route segment (NWI)	3.6	1.5
# of Stream Crossings	17	13
NON-AQUATIC ECOSYSTEMS		
# of RTE species within 50’ of route segment	7	9
# of RTE species within 100’ of route segment	7	10
Acres of RTE species within 50’ of route segment	23.0	14.1
Acres of RTE species within 100’ of route segment	29.2	27.2
Acres of Significant Natural Communities within 50’ of route segment	0	0.9
Acres of Significant Natural Communities within 100’ of route segment	0.03	1.8
# of Uncommon species within 50’ of route segment	6	7
# of Uncommon species within 100’ of route segment	6	8
Acres of Uncommon species within 50’ of route segment	13.3	8.4
Acres of Uncommon species within 100’ of route segment	26.5	16.6
Acres of Deer Wintering Areas within 50’ of route segment	0.3	6.3
Acres of Deer Wintering Areas within 100’ of route segment	1.5	14.3
# of Public Water Source Protection Areas - Groundwater within 500’ of route segment	2	0
# of Public Water Source Protection Areas – Surface Water within 500’ of route segment	0	0
# of Hazardous Waste Sites within 500’ of route segment	2	0

4.2.3.2 Western Segment (Railroad Alternative)

The Project route represents a comparable or lower potential environmental impact to aquatic resources than the Railroad Alternative. Although the two routes are essentially equivalent in terms of length, the acreage of wetlands within proximity to the Project route is significantly less than within the same distance of the Railroad Alternative. This finding is supported by a visual survey along the entire railroad route conducted by TDI-NE in early 2014, which indicated significant wetland acreage near the railroad embankment.

Additionally, field visits indicate that the construction along the railroad ROW could be difficult because in many segments the cable would need to be installed at the base of the Railroad embankment to be within the ROW but sufficiently distant from the tracks, which would likely result in greater wetland and other environmental impacts compared to the other alternatives.

TABLE 4-3
COMPARISON OF WESTERN SECTION ALTERNATIVES

CRITERIA	PROJECT ROUTE	RAILROAD / ROADWAY ALTERNATIVE
AQUATIC ECOSYSTEMS		
Acres of Wetlands within 50’ of route segment (VSWI)	0.7	60.8
Acres of Wetlands within 100’ of route segment (VSWI)	4.7	128.9
Acres of Wetlands within 50’ of route segment (NWI)	1.1	44.8
Acres of Wetlands within 100’ of route segment (NWI)	3.6	93.4
# of Stream Crossings	19	13
NON-AQUATIC ECOSYSTEMS		
# of RTE species within 50’ of route segment	3	1
# of RTE species within 100’ of route segment	3	2
Acres of RTE species within 50’ of route segment	9.1	0.4
Acres of RTE species within 100’ of route segment	18.4	0.9
Acres of Significant Natural Communities within 50’ of route segment	0	2
Acres of Significant Natural Communities within 100’ of route segment	0	5.1
# of Uncommon species within 50’ of route segment	0	4
# of Uncommon species within 100’ of route segment	1	4
Acres of Uncommon species within 50’ of route segment	0.0	5.8
Acres of Uncommon species within 100’ of route segment	0.1	12.2
Acres of Deer Wintering Areas within 50’ of route segment	0.0	0.0
Acres of Deer Wintering Areas within 100’ of route segment	3.7	0.0
# of Public Water Source Protection Areas - Groundwater within 500’ of route segment	8	10
# of Public Water Source Protection Areas – Surface Water within 500’ of route segment	0	0
# of Hazardous Waste Sites within 500’ of route segment	2	5

4.2.3.3 Eastern Segment Alternatives

The three alternatives considered within the Eastern segment appear to be comparable to each other in terms of the potential impacts to aquatic and non-aquatic ecosystems. However, there are uncertainties associated with the VELCO ROW alternative because VELCO and the underlying property owners have not given permission to TDI-NE to use the ROW.

TABLE 4-4
COMPARISON OF EASTERN SECTION ALTERNATIVES

CRITERIA	PROJECT ROUTE	VELCO ALTERNATIVE	RAILROAD / ROADWAY ALTERNATIVE
AQUATIC ECOSYSTEMS			
Acres of Wetlands within 50’ of route segment (VSWI)	7.9	21.2	16.0
Acres of Wetlands within 100’ of route segment (VSWI)	22.3	41.2	37.4
Acres of Wetlands within 50’ of route segment (NWI)	6.4	6.2	14.0
Acres of Wetlands within 100’ of route segment (NWI)	18.3	11.8	32.2
# of Stream Crossings	36	22	43
NON-AQUATIC ECOSYSTEMS			
# of RTE species within 50’ of route segment	4	8	4
# of RTE species within 100’ of route segment	4	8	4
Acres of RTE species within 50’ of route segment	12.0	26.0	18.6
Acres of RTE species within 100’ of route segment	23.8	50.8	37.2
Acres of Significant Natural Communities within 50’ of route segment	0	3.2	11.7
Acres of Significant Natural Communities within 100’ of route segment	1.8	5.5	23.4
# of Uncommon species within 50’ of route segment	2	6	3
# of Uncommon species within 100’ of route segment	2	7	3
Acres of Uncommon species within 50’ of route segment	2.6	1.6	9.2
Acres of Uncommon species within 100’ of route segment	4.7	2.7	11.4
Acres of Deer Wintering Areas within 50’ of route segment	11.0	0.0	19.9
Acres of Deer Wintering Areas within 100’ of route segment	26.6	4.5	47.1
# of Public Water Source Protection Areas - Groundwater within 500’ of route segment	7	4	6
# of Public Water Source Protection Areas – Surface Water within 500’ of route segment	0	0	0
# of Hazardous Waste Sites within 500’ of route segment	11	0	5

