NEW ENGLAND CLEAN POWER LINK PROJECT

NARRATIVE ON PROJECT DESCRIPTION AND PURPOSE

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Champlain VT, LLC, d/b/a TDI-New England (Applicant or TDI-NE) is submitting an application to the United States Army Corps of Engineers (USACE) to obtain construction permits pursuant to Section 404 of the Clean Water Act (Section 404) and Section 10 of the Rivers and Harbors Act (Section 10) (USACE Application) for the proposed New England Clean Power Link Project (NECPL Project). The narrative below discusses the NECPL Project's purpose and describes the activities involved.

1.0 PROJECT PURPOSE

The NECPL Project's purpose is:

> The delivery of clean, renewable power from Canada into Vermont and the markets operated by the New England Independent System Operator (ISO-NE) through a new 1,000 MW HVDC underground/underwater merchant transmission line.

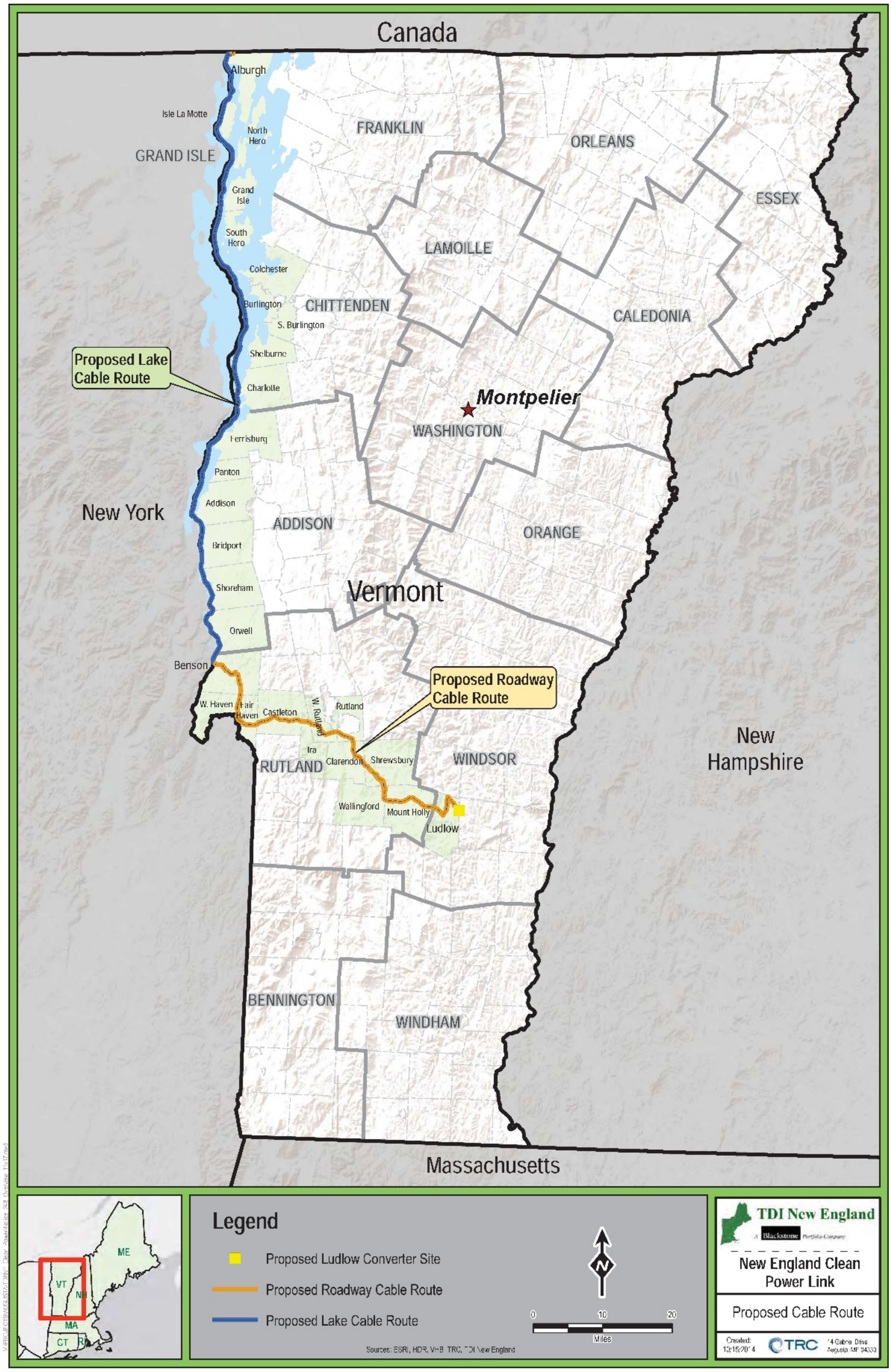
The NECPL Project is needed to further the New England States' energy and environmental policy goals, diversify fuel supply in ISO-NE, lower energy prices for consumers, reduce carbon emissions in New England, improve the economic competitiveness of the New England States, and provide economic benefits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

2.0 PROJECT DESCRIPTION

2.1 Overview

The NECPL Project would cross the United States-Canada border in the United States in the Town of Alburgh, Vermont, and extend approximately 154.1 miles south through Vermont to interconnect with the transmission system operated by ISO-NE. The Applicant would construct, operate, and maintain the aquatic (underwater) and terrestrial (underground) transmission line system that would connect to a converter station in Ludlow, Vermont and ultimately terminate at a substation located in Cavendish, Vermont. Although primarily underwater or underground, some specific project components of the transmission system, including the converter station, would be aboveground. Figure 2-1 depicts, in general, the proposed route of the NECPL Project. Location maps are provided in Attachment A.

FIGURE 2-1
PROJECT OVERVIEW



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 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 Town of Cavendish, Vermont owned by the Vermont Electric Power Company (VELCO). This underground circuit will be approximately 0.3 miles in length.

The transmission line will connect to an HVDC transmission line in the Canadian Province of Québec. The new HVDC converter station will convert the electrical power from direct current (DC) to alternating current (AC) in Canada.

2.2 Description of the Route Segments

For the purpose of facilitating an understanding of the environmental settings associated with the 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. The HVDC transmission system will then enter Lake Champlain via horizontal directional drilling (HDD) and be installed beneath (or, in deeper waters, be laid on) the bed of Lake Champlain lake bed for approximately 97.6 miles entirely within the jurisdictional waters of the State of Vermont. The cables will exit the Lake via HDD in the Town of Benson, Vermont. Cables that are laid on the lake bed are anticipated to settle an average of 1 foot below the surface over time. This portion of the route comprises the Lake Champlain Segment (see Figure 2-2).