Section 5
Agency Actions, Regulatory Approvals, and Outreach

To construct and operate the Project, approvals and permits must be obtained from several state, federal, and municipal entities. This section summarizes these potentially applicable permitting requirements and approval processes. This section also describes the Applicant's public outreach efforts.

5.1 Federal Authorizations and Approvals

Department of Energy (DOE). Pursuant to Executive Order (EO) 10485 of 1953, as amended by EO 12038, and 10 CFR Section 205.320, the DOE has authority to review and approve the construction, operation, and interconnection of electric transmission facilities at the international border. DOE, therefore, will render a Presidential Permit decision for the proposed Project based on an evaluation of, among other things, potential impacts to electric reliability and environmental resources. To support its evaluation, DOE will prepare an environmental impact statement as required by the National Environmental Policy Act, and will consult with the U.S. Fish and Wildlife Service (FWS) and NOAA Fisheries as necessary with regard to any potential Project impacts to federal threatened and endangered species. As required by the National Historic Preservation Act, DOE also will consult with the Vermont Division for Historic Preservation regarding potential Project impacts to historic properties. Pursuant to the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, 16 U.S.C. 668-668c, DOE also will consult with the USFWS to determine if the Project is likely to impact migratory birds or bald and golden eagles.

U.S. Army Corps of Engineers (USACE). Pursuant to Section 10 of the Rivers and Harbors Act of 1899 (RHA), 33 U.S.C. Section 403, and Section 404 of the Clean Water Act, 33 U.S.C. Section 1344, USACE will issue a permit authorizing certain aspects related to the construction of the Project. Section 10 of the RHA requires USACE approval prior to the commencement of construction activities in navigable waters of the United States. CWA Section 404 requires USACE approval prior to discharging dredged or fill material into jurisdictional waters of the United States, including wetlands.

Federal Energy Regulatory Commission (FERC). The Project will be a public utility subject to regulation by FERC under the Federal Power Act (FPA). On March 10, 2014, the Federal Energy Regulatory Commission (FERC) issued an order conditionally authorizing TDI-NE to sell transmission rights for the Project at negotiated rates. 146 FERC ¶ 61,167 (2014). Pursuant to this order, TDI-NE must turn over operational control of the Project to the New England Independent System Operator (ISO-NE) and ISO-NE will operate the transmission line pursuant to its FERC-approved open access transmission tariff.

US Federal Highway Administration (FHA). Because Route 4 and Route 7 are classified as limited access roadways that were constructed in part with federal funds, the FHA must concur with the installation of any utilities within these ROWs.

US Coast Guard (USCG). While the USCG does not have a direct regulatory role in siting the Project, TDI-NE also intends to consult with the USCG throughout all stages of Project development to identify methods to avoid or minimize impacts on maritime navigation.

5.2 Vermont Authorizations and Approvals

Vermont Public Service Board (VPSB). Construction and operation of the Project will require a Certificate of Public Good (30 V.S.A. Section 248) from the VPSB, determining that the Project will promote the general good of the State. In addition, the Applicant will be required to obtain a Certificate of Public Good in order for it to own and operate a transmission-related facility in Vermont (30 V.S.A. Section 231).

Vermont Department of Environmental Conservation (VDEC). VDEC is responsible for processing requests for several permits and approvals. These include:

- 401 Water Quality Certificate (CWA Section 401): Required when a federal permit, license or approval related to a discharge to navigable waters is involved.

- Construction Stormwater Permit (10 V.S.A. Chapter 47 and 33 U.S.C. §1251 et. seq): Required if more than one acre of ground disturbance is proposed to occur during the construction of a project.

- Operational Stormwater Permit (10 V.S.A. Chapter 47): Required if more than one acre of impervious surface is proposed to be constructed.

- Shoreline Encroachment Permit (29 V.S.A. Chapter 11): Required when placement of material or structure beyond the shoreline of lakes and ponds which are public waters, or which alters the land underlying such lakes and ponds. A review under the Public Trust Doctrine is also conducted as part of this permit process.

- Stream Alteration Permit (10 VSA Chapter 41): Required when there is the movement, excavation or fill involving 10 or more cubic yards annually in any watercourse with a drainage area greater than 10 square miles or in any designated outstanding resource water. Approval also required for municipal or private stream crossings greater than 1.0 square mile watershed.

- Vermont Wetland Permit (10 V.S.A. Chapter 37): Required when work is being completed in Vermont Class I or Class II wetlands or their buffers.

- Air Pollution Control Permit (10 V.S.A. Section 556, 556a): Although not likely, the VDEC will need to determine if an air permit is required for construction and operation of the facility.

Vermont Agency of Natural Resources (VANR). If it is determined that a state-listed threatened or endangered species could be taken by the Project, a Threatened and Endangered Takings Permit will be required from VANR (10 V.S.A. Chapter 123).

Vermont State Historic Preservation Office (SHPO). Under Section 106 of the National Historic Preservation Act (NHPA), 16 U.S.C. Section 470f, and its implementing regulations, the Vermont Division of Historic Preservation, which acts as the State Historic Preservation Office (SHPO) and is under the Vermont Agency of Commerce and Community Development, is authorized to review all projects that could have a significant impact on historical structures or protected archaeological sites (22 V.S.A. Chapter 14).

Vermont Agency of Transportation (VTrans). The VTrans must issue a Highway Right of Way Permit for any improvements or work within a state ROW pursuant to 19 V.S.A. Section 1111. The VTrans must also approve the location of a utility line within a state ROW under the same state statute. VTrans typically issues a Notice of Intent for purposes of the Section 248 proceedings and then issues the actual permit once those proceedings are complete. An Overweight/Oversized Load Permit pursuant to 23 VSA § 1400 and § 1402 will also be required from VTrans for vehicles which exceed legal load, height or length limits.

Vermont Department of Public Safety (VDPS). The VDPS must issue a Fire Safety Construction Permit pursuant to 20 V.S.A. Ch. 173 § 2730 and Vermont Fire and Building Safety Rules 2006 for the converter station building. This approval must be granted at least 15 days prior to occupancy.

5.3 Municipal Authorizations and Approvals

Project governed by Certificates of Public Good under 30 V.S.A. Section 248 are exempt from municipal zoning. However, for any improvements or work within a town road ROW, a Highway Right of Way Permit is required from the affected town (19 V.S.A. Section 1111).

5.4 Regulatory Schedule

Table 5-1 below presents the Applicant's anticipated schedule for major milestones associated with the required regulatory approvals and permits.

TABLE 5-1
TDI-NE'S PROPOSED PERMITTING SCHEDULE

		2013	2014				2015				2016		2017	2018	2019
Permit / Approval	**Agency**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2-Q4**			
Negotiated Rate Authority	FERC		Order Filed	Order Received											
I-39 Interconnection Agreement	ISO-NE	Request Filed							Request Approved						
Presidential Permit	US DOE			File Application	Public Scoping		DEIS Issued		FEIS Issued	Permit Issued					
Army Corps Individual Permit	US ACOE				File Application		Notice Issued			Permit Issued					
VT Section 248	VT PSB					File Petition					Permit Issued				
VT 401 Water Quality Cert.	VT ANR					File Application				Permit Issued					
VT Stormwater Permits	VT ANR					File Application				Permit Issued					
VT Wetland Permit	VT ANR					File Application				Permit Issued					
VT Stream Alteration Permit	VT ANR					File Application				Permit Issued					
VT Shoreland Encroachment Permit	VT ANR					File Application				Permit Issued					
1111 Permit	VTrans				File Application	Receive NOI					Permit Issued				
Pre-Construction															
Construction															
Operation															

5.5 Public Outreach and Agency Coordination

5.5.1 Outreach Initiatives to Date

Since announcing the Project in late October, 2013, TDI-NE has made a concerted effort to initiate outreach with interested and potentially impacted stakeholders (including local landowners), town leaders, elected officials, resource agency representatives, local businesses, Vermont utilities, trade associations, regional committees and Vermont citizens (see Table 5-2 below). In sum, TDI-NE has engaged with approximately 70 different parties in Vermont and New England at more than 100 meetings or briefings. TDI-NE will continue to execute its outreach as detailed below throughout 2014.

TABLE 5-2
REPRESENTATIVE TABLE OF OUTREACH EFFORTS

STAGE 1: October, 2013 – February, 2014 (COMPLETE)	
Nonprofits	Conservation Law Foundation, VT Natural Resources Council, Lake Champlain International, Lake Champlain Basin Program, Lake Champlain Committee, Lake Champlain Maritime Museum, VT Public Interest Research Group
Utilities	VELCO, VT Public Power Supply Authority, Burlington Electric Department, Vermont Electric Department, Washington Electric Department, Ludlow Electric Light Department, Green Mountain Power, ISO-NE
Businesses / Trade Groups	Renewable Energy VT, Okemo Chamber of Commerce, All Earth Renewables, Vermont Energy Partnership, The Business Roundtable, Lake Champlain Chamber of Commerce, Associated Industries of VT, VT Chamber of Commerce
Elected Officials	Office of VT Governor Shumlin, VT Lt. Governor Phil Scott, VT Speaker Smith, VT Representative Klein, VT Representative Deen, VT Representative Devereaux, VT Representative Stevens, VT Senator Hartwell, VT Senator Flory, Office of US Senator Leahy, Office of US Senator Sanders, Office of US Representative Welch, NH Governor’s Office, MA Governor’s Office
Agencies	VT Agency of Natural Resources, VT Agency of Transportation, VT Agency of Commerce & Community Development, Vermont Department of Environmental Conservation, Vermont Department of Public Service, Vermont Fish & Game Department, US Army Corps of Engineers, US Department of Energy, US Coast Guard, MA Department of Energy Resources, CT Department of Energy and Environmental Protection
STAGE 2: March, 2014 – July, 2014 (Ongoing)	
Towns (All meetings listed have occurred)	Alburgh Select Board, Benson Select Board & Road Commissioner, West Haven Select Board, Fairhaven Town Manager & Road Commissioner, Castleton Town Manager & Select Board, Ira Select Board, West Rutland Town Manager & Select Board, Rutland Town Manager, Clarendon Select Board, Shrewsbury Town Clerk, Wallingford Select Board, Mt. Holly Select Board, Ludlow Town Manager & Select Board, Abutters in Alburgh, Ludlow and Benson
Regional Organizations	Vermont Regional Development Corporations, Vermont Regional Planning Commissions (Counties of Rutland, South Windsor, Addison, Chittenden, Northwest County Regional Planning Commissions)