**FIGURE 2-2
LAKE CHAMPLAIN SEGMENT**

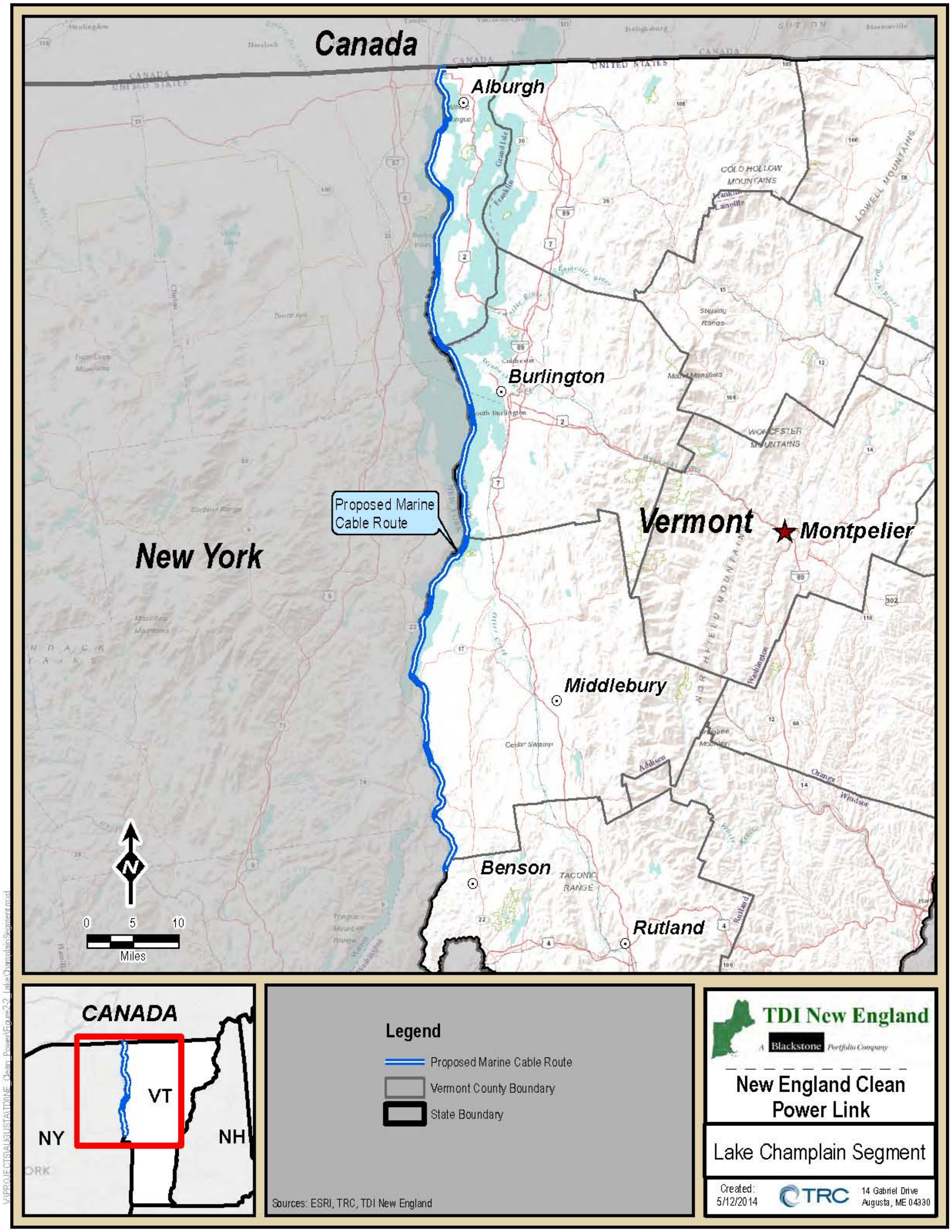
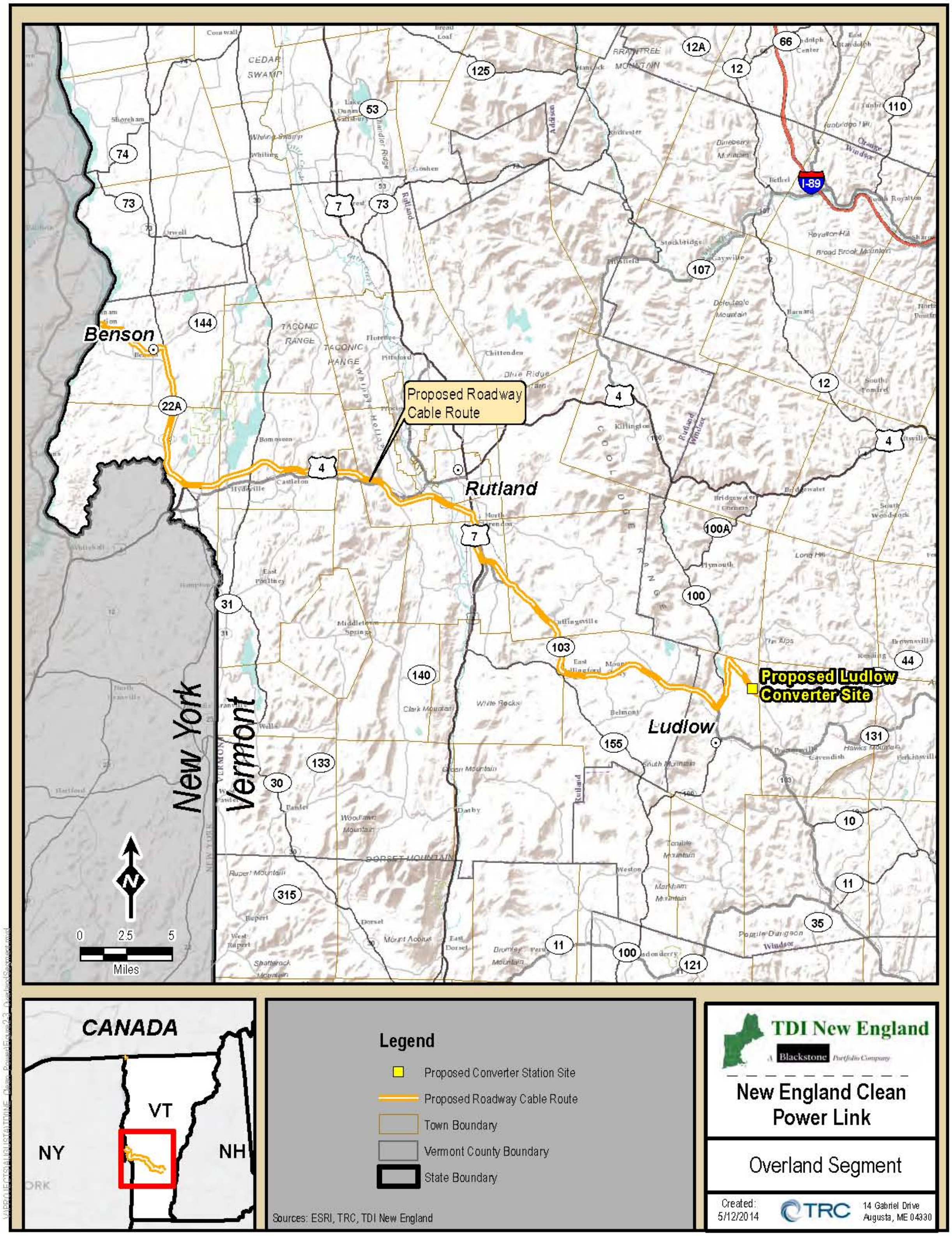


FIGURE 2-3
OVERLAND SEGMENT



The Overland Segment begins at the southern end of Lake Champlain in the Town of Benson. The cables will be installed overland by burial in public transportation corridors as follows:

- Town roads (in ROW or underneath roadways) east to Route 22A (4.4 miles)
- Route 22A ROW south to Route 4 in Fair Haven (~8.1 miles)
- Route 4 ROW east to Route 7 in Rutland (~17.2 miles)
- Route 7 ROW south to Route 103 in North Clarendon (~2.6 miles)
- Route 103 ROW south to railroad ROW in Shrewsbury (~3.9 miles)
- Railroad ROW south to Route 103 in Wallingford (~3.5 miles)
- Route 103 ROW south / southeast to Route 100 in Ludlow (~10.4 miles)
- Route 100 ROW north to Town Roads (~0.8 miles)
- Town Roads to proposed HVDC converter station (~4.8 miles)
- Proposed HVDC converter station to VELCO Coolidge Substation (~0.3 miles)

The Ludlow HVDC Converter Station post-construction site area (i.e., building and associated areas and equipment) will occupy approximately 4 to 5-acres (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 VELCO (see Figure 2-3). The permanent area that must be maintained to keep it void of deep routed trees for the life of the NECPL Project overland route will be approximately 12' feet wide within the corridor ROWs. Along ROWs, the transmission cables will be installed in the cleared areas adjacent to the road or, where that is not possible due to constraints, under the road or within non-cleared areas. Within the Town roads of Alburgh, Benson and Ludlow the cables are proposed under the roads, which are generally unpaved. Table 2-1 provides a breakdown of the cable sections associated with the 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 NECPL PROJECT TRANSMISSION LINE ROUTE