Outreach Plan and Accomplishments

October, 2013 – February, 2014 > Outreach Material Development: TDI-NE launched a website in October, 2013, created a one-page fact sheet and developed a Project Brochure (see Appendix E). The website is continually updated to reflect any public filings, schedule changes or notable press stories.

October, 2013 – March, 2014 > Stage 1: Initial Stakeholder Outreach: Initial outreach for the Project focused on nonprofit organizations, state and federal Agencies, Vermont utilities and elected officials. The primary goal of this outreach was to brief these entities on the Project, garner stakeholder feedback, and identify any material concerns with the proposed Project. Once this consultation was completed, Stage 2 of the outreach plan commenced.

March, 2014 – July, 2014 Stage 2: Local and Regional Outreach: Outreach during this stage has and will focus on providing information and soliciting feedback on the Project with affected towns, abutters (i.e. those people with land adjacent to the road portion of the Project) and regional committees, such as Regional Development Corporations and Planning Commissions. Information sharing with the towns has generally occurred at the Select Board or Town Manager level, but Road Commissioners and abutters have also been contacted. In addition, letters to all potential non-Highway project abutters and the Towns have been or will be sent to provide additional information on the Project and invite them to Public Information Meetings. Regional Planning Commissions and Environmental Organizations will be the focus of continued local outreach. TDI-NE is committed to meeting with any interested party regarding the Project.

August, 2014 – September, 2014 > Stage 3: Public Information Meetings: As mentioned above, public information meetings will be held at the local level and will provide a forum for information exchange between TDI-NE and the town citizens. Based on feedback to date from many of the towns, these meetings will likely be scheduled later this summer or early fall after the field survey season and once engineering of the proposed cable route is advanced. TDI-NE also is working with VTrans to provide information regarding the installation and operation of the Project. TDI-NE is committed to incorporating feedback from the public into the project design and sharing project updates with the Towns and other interested parties.

Summer, 2014 - 2015 > Stage 4: Public Scoping: As part of the NEPA process, and potentially as part of the Section 248 process, formal public meetings will be scheduled by the DOE and State of Vermont.

Section 6.0
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VERIFICATION

I, WILLIAM S. HELMER, being duly sworn on his own, do hereby affirm that I am Executive Vice President and General Counsel of Champlain VT, LLC, d/b/a TDI New England, and have authority to file the foregoing document, and that I have examined the statements contained therein and that all such statements are true and correct to the best of my knowledge, information, and belief.

William S. Helmer
Executive Vice President
and General Counsel

Subscribed and sworn to before me this 16th day of May, 2014.

Nancy A. Clarke
My Commission Expires June 19, 2015

NANCY A. CLARKE
Notary Public, State Of New York
Qualified In Rensselaer County
No. 01CL5045361
Commission Expires June 19, 20 15

APPENDICES

APPENDIX A
OPINION OF COUNSEL

CHAMPLAIN VT, LLC

d/b/a TDI NEW ENGLAND

I, William S. Helmer, Executive Vice President and General Counsel of Champlain VT, LLC ("CHVT") d/b/a TDI New England ("TDI-NE"), do hereby state and give my opinion pursuant to 10 CFR §205.322(a)(6) as follows:

1. I have examined and am familiar with CHVT's Limited Liability Company Agreement;

2. I have examined and am familiar with the contents of CHVT's Application for Presidential Permit, to which this Opinion is attached as an Exhibit; and

3. I am of the opinion that the operation and maintenance of the facilities, as proposed in said Application, is within the company power of CHVT as set out in CHVT's Limited Liability Company Agreement.