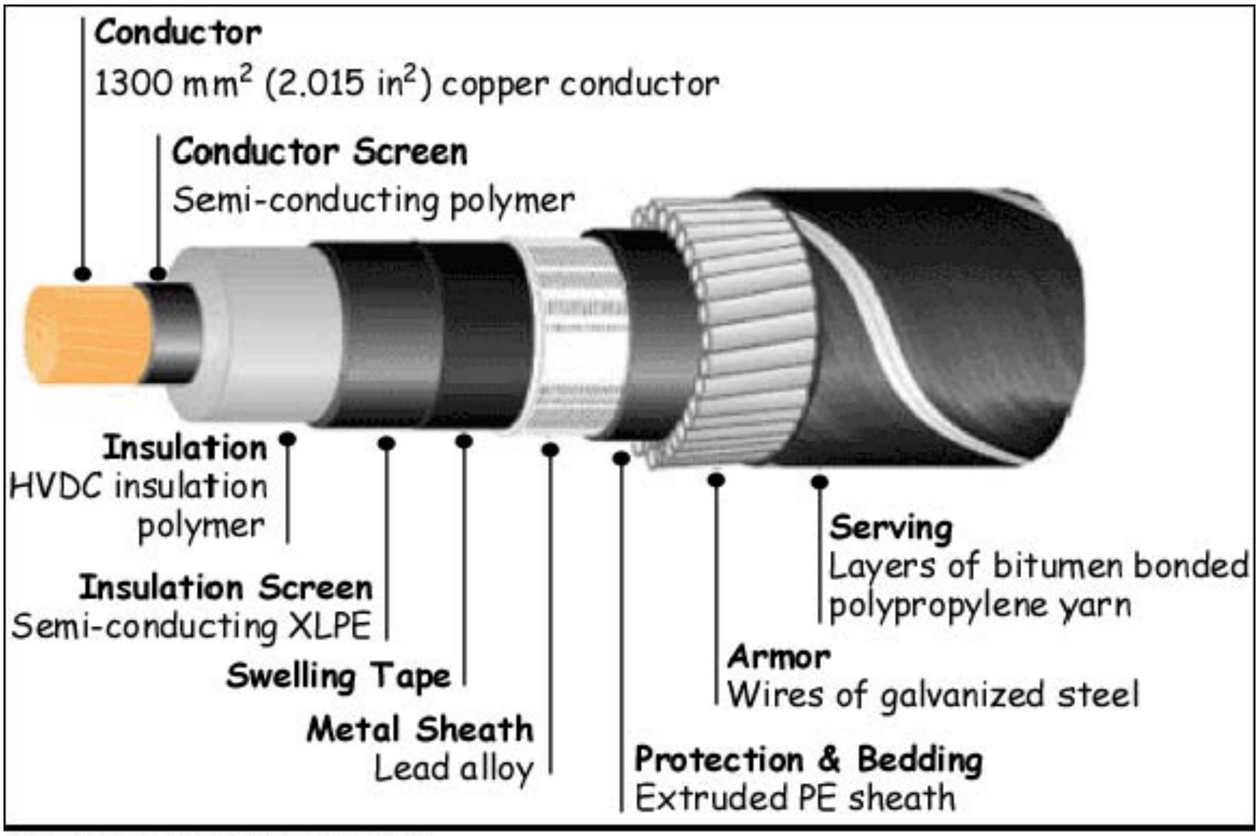
Cable Section	Segment	Corridor Type	Approximate Length (miles)
U.S./Canada Border to Alburgh, VT (along local roads)	Lake Champlain	Terrestrial	0.5
Lake Champlain from Alburgh, VT to Benson, VT	Lake Champlain	Aquatic	97.6
Benson to Route 22A (along local roads)	Overland	Terrestrial	4.4
Route 22A to Route 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
Converter station to Coolidge Substation	Overland	Terrestrial	0.3
		Total Length	**154.1**

2.3 Cable Technology

2.3.1 Aquatic 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 and the cable will weigh approximately 30 pounds per foot (lb/ft)).

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

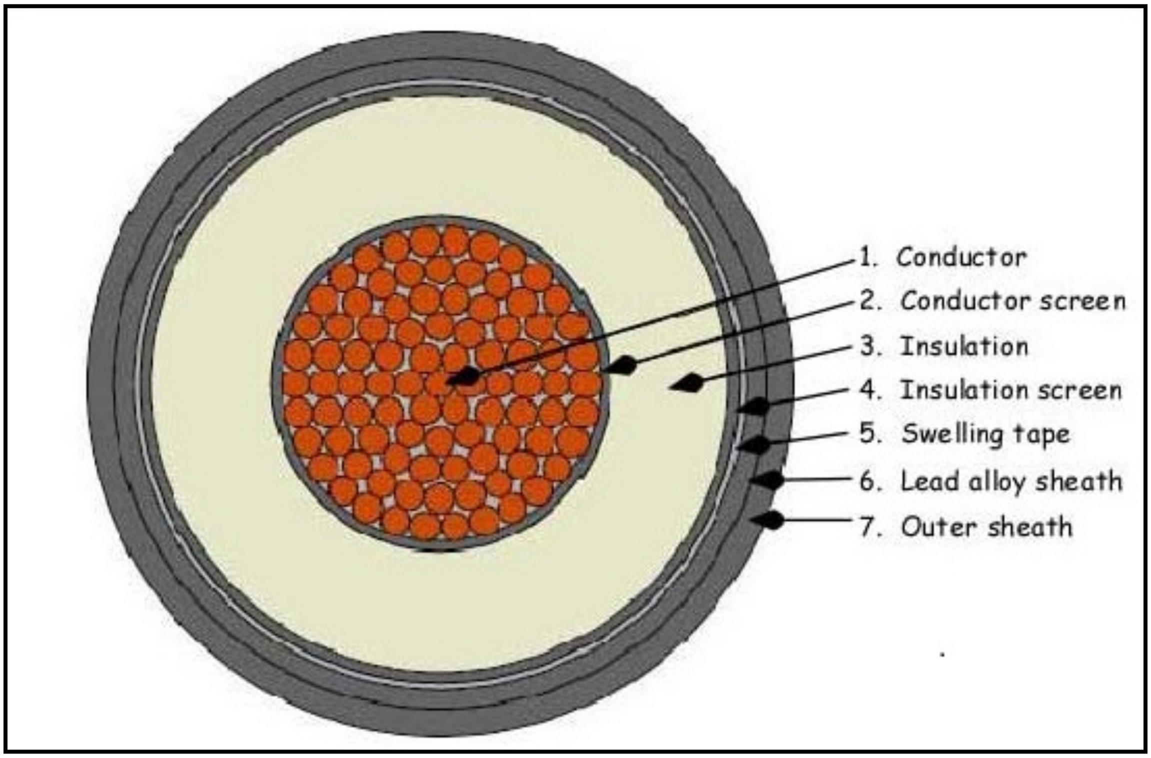


Source: Cross-Sound Cable Company 2012

2.3.2 Terrestrial Transmission Cable

For the underground transmission cables, the outer sheathing insulation will be composed of an ultraviolet-stabilized, extruded polyethylene layer (see Figure 2-5). The underground transmission cables will have an outside diameter of 4.5 inches, and each cable will weigh approximately 30 lb/ft. Both the terrestrial and aquatic cables will have a fiber optic cable attached to one of the cables to facilitate operation of the transmission system.

FIGURE 2-5
EXAMPLE TERRESTRIAL HVDC TRANSMISSION CABLE CROSS-SECTION



3.0 CONSTRUCTION METHODS

Given the length of the route from the Canadian border to the NECPL Project terminus (approximately 154.1 miles from the international border to the Coolidge Substation) and the diversity of landforms and water areas that are crossed by the cable route, a variety of construction methods and equipment will be employed.

3.1 Underwater Installation Methods

The two HVDC underwater cables associated with the NECPL Project will be bundled and laid together within the same trench. The cables will be initially placed in a vertical position (one on top of the other) in the trench, although sediment conditions could allow for slumping into a horizontal position (side-by-side) relative to each other. Cable burial will generally be performed at the same time the cable is laid or at a later date, as deemed appropriate or necessary due to subsurface conditions. The cables will be laid by a specially outfitted lay-barge.

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. To the extent practical, the aquatic transmission cables will be buried in Lake Champlain to a target depth of between 3 and 4 feet or the maximum reasonably attainable depth, whichever is deeper. 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 (see Section 3.1.4 below). In waters of depths greater than 150 feet, the Applicant proposes to lay the cables on the bottom of the lake. Cables that are laid on the lake bed are anticipated to settle an average of 1 foot below the surface over time.

The cables will be transported from the manufacturer by a special cable transport vessel and transferred onto the cable installation vessel. The linear cable machines onboard the installation vessel will pull the cables from coils on the transport vessel onto the installation vessel and into prefabricated tubs. After the cable has been transferred, the installation vessel will travel to the construction commencement location. This process will be repeated as necessary to deliver and install the cable along the length of the various waterways.

Given the need for certain installation activities to remain uninterrupted (e.g., cable installation involving water jetting or HDDs at the shoreline), it is anticipated that aquatic cable installation activities will occur twenty four hours per day/seven days per week in most areas, with nighttime shutdowns occurring only in select sensitive receptor areas. This will require that nighttime lighting be used. Directed lighting will be employed to avoid and/or minimize lighting of areas outside of the workspace.

Based on sediment data collected during a 2010 Marine Route Survey in the vicinity of the NECPL Project route[1], it is not anticipated that a backfill plow will be needed. As the cables will be simultaneously laid and buried, the majority of sediments will refill the trench. In addition, due to the natural dynamic processes in the lake, sediments will be naturally deposited within the trench.

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 3-1.

TABLE 3-1
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, Vermont	September 15 to December 31	Shear Plow

* See below for discussion of construction methods.

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

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

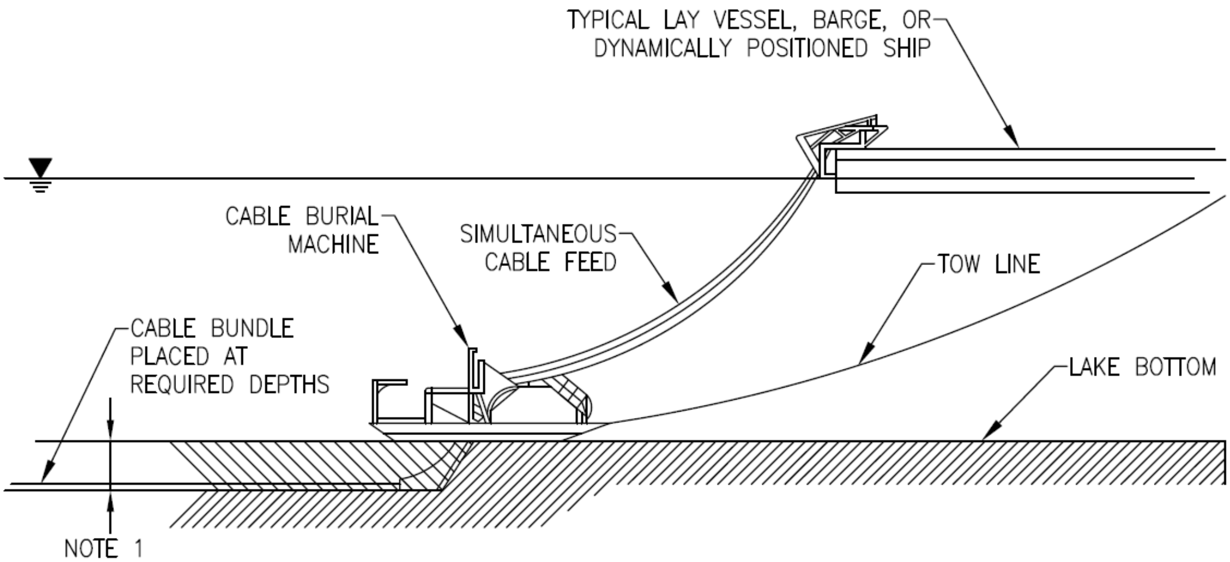
[1] In 2010, core samples were collected for the Champlain Hudson Power Express project, which is proposing to install HVDC cables along the length of Lake Champlain along a route that is in the general proximity of the NECPL project (Champlain Hudson Power Express. 2010. Marine Route Survey). A sediment similarity analysis conducted by researchers associated with Middlebury College determined that two project were generally of a similar sediment type (Marine Research Corp. 2014. Acoustic Similarity Between the NY and VT HVDC Corridors).

The first step in the installation of the aquatic transmission cables will involve conducting a pre-installation route clearance operation. During this operation, also referred to as 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 a specially designed cable barge and towed plow device that simultaneously lays and embeds the aquatic transmission cables in a trench. The vessel will be dynamically positioned, using thrusters and a propulsion system to tow the plow without the use of anchors.

The skid-mounted plow will be towed by the barge, because the plow has no propulsion system. For burial, the barge tows the plow at a safe distance as the laying and burial operation proceeds (see Figure 3-1). 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 floor, and the plow blade cuts into the lake bed 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 3-1
TYPICAL AQUATIC TRANSMISSION CABLE INSTALLATION PROCESS



NOTES:
1. BURIAL DEPTH SHALL BE APPROXIMATELY 4 FEET ON LAKE BOTTOM.
2. CABLE LAY MACHINE IS TYPICAL OF EQUIPMENT THAT MAY BE EMPLOYED.

It is anticipated that the aquatic cable will be installed in Lake Champlain using four different techniques: a) divers lay; b) jet plow; c) shear plow; and d) installed on the bottom. The expected locations for each of these installation methods is shown in Table 3-2 and the jet plow and shear plow technologies are discussed below.

TABLE 3-2
UNDERWATER INSTALLATION TECHNIQUES

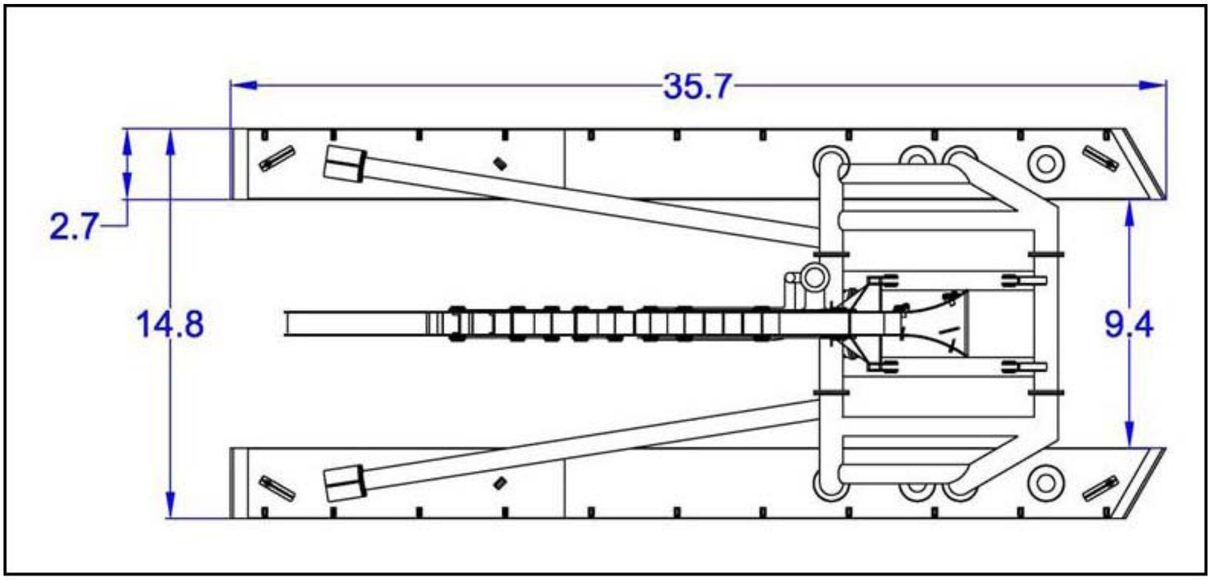
Approximate Project Milepost	Construction Method
0.5 to 2	Diver Lay
2 to 22	Jet Plow
22 to 66	Install on bottom
66 to 74	Jet Plow
74 to 98	Shear Plow

3.1.1 Jet Plow/Water Jetting

It is anticipated that the buried aquatic cable in the northern part of Lake Champlain will be installed using water-jetting techniques (see Figures 3-2 and 3-3). The water-jetting process uses jets of pressurized water from the Lake 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 their own weight before the sediments settle back into the trench.