Dated: May 16, 2014

CHAMPLAIN VT, LLC
d/b/a TDI NEW ENGLAND

William S. Helmer

William S. Helmer, Esq.
Executive Vice President
and General Counsel

APPENDIX B
MAPPED FLOODPLAINS WITHIN PROXIMITY TO PROJECT

FLOODPLAINS OCCURING WITHIN PROXIMITY TO PROJECT

Closest Milepost	Flood Zone	FIRM Panel Number	Date Effective
0.5	A2	5002210005A	3/16/1981
97.8	A	50021C0155D	8/28/2008
99.9	A	50021C0155D	8/28/2008
101.2	A	50021C0155D	8/28/2008
103.6	A	50021C0160D	8/28/2008
105.1	A	50021C0170D	8/28/2008
110.6	A	50021C0332D	8/28/2008
113.1	A	50021C0351D	8/28/2008
115.3	A	50021C0352D	8/28/2008
115.8	A	50021C0356D	8/28/2008
116.9	AE	50021C0356D	8/28/2008
116.9	AE	50021C0356D	8/28/2008
116.9	AE	50021C0356D	8/28/2008
121.9	A	50021C0380D	8/28/2008
123.5	AE	50021C0383D	8/28/2008
123.9	A	50021C0383D	8/28/2008
126.7	AE	50021C0403D	8/28/2008
126.8	AE	50021C0403D	8/28/2008
127.1	AE	50021C0403D	8/28/2008
128.3	A	50021C0404D	8/28/2008
129.8	A	50021C0415D	8/28/2008
134.6	AE	50021C0419D	8/28/2008
134.8	AE	50021C0419D	8/28/2008
135.9	AE	50021C0557D	8/28/2008
136	AE	50021C0557D	8/28/2008
136.5	AE	50021C0557D	8/28/2008
137	AE	50021C0557D	8/28/2008
137	AE	50021C0576D	8/28/2008
137.6	AE	50021C0559D	8/28/2008
137.9	AE	50021C0578D	8/28/2008
138.1	AE	50021C0578D	8/28/2008
138.2	AE	50021C0559D	8/28/2008
138.2	AE	50021C0559D	8/28/2008
138.6	AE	50021C0559D	8/28/2008
139.9	A	50021C0578D	8/28/2008
141.5	A	50021C0579D	8/28/2008
145.4	A	50021C0595D	8/28/2008

Closest Milepost	Flood Zone	FIRM Panel Number	Date Effective
145.4	A	50021C0585D	8/28/2008
147.9	AE	50021C0615D	8/28/2008
148	AE	50021C0615D	8/28/2008
148.1	AE	50021C0615D	8/28/2008
148.2	AE	50021C0615D	8/28/2008
148.3	AE	50021C0615D	8/28/2008
148.4	AE	50021C0615D	8/28/2008
148.9	AE	50021C0615D	8/28/2008
149	AE	50021C0615D	8/28/2008

APPENDIX C
MAPPED WETLANDS WITHIN PROXIMITY TO PROJECT

NATIONAL WETLAND INVENTORY WETLANDS OCCURING WITHIN PROXIMITY TO PROJECT

Closest Milepost	Class	System	Area within ROW (acres)	Crossing Length (feet)
0.5	Unconsolidated Bottom	lacustrine	0.45	24.0
98.1	Unconsolidated Bottom	lacustrine	0.04	0.0
99.9	Emergent	palustrine	0.09	0.0
100.3	Forested	palustrine	0.53	162.0
100.8	Forested	palustrine	1.39	366.8
101.2	Forested	palustrine	0.63	0.0
102	Unconsolidated Bottom	palustrine	0.03	0.0
103.4	Emergent	palustrine	0.21	0.0
106.6	Forested	palustrine	0.03	0.0
109.7	Emergent	palustrine	0.21	70.8
109.8	Emergent	palustrine	0.03	0.0
110.5	Emergent	palustrine	0.60	0.0
111.3	Forested	palustrine	0.08	0.0
113.1	Unconsolidated Bottom	lacustrine	1.39	298.7
114.2	Forested	palustrine	0.00	0.0
115.3	Emergent	palustrine	0.06	0.0
116.4	Forested	palustrine	0.45	0.0
122	Emergent	palustrine	0.54	0.0
122.1	Emergent	palustrine	0.26	0.0
123.1	Scrub-Shrub	palustrine	0.92	0.0
126.7	Unconsolidated Bottom	palustrine	0.26	118.9
127	Forested	palustrine	0.94	207.0
127.3	Forested	palustrine	3.80	942.5
129.8	Forested	palustrine	0.17	0.0
134.6	Scrub-Shrub	palustrine	0.02	0.0
137.1	Unconsolidated Shore	riverine	0.00	0.0
137.6	Unconsolidated Shore	riverine	0.07	0.0

139.4	Unconsolidated Bottom	palustrine	0.21	0.0
141.8	Scrub-Shrub	palustrine	1.51	0.0
142.4	Scrub-Shrub	palustrine	0.19	0.0
143.7	Scrub-Shrub	palustrine	0.40	0.0
143.8	Unconsolidated Bottom	palustrine	0.03	0.0
144.1	Scrub-Shrub	palustrine	0.54	23.3
144.8	Scrub-Shrub	palustrine	1.42	84.6
145.4	Scrub-Shrub	palustrine	0.57	0.0
149	Unconsolidated Bottom	lacustrine	0.03	0.0
150.8	Forested	palustrine	0.19	0.0
152.1	Scrub-Shrub	palustrine	3.04	722.8