FIGURE 3-2
EXAMPLE OF WATER JET TRENCHING DEVICE

FIGURE 3-3
TYPICAL WATER JET TRENCHING DEVICE DIMENSIONS



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

The jet plow/water jetting embedment methods for underwater cable installations are considered to be the most effective and least environmentally damaging when compared to traditional mechanical dredging and trenching operations. This method of laying and burying the cables simultaneously ensures the placement of the underwater cable system at the target burial depth and minimizes bottom disturbance, with much of the fluidized sediment settling back into the trench.

Jet Plow/water jetting equipment uses pressurized water from water pump systems onboard the cable vessel to fluidize sediment. The water jetting device is typically fitted with hydraulic pressure nozzles located down the length of "swords" that are inserted into the sediment on either side of the cable and which create a direct downward and backward "swept flow" force inside the trench. This provides a down and back flow of re-suspended sediments within the trench, thereby "fluidizing" the *in situ* sediment column as the equipment progresses along the cable route such that the underwater cable settles into the trench under its own weight to the target depth of burial. The water jetting device's hydrodynamic forces do not work to produce an upward movement of sediment into the water column, since the objective of this method is to maximize settling of re-suspended sediments within the trench to bury or "embed" the cable system. The pre-determined deployment depth of the jetting swords controls the cable burial depth using adjustable hydraulics on the water jetting device.

The cable system location and burial depth will be recorded during installation for use in the preparation of as-built location plans. The water jetting device is equipped with horizontal and vertical positioning equipment that records the laying and burial conditions, position, and burial depth. This information is monitored continually on the installation vessel. This information will be forwarded to appropriate agencies and organizations as required for inclusion on future navigation charts.

In addition to continuous closed circuit video monitoring, divers will make regularly scheduled dives in order to monitor the cable installation operation and inspect the condition of the cable trench and jet sled. Occasionally, the jet sled may require maintenance during cable burial operations due to nozzle wear or loss. During these maintenance periods, the jet leg roller load cells, suction piping, and hose connections are checked, and hydraulic fluid is replenished as required. As necessary, a Spill Prevention, Countermeasure, and Control ("SPCC") Plan or its equivalent will be developed pursuant to federal and/or state regulations and will be followed during construction equipment maintenance and repair activities.

In certain small areas, typically transition areas between shoreline HDDs and underwater cable trenches, a diver-operated hand jet or Remotely-Operated Vehicle ("ROV") may be used to bury the cable. In this process, a support vessel provides pressurized water through a hose with a nozzle that is maneuvered by a diver or ROV. The jet of water works the sediment under the cable to create a trench into which the cable settles. This method will be employed for short distances only.

3.1.2 Shear Plowing

For portions of the transmission line route where the sediment stiffness is low and the waterway is narrow, which is expected to be the case 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 that tows the plow along the lake or riverbed. A trench, approximately 1.5 feet wide and 3 to 5 feet deep, is made for the cables by the plowshare and the cables settle into the trench.

Shear plows can potentially reduce sediment disturbance inasmuch as they do not fluidize the sediment and generally require less force and create a narrower trench) than do other types of cable installation equipment. Some issues that affect the suitability of shear plows for underwater cable installation and burial are sediment cohesiveness and burial depth. Use of the shear plow is typically limited to sediments that have shear strengths less than 20 Kilopascals (kPa). Also, shear plows are typically used with shallower burial depths (less than four (4) feet), which generally reduces the overall amount (i.e., volume) of sediment disturbed during installation.

3.1.3 Non-Burial Protection

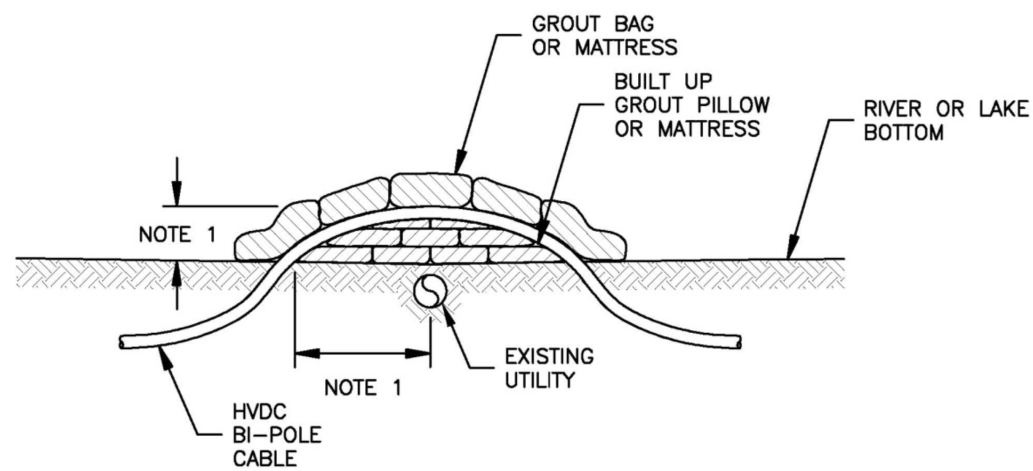
Burial depths also might vary in response to site-specific factors identified within Lake Champlain. These factors could include the presence of existing infrastructure, the potential for anchor damage, the identification of archaeological or historic resources, localized geological or topographical 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 typically be laid over the existing utility and protective coverings such as articulated concrete mats will be installed over the cable crossing (see Figure 3-4). Articulated concrete mats (see Figure 3-5) are typically made of small pre-formed 9- to 12-inch thick concrete blocks that are interconnected by cables or synthetic ropes in a two-dimensional grid and are typically sized as 40 feet long and 8 feet wide. Coordination with utility owners will occur and standard utility crossing procedures will be employed to prevent damage to pre-existing utilities.

Similarly, where bedrock is near the surface and burial is not practicable, protective coverings such as concrete mats will be installed to protect the cables. In deepwater sections of Lake

Champlain (i.e., greater than 150 feet), the possibility of damage to the cables should be so low as to allow the cables to be laid on the lakebed without burial.

FIGURE 3-4
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 3-5
TYPICAL ARTICULATED CONCRETE MATS

Source: IMCA 2011

A "chain-ferry" operates across the proposed underwater cable route within Lake Champlain. The chain ferry utilizes ferry cables laid on the bottom of Lake Champlain. The normal penetration of the ferry cables into the lakebed will be assessed, and, if deemed necessary, additional protection in the form of deeper cable burial at the crossing point or the use of an outer protection sleeve against abrasion will be installed. The ferry cables will be temporarily removed to facilitate the installation of the underwater cables. The ferry cables will then be replaced over the top of the transmission cables. The ferry operator reports that its cables are replaced every year in November; therefore, there may be an opportunity to coordinate the HVDC cable installation schedule with the regular ferry cable replacement schedule. Detailed coordination and discussions will be required with the ferry operator on methodologies and scheduling.

The underwater HVDC cables will also be routed beneath overhead infrastructures, including road bridges. The superstructure on the cable-laying vessels will be designed to take account of any height restrictions.

3.2 Horizontal Directional Drilling Installation Methods

HDD will be used to install the transmission cables in transition areas between aquatic and terrestrial portions of the NECPL Project route and may be used 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.