NATIONAL WETLAND INVENTORY WETLANDS OCCURING WITHIN PROXIMITY TO PROJECT

Closest Milepost	Class	Area within ROW (acres)	Crossing Length (feet)
99.5	2	0.45	0.0
99.9	2	0.19	0.0
100.3	2	0.88	261.8
100.5	2	0.27	0.0
100.8	2	1.42	371.0
101.2	2	1.15	0.0
102	2	0.06	0.0
103.4	2	0.26	0.0
103.6	2	0.15	0.0
105.2	2	0.02	0.0
105.2	2	0.59	0.0
106.6	2	0.03	0.0
106.7	2	0.24	0.0
106.9	2	0.33	0.0
109	2	0.65	150.6
109.7	2	0.22	72.7
109.8	2	0.02	0.0
110	2	0.03	0.0
110.1	2	0.12	0.0
110.6	2	0.91	159.8
112	2	0.34	0.0
112.2	2	0.49	104.1
113.5	2	0.00	0.0
114	2	0.01	0.0
114	2	0.06	0.0
114.2	2	0.03	0.0
114.2	2	0.52	0.0
115.3	2	0.13	0.0
116.3	2	1.02	164.7
116.6	2	0.26	0.0
118	2	0.33	0.0
120.3	2	0.00	0.0

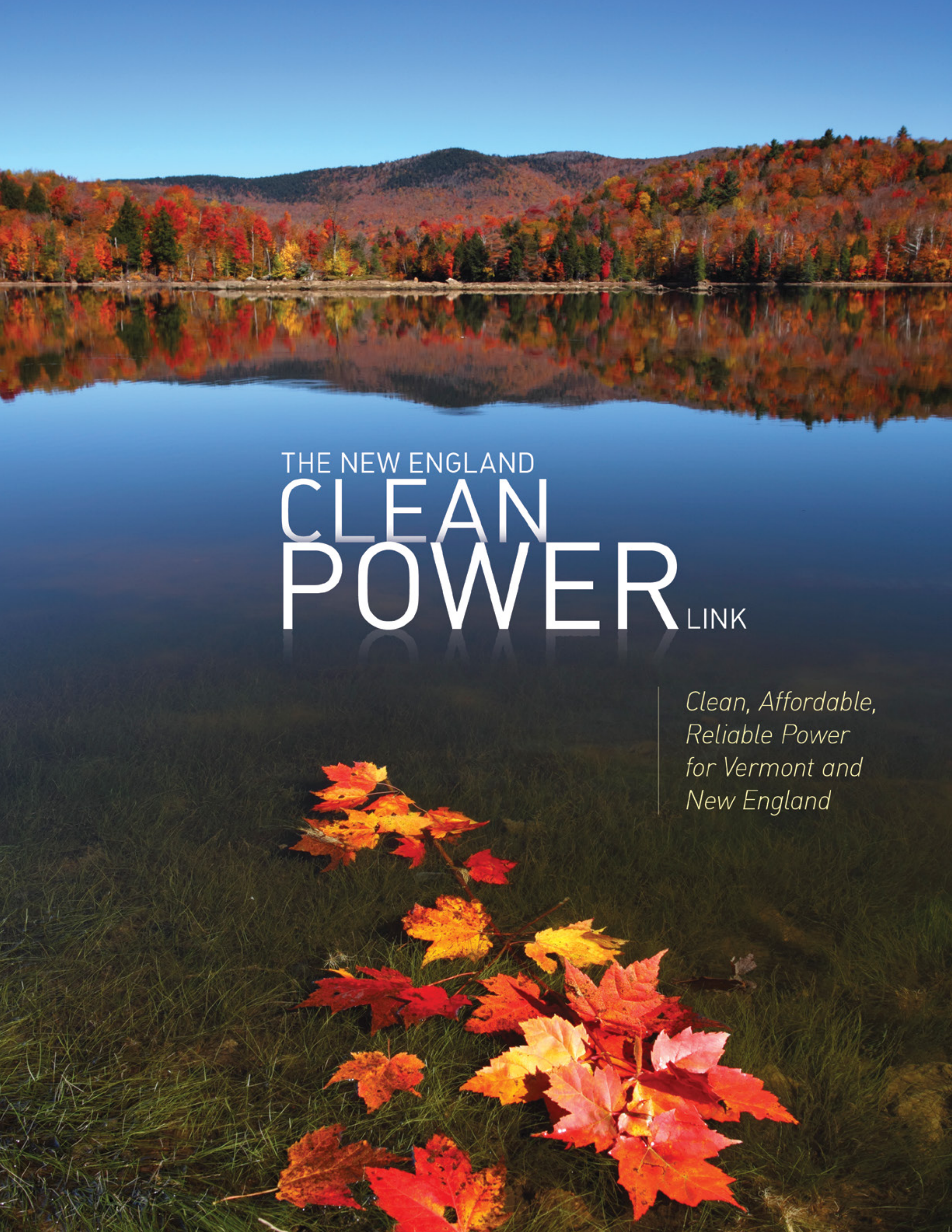
Closest Milepost	Class	Area within ROW (acres)	Crossing Length (feet)
121.9	2	0.05	0.0
122.1	2	0.66	0.0
123.1	2	0.83	0.0
123.7	2	0.28	0.0
125.4	2	0.38	0.0
126.7	2	0.54	169.2
127.3	2	5.97	1113.1
127.4	2	0.08	0.0
131	2	0.09	0.0
132	2	1.26	0.0
134.6	2	0.04	0.0
134.7	2	0.40	0.0
136.8	2	0.88	71.6
137.1	2	0.00	0.0
139.4	2	0.36	69.2
139.9	2	1.82	0.0
141.5	2	0.99	0.0
141.6	2	1.29	0.0
143.7	2	0.61	0.0
143.8	2	0.05	0.0
144.1	2	0.90	182.8
144.2	2	0.10	0.0
144.6	2	0.04	0.0
144.8	2	1.96	450.0
145.4	2	0.72	0.0
150.8	2	0.44	10.2
152.1	2	3.42	797.9

APPENDIX D
NATIONAL REGISTER OF HISTORIC PLACES SITES WITHIN PROXIMITY TO PROJECT

NATIONAL REGISTER OF HISTORIC PLACES SITES WITHIN PROXIMITY TO THE PROJECT

Site Name	Distance from Proposed Project Route
Benson Village	0.25 miles
Cold River Bridge	0.25 miles
East Clarendon Railroad Station	50'
Laurel Glen Mausoleum--Laurel Hall	0.25 miles
Mountain View Stock Farm	50'
Smith, Simeon, House	0.25 miles

APPENDIX E
PUBLIC INFORMATION BROCHURE



THE NEW ENGLAND CLEAN POWER LINK

Clean, Affordable, Reliable Power for Vermont and New England

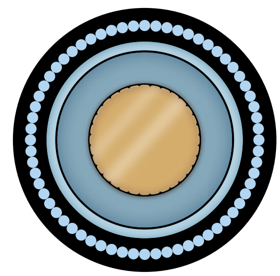
WHAT IS THE NEW ENGLAND CLEAN POWER LINK?

The New England Clean Power Link is a proposed 1,000 MW High Voltage Direct Current (HVDC) transmission line that would deliver clean, affordable hydropower to Vermont and the New England marketplace. The privately financed line would be submerged in Lake Champlain and buried in existing rights of way and would run from the Canadian border to a converter station that would be built in Ludlow, VT.

HOW WILL THE CLEAN POWER LINK WORK?

Two small, five-inch-diameter cables will carry the power. The cables are state-of-the-art, completely solid, do not contain any liquids or gels, and are equipped with fiber-optic technology that can detect any operating issues and automatically shut off in an instant. After installation, the ground is restored and the cables are never seen.

Once installed, the cables are virtually maintenance free. Similar cables have been in use all over the world for more than 60 years. There would be no overhead lines and no new transmission towers.



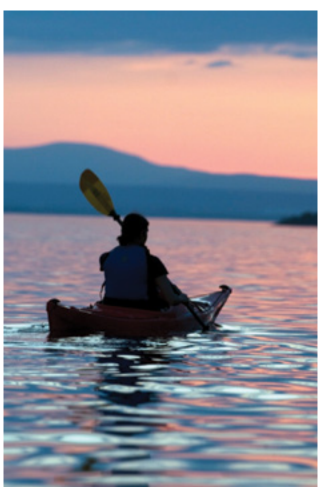
Cross-section of five-inch- diameter HVDC cable used in this project

WHAT ARE THE BENEFITS?

The Clean Power Link will:

- lower and stabilize power prices to help consumers and to fuel economic growth;
- reduce emissions to help fight climate change;
- diversify the region's energy sources;
- create a new Vermont-specific public benefit fund;
- bring millions of dollars of new tax revenue to Vermont, and
- boost the economy with hundreds of construction jobs.

In addition, ratepayers would be protected because the financial risk that comes with developing and constructing the project will be with TDI New England and not consumers.



WHY IS THIS PROJECT BEING PROPOSED?

- The New England marketplace needs fuel source diversity. The fuel mix now includes more than 50 percent natural gas generation. This is likely to increase with the announced retirements of several nuclear and coal facilities in the Northeast. The Clean Power Link will allow increased imports of clean hydropower, which will benefit consumers and the electric grid, and help develop and integrate other renewable power sources into the electric grid.
- The New England governors have expressed a strong desire to reduce greenhouse gases and provide affordable, clean, and reliable hydroelectricity to power New England businesses and homeowners.
- Scheduled retirements of existing generation in Vermont will create available capacity in the state's transmission system in southern Vermont, making it a key interconnection point to the regional electric grid.