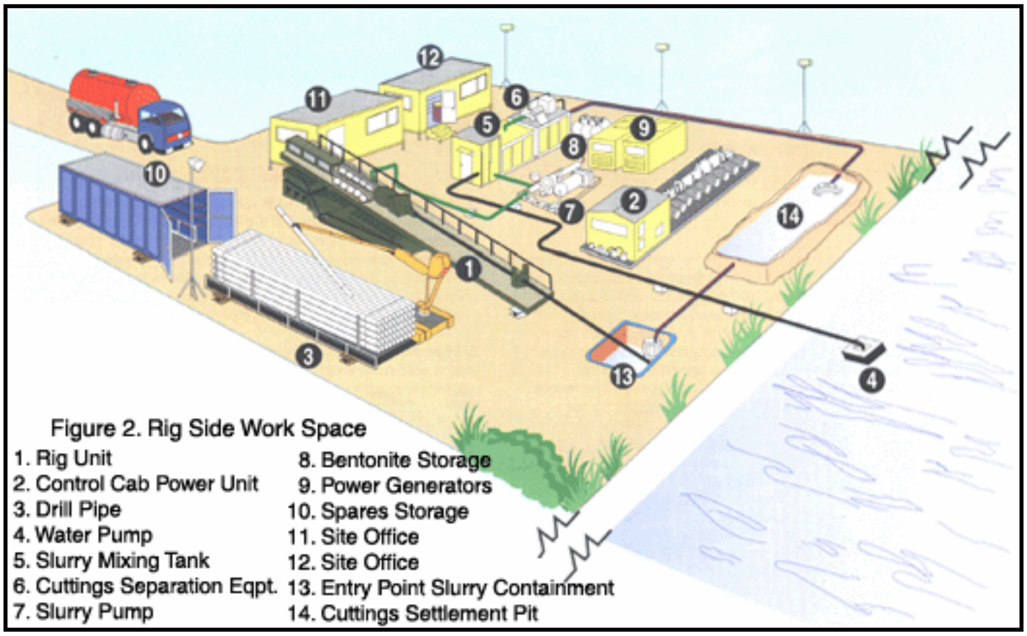
For each proposed HDD location, two separate drill holes will be required, one for each cable. Each cable will be installed within a 10-inch diameter, or larger, high-density polyethylene (HDPE) tube-shaped duct or conduit. To maintain appropriate separation between the two cables, a minimum of 6 feet 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 primarily of water (approximately 95 percent) with a limited volume of bentonite (approximately 5 percent) (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 segment of pipe is installed, an additional length of drill pipe will be added until the final drill length has been achieved (see Figure 3-6). 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.

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 be removed and disposed of at an approved location. The Applicant estimates that approximately 100 cubic yards of drill cuttings (used bentonite and excess soil) will be generated for appropriate disposal at each of the major HDD installations. Figure 3-7 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 3-7
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. The Applicant's preferred method would be to utilize a guide shaft, whereby 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.

Alternatively, a temporary cofferdam could be constructed at the offshore exit-hole location. A cofferdam would be approximately 16 feet by 30 feet with a dredged entry/exit pit typically 6 to 8 feet deep and constructed using steel sheet piles driven by a barge-mounted crane. The cofferdam would 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 is based on existing conditions. The area inside the cofferdam would 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 of sediment could be excavated from within a cofferdam. The dredged material would 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 would be backfilled with clean sand, and the HDD staging area restored and revegetated as appropriate to preconstruction grades and conditions to the extent practicable.

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 of 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 according to previously established protocols. These actions could include but not be limited to halting drilling activities, injection of loss circulation additives such as Benseal which can be mixed in with drilling fluids at the mud tanks, initiating cleanup of released bentonite, and other mitigation measures as appropriate. 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 NECPL 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.

3.3 Terrestrial Installation Methods

In general, the buried transmission line will be routed underground beginning at the U.S.-Canada border into Alburgh and from Benson to the proposed converter station location in the Town of Ludlow. 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 specific areas to avoid certain resource impacts.

The two cables within the bipole system will typically be laid side-by-side (approximately 12 to 36 inches apart in a trench approximately 4 to 5 feet deep to provide for at least 3 feet of cover over the cables. The total excavated width of the trench will typically be approximately 4 feet. Subsequent to laying the cables in the open trench, low thermal resistivity material, such as well-graded sand to fine gravel, stone dust, or crushed stone will be backfilled into the trench. 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 above the cables and then the remainder of the trench will be backfilled and brought to grade.

Construction layout and work areas for cable installation within road ROWs will be confined to the public road and railroad ROW to the greatest extent practical. A typical staging area for construction equipment in a roadway ROW will be approximately 20 to 50 feet wide along one side of the roadway.

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

- Initial clearing operations (where necessary) and EPSC measure installation
- Trench excavation
- Cable installation and splicing
- Backfilling
- Restoration and revegetation.

Each of these steps is described below.

3.3.1 Initial Clearing Operations & EPSC Measures

Initial clearing operations will include the removal of vegetation within the cable trench area and within any temporary additional construction workspace (e.g., HDD workspace, cable joint pits, access roads and staging areas) either by mechanical or hand cutting. Vegetation will be cut at ground level, leaving existing root systems intact except for the immediate trench area, and the aboveground vegetation will be removed for chipping or disposal. Tree stumps and rootstock will be left undisturbed in the temporary workspace wherever possible to encourage natural revegetation. Brush and tree limbs will be chipped and spread in approved locations or hauled off-site for disposal. Timber will be removed from the ROW for salvage or to approved locations.

The cleared width within the ROW and temporary construction workspace will be kept to the minimum that will allow for spoil storage, staging, assembly of materials, construction vehicle passage, and all other activities required to safely install the cables and associated equipment.

Prior to or closely following initial disturbance of the soil, EPSC measures will be properly installed as required. Design of the EPSC measures per the applicable Vermont DEC Standards and Specifications is anticipated to be completed in 2nd Quarter 2015 and will include both structural Best Management Practices (BMPs) such as silt fences, haybales, temporary mulching, etc. and non-structural BMPs such as limitations on the concurrent area and duration of earth disturbance.

It is anticipated that for installation within roadway and railroad ROWs, the majority of the supplies and equipment required for terrestrial transmission cable installation will be transported via roadways. 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.

3.3.2 Trench Excavation

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 wherever possible. The typical trench will be up to 4 feet wide at the top and approximately 4 to 5 feet deep to achieve proper depth and a 1-foot 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 or in non-cleared areas. 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 EPSC measures (see previous section).

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 Applicant's preferred approach will be mechanical removal. If that is not possible, then the Applicant 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, nearby water supplies and underground utilities.

3.3.3 Cable Installation

Once a pre-selected length of trench is excavated to the necessary depth and the base prepared, rollers will be placed in the bottom of the trench (or along the upper rim of the excavation) to facilitate pulling the cable into the trench. A cable attached to a winch at the opposite end of the trench from the cable spool will be attached to the cable and reeled in, pulling the cable down the length of the trench on the rollers. Depending upon the soil conditions on the bottom of the trench, the bottom of the trench may require padding fill (i.e., clean sand) before pulling the cable into the trench, but this circumstance is expected to be encountered infrequently. Once the cable segment is pulled down the length of the trench, it is moved off the rollers.

If allowed by the regulatory agencies cable installation activities may occur twenty fours hour per day/seven days per week in some areas, with nighttime shutdowns occurring in sensitive receptor areas. This approach will require that nighttime lighting be used. To the extent possible, directed lighting will be employed when in residential areas to minimize lighting of areas outside of the workspace.

3.3.4 Backfilling

Subsequent to laying the cables, the trench will be backfilled with a layer of soil exhibiting the required low thermal resistivity properties needed to surround the cables, which may include non-native material if the native materials do not exhibit the required low thermal resistivity properties. A protective cover will be placed directly above the low thermal resistive backfill material and a marker tape placed above the cables. The top of the trench may be slightly crowned to compensate for settling. Excess clean spoil material from trench excavation will be disposed of by spoiling on site where approved or will be properly disposed of off-site at an approved location. Contaminated spoils will be disposed of as required by federal and/or state regulation.

3.3.5 Restoration and Re-vegetation

Cleanup crews will complete the restoration and revegetation of the rights-of-way and temporary construction workspace. In conjunction with backfilling operations, any remnant woody material and construction debris will be removed from the rights-of-way as allowed by state and federal regulators. The construction area will be seeded with an approved seed mix for the temporary work area and allowed to further revegetate naturally. Paved areas will be restored to match existing conditions in accordance with federal, state and/or municipal requirements.

3.3.6 Waterway Crossings

For crossings of waterbodies and small streams, five 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 temporarily dammed upstream of the work area and a pump and hose or gravity flow pipe are used to transport the stream flow around 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.

- Jack and Bore: For this method a pit excavated on each side of the stream. A conduit is then pushed into place under the streambed by hydraulic rams or a combination of boring and ramming. The cables are then pulled through the conduit.

- 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.

3.3.7 Wetland Crossings

In wetland areas, the cables will typically 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 avoid and/or minimize permanent impacts to wetlands functions and expedite revegetation of wetlands, the top 1 foot of wetland soil will be stripped from over the trench, retained separately from subsoils, 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 specified wetland seed mix to quickly stabilize the wetland area while the rhizomes, rootstock, and seeds in the wetland soils allow the native vegetation to re-establish.

3.4 Operations and Maintenance

The 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 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.

ROW Maintenance. During operation of the NECPL Project, vegetation clearing will be performed on an as-needed basis over the transmission cables, which will be approximately 12' feet wide along roadway ROWs. Vegetation management will include mowing, selective cutting to prevent the establishment of large trees (i.e., greater than 20 feet tall) directly over the trenched 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. It is anticipated that current vegetation management activities that occur along most portions of the roadway ROWs will continue following the construction and operation of the transmission cable, thus requiring little or no additional vegetation management by TDI-NE. A detailed vegetation management and invasive species control plan for the construction and operational period of the transmission system will be developed and submitted to resource agencies. The goal of the vegetation management plan will be to maintain stable low-growing vegetation with shallow root systems that will not interfere with the cables.

Transmission Cable Inspection. Following transmission cable installation, regular inspections of the transmission cables in Lake Champlain, 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
- 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.

Transmission Cable Repairs. While not anticipated, it is possible that over the 40-year lifespan of the 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.

In depths less than 150 feet, burial of the aquatic transmission cables to an average depth of at least 3 to 4 feet below the Lake bottom 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 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 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 NECPL Project route is described as follows:

- Aquatic Transmission Cable Repair. 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.

- Terrestrial Transmission Cable Repair. 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.

4.0 ROUTE SPECIFIC DESCRIPTION AND EFFECTS

The NECPL Project route is approximately 154 miles long and covers varying landforms and water areas, and numerous existing utility crossings that require a variety of cable installation and construction methods and equipment. The effects from the different construction methodologies are discussed below.

4.1 Northern Lake Champlain (Submarine)

The northernmost segment of the NECPL Project route crosses the U.S./Canadian border in Town of Alburgh, Vermont and continues overland for approximately 0.5 miles. For the purposes of this analysis, the effects associated with this section are the same as those for the Overland Segment (Section 4.3).

The HVDC transmission system will then enter Lake Champlain via HDD and be installed beneath or, in depths greater than 150 feet, laid on top of, the Lake Champlain lake bed for approximately 74 miles to Chimney Point, Vermont. Cables that are laid on the lake bed are anticipated to settle an average of 1 foot below the surface over time. The existing conditions, construction methods, and project effects of this segment are discussed in the following sections. This physiographic route segment is represented in Sheets 1 through 5 of the location maps provided in Attachment A of this document.

4.1.1 Existing Conditions

Lake Champlain is a large freshwater lake at the northwest corner of Vermont. Most of the lake length is within the United States and hosts the border between New York and Vermont, but the northernmost end extends into Canada. The waters of Lake Champlain reach their greatest depth, over 400 feet, in the area between Charlotte, Vermont and Essex, New York. The average depth of the Lake is only 64 feet and some parts of the Lake are very shallow. However, water depths along the NECPL Project route vary from 10 feet to nearly 400 feet. Throughout Lake Champlain there are basins, troughs, and plateaus. The cable route was sited to remain away from the shoreline and avoid steep changes in slope, areas known to provide habitat for fish and marine archaeological sites to the extent possible.

In the section of the Lake Champlain that extends from the Town of Alburgh south to the southern end of Grand Isle at MP 29, water depths vary widely, ranging from approximately 15 feet deep where the cables enter the water to almost 240 feet deep near the southern end of Grand Isle. Surficial sediments along this section appear to be fine grained with rocky areas and obstructions occurring in several locations. Sub-bottom profile surveys revealed a layer of soft sediments as there was deep sub-bottom penetration along the majority of the proposed route. In some localized areas sub-bottom penetration indicated bedrock or compacted sediments.

The section of Lake Champlain that extends between the southern end of Grand Isle (MP 29) and Chimney Point (MP 74), across from Crown Point, New York, encompasses some of the deepest areas along the NECPL Project route, with water depths increasing to as much as nearly 400 feet. Overall, the surficial features between Grand Isle and Chimney Point are relatively smooth, although there were many large bathymetric features observed, causing abrupt changes in water depths over relatively short distances. The sub-bottom profiles showed deep penetration throughout this section, indicating a soft bottom. Some possible rock outcrops restricted penetration in isolated areas.

4.1.2 Construction Methods

Within the Lake Champlain segment from MP 0 to 74 the cables are anticipated to be buried by jet plow/water jetting. As described in Section 3.1.1, the use of the jet plow/water jetting in this segment would result in the fluidization of the sediment sufficient to allow the cables to be buried at a target depth of between three (3) and four (4) feet or the maximum reasonably attainable depth, whichever is shallower. In locations along this segment where the water depths of Lake Champlain are 150 feet or deeper, the cable will be laid on the lake bottom without burial.

Submarine cables (some of which are decommissioned) have been identified within Lake Champlain and will require special techniques for cable crossings. In areas where the HVDC underwater cables cross existing submerged infrastructure, the cables will utilize the aforementioned methodologies for infrastructure crossings, as appropriate.

4.1.3 Project Effects

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, the aquatic transmission cables will be installed within the lakebed sediment at depths of approximately 4 feet 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. Water quality modeling developed in support of the NECPL Project will be provided in a supplemental submission.

Once the cables are buried, it is anticipated that the bathymetry will return to pre-installation conditions through re-deposition of the disturbed material into the trench. Even in cases where less than 100 percent of the disturbed sediment settles in the trench, the hydrodynamic regime at any given location along the underwater cable route will not be changed, so it can be expected that in time natural sedimentation will complete the refilling of the trench.

In general, any impacts to water quality along the underwater cable route will be influenced by sediment type and sediment characteristics. Re-suspension of materials contained in sediment as a result of project activities may make materials more readily available in the water column and to aquatic organisms. Any impacts of re-suspension is expected to be both temporary and limited to areas immediately adjacent to the area of cable installation. Water quality modeling currently being completed for the conditions in Lake Champlain will describe the level of impacts relative to the Vermont water quality standards.

Where bottom conditions or deep water do not permit burial in the substrate, the cable will be laid on the bottom and protected by laying concrete mats or rip-rap over the cables for protection. The mats will alter local hydraulic conditions such that some sediment deposition or scouring may occur around the irregularity in the bottom formed by the mats. However, the overall change in bottom topography will be insignificant because the mats will extend only a short height above the bottom and functional benthic habitat will develop. The volume of the cable is extremely small relative to the sediment layer and bottom hydrography of the water bodies involved, and the effect of the cable on bathymetry will be insignificant relative to natural levels of fluctuation due to currents, storms, navigational traffic, and other pre-existing factors.

4.2 Southern Lake Champlain (Submarine)

The Southern Lake Champlain section of the NECPL Project route begins at Chimney Point, at MP 74 and continues south within Lake Champlain until the Town of Benson, located at MP 98. The HVDC cables will be installed underwater for this entire segment. This physiographic route segment is represented in Sheets 5 to 6 of the location maps provided in Attachment A.

4.2.1 Existing Conditions

The southern section of Lake Champlain is similar to a river in terms of its configuration and composition. Water depths along this segment of the cable route are generally less than 30 feet. Surficial sediments along this portion of the route are relatively fine grained, with some areas containing course grain surficial sediments and larger materials, specifically in the southern half of this stretch.

4.2.2 Construction Methods

In an effort to minimize the level of total suspended sediments in lower Lake Champlain, where the water body is narrow and water depths are shallow, cables will be installed via shear plow to a burial depth of approximately three to four feet. The Applicant will provide additional details on shear plow installation specifications as part of its supplemental report on water quality modeling for lower Lake Champlain.

4.2.3 Project Effects

The shear plow results in a relatively narrow estimated trench and a smaller estimated percentage of re-suspended sediments as sediment cohesive strengths and burial depths suitable for shear plow use generally require less force. The TSS loading is the rate of sediment mass re-suspended into the water column above, which is a function of the trench cross-sectional area, the plow speed, the force required to overcome sediment shear strength, the percentage of re-suspended sediment, sediment porosity, and density. The shear plow would reduce the cross-sectional area of the trench and require less force than that normally achieved through jet plow operations, thus reducing the likely percentage of re-suspended sediment. As such, impacts to water quality would be similar in type to those of the jet plow but diminished.