Affordable Power = Economic Benefits

$2B
IN ESTIMATED ENERGY SAVINGS TO NEW ENGLAND OVER THE FIRST 10 YEARS OF SERVICE, $100 MILLION OF WHICH WILL GO TO VERMONT

100s
OF CONSTRUCTION JOBS CREATED

$
NEW STATE AND LOCAL TAX REVENUE FOR VERMONT

$
NEW VERMONT PUBLIC BENEFIT FUND

100%
FINANCED BY THE PRIVATE SECTOR

Clean Power = Healthier Environment

SAFE, MINIMALLY INVASIVE, BURIED TRANSMISSION—NO OVERHEAD LINES

CLEAN, RENEWABLE HYDROPOWER TO LOWER GREENHOUSE GAS EMISSIONS

BUILT TO THE HIGHEST ENVIRONMENTAL STANDARDS TO PROTECT LAKE CHAMPLAIN, VERMONT'S NATURAL RESOURCES, AND LOCAL COMMUNITIES

Safe, Reliable Power = Stronger Grid

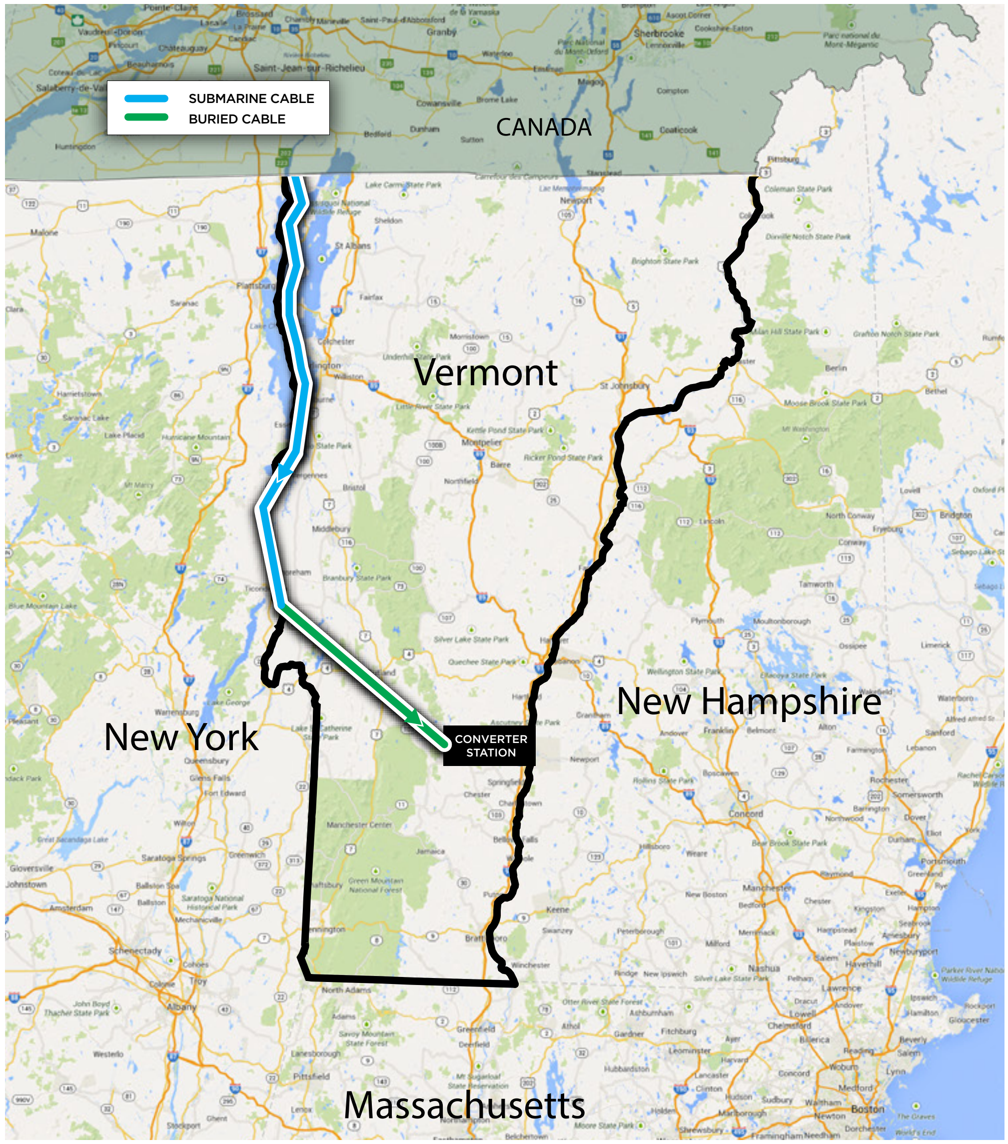
ENHANCE THE REGION'S FUEL DIVERSITY

LOWER/PREDICTABLE ELECTRICITY PRICES

STATE-OF-THE-ART SMART GRID TECHNOLOGY

TRANSMISSION LINES PROTECTED FROM NATURAL DISASTERS

"BLACK START" CAPABILITY CAN QUICKLY RESTART THE ELECTRIC GRID IN CASE OF A BLACKOUT



ABOUT TDI NEW ENGLAND

TDI New England is a Blackstone portfolio company. Blackstone is a leader in alternative asset management with over $248 billion currently under management. TDI New England is made up of the same leadership team currently developing the Champlain Hudson Power Express in New York State.

The developers have a strong track record of working in partnership with local communities, residents, elected officials, and other stakeholders to develop projects that meet unique energy needs of growing economies, combating climate change while minimizing local impacts.

More information on the project and the company is available at www.necplink.com.

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