4.3 Overland Segment

In the Town of Benson, at MP 98, the transmission cables will transition from the waters of Lake Champlain to the private land owned by the Applicant via an HDD. The cables will travel within or adjacent to local roads east for 4.4 miles to Route 22A, then continue south for 8.1 miles to Fair Haven. The cables route transitions to the Route 4 ROW east for 17.8 miles, then extend south within the Route 7 ROW for 2.6 miles, then extend south by southeast for 14.3 miles along Route 103 and a short (~3.5) segment of a railroad ROW. In Ludlow, the cables will enter the Route 100 ROW and, after travelling 0.8 mile north, will be located within or adjacent to local roads for 4.8 miles before reaching the Ludlow HVDC Converter Station. From the converter station, AC cables will be laid for 0.3 miles to connect to the existing Coolidge Substation. The overland portion of the cable route is reflected in Sheets 6 to 23 of the location maps provided in Attachment A.

4.3.1 Existing Conditions

The underground portion of the NECPL Project route from Benson to Ludlow is proposed to be constructed within existing road and railroad ROWs or for very short stretches on land controlled by TDI-NE either by direct ownership or temporary easement. As such, the dominant land use for this segment is "transportation" although a wide variety of land uses may be found on the adjacent parcels.

In 2014, wetland and stream delineation surveys were completed along the overland route. Attachment C provides a Wetland and Waters Classification Memo, which includes a summary of delineated streams and wetlands. Wetland data forms and Natural Resource maps are also provided as part of this submission.

4.3.2 Construction Methods

The Applicant will utilize an HDD to transition from the waters of Lake Champlain to private land controlled by the Applicant before transition to road ROWs. The two cables will be primarily buried within excavated trenches from the landfall in Benson to Ludlow. HDD installation methods will also be used, as necessary, at existing infrastructure crossings and other obstacles including lake and creek crossings (such as the crossings at Otter Creek and Lake Bomoseen). Where the cables cross two streams at the Town of Ludlow, the cables will be installed in conduits that will be attached to existing bridge structures.

Waterbody crossings along the ROWs will typically be constructed by trenching across the waterbody either within the culvert or at the culvert outlet, followed by the restoration of the culvert or bed and banks. For certain crossings, replacing culverts may occur due to the poor condition of the culvert or to provide for proper water flow. Intermittent and ephemeral streams may be dry or may have very low flow at the time of crossing. For these crossings, the Applicant will excavate an open cut through the stream. Isolation of the stream flow will be used where required by project permits and where it facilitates construction operations. Where large perennial or other significant stream flows are present, the Applicant plans to use Horizontal Directional Drilling (HDD) or may use a dry-ditch method to isolate the work area from the flow of water if the water flow is low enough to permit this approach. 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. Representational drawings for steam crossings will be included in the supplement to this Application.

4.3.3 Project Effects

The NECPL Project construction activities will result in direct temporary impacts to wetlands within the construction corridor of this segment. Surface hydrology in disturbed wetland areas will be re-established by backfilling the transmission line trench and the previously removed top 1 foot of wetland soil will be spread back over and across the backfilled trench area to facilitate wetland regrowth. By restoring the surface to pre-construction contours and re-establishing vegetative cover, the installation will represent temporary impact.

The NECPL 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.

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. 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. Following completion of the terrestrial transmission line, on-the-ground inspectors will survey and inspect the overland transmission line ROW on approximately an annual basis.

5.0 QUANTIFICATION OF EFFECTS

In December, the Applicant will supplement this application with information regarding the following quantifications of impacts:

- 5.1 Impacts to Waters
- 5.1.1 Cable Burial
  - 5.1.1.1 Lake Champlain
  - 5.1.1.2 Waterbody Crossings
- 5.1.2 Non-burial cable protection
  - 5.1.2.1 Utility crossings

5.1.2.2 Bedrock crossings

5.1.3 Dredging

5.1.4 Anchor Positioning

5.1.5 Cumulative Impacts

5.2 Impacts to Wetlands along the Overland Route

5.2.1 Description of Fill due to Cable Installation

5.2.1.1 Temporary Fill

5.1.1.2 Permanent Fill

5.2.2 Description of Impacts due to Construction and Vegetative Maintenance

5.2.1.1 Temporary Impacts

5.1.1.2 Permanent Impacts

6.0 AVOIDANCE, MINIMIZATION AND MITIGATION ACTIVITIES

The NECPL Project as proposed has been sited and designed to avoid or minimize impacts to sensitive resources. The underwater cable route is sited to avoid significant habitat and cultural features. Most of the overland portions of the NECPL Project route consist of previously disturbed roadway ROWs which have been subjected to routine vegetative maintenance activities. It is anticipated that wetland hydrology, vegetation, and water quality will return to pre-construction conditions in most areas when construction is completed. However, in limited areas, forested wetland cover may be converted to a scrub-shrub community.

In December, in a supplemental filing, the Applicant will provide a description of the avoidance, minimization, and mitigation activities that will be in place during the construction and operation of the transmission system. These will include Best Management Practices that will be utilized during construction as well as information related to, among other resources, impacts to wetlands, streams, water quality, sensitive habitat and species, and cultural resources. In addition, the Applicant will submit EPSC plans in early 2015 that will provide additional design level measures to avoid and minimize impacts.

7.0 ALTERNATIVES ANALYSIS

7.1 Introduction

Pursuant to the Environmental Protection Agency's (EPA) "*Guidelines for Specification of Disposal Sites for Dredged or Fill Material*" (Guidelines)[2] implementing Section 404(b)(1) of the Clean Water Act, applicants for a Section 404 permit must demonstrate there is no practicable alternative to a proposed discharge "which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences."[3] An alternative is "practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."[4]

The USACE is the final arbiter of 404(b)(1) determinations regarding the least environmentally damaging practicable alternative. To assist in the USACE's analysis, TDI-NE has evaluated a number of alternatives and assessed a number of factors, and selected a preferred alternative based on the requirements of Section 404 (b)(1) of the CWA.

7.2 Initial Reliability and Engineering Considerations

TDI-NE conducted feasibility studies to determine where the Project could safely interconnect in Vermont to the ISO-NE transmission system without jeopardizing grid reliability. To evaluate potential points of interconnection, TDI-NE retained Siemens PTI to study the following three existing backbone 345kV substations in Vermont, all of which are owned and operated by VELCO: the New Haven 345 kV Substation located in Addison County, Vermont (New Haven Substation); the West Rutland 345 kV Substation located in Rutland County, Vermont (West

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[2] 40 C.F.R. § 230 et seq.
[3] 40 C.F.R. § 230.10(a).
[4] *Id.* at § 230.10(a)(2).

Rutland Substation); and the Coolidge 345 kV Substation in Windsor County, Vermont (Coolidge Substation).

To assess the suitability of interconnecting 1,000 MW of new generation at each of these interconnection points, TDI-NE analyzed each substation to determine:

- whether the substation has sufficient interconnection points (or whether the substation had the capability to add sufficient interconnection points);
- whether the ISO-NE transmission system could accommodate the additional generation supply at these locations without requiring significant transmission system upgrades;
- whether a DC-to-AC converter station could be sited in close proximity to the substation; and
- whether the AC transmission cables from the converter station could access the substation without encountering significant constraints.

After concluding its technical analyses, TDI-NE determined that the New Haven Substation and West Rutland Substation presented significant issues because both of these substations interconnect to only *one* existing 345-kV transmission line. Without significant upgrades to the ISO-NE transmission system, it would not be possible to reliably deliver 1,000 MW of new capacity to these substations. In contrast, the Coolidge Substation is interconnected to *two* existing 345-kV transmission lines, thereby providing the infrastructure necessary to reliably interconnect the Project. Further, TDI-NE was able to secure site control at three parcels for the converter station that are located in close proximity to the Coolidge Substation. Siting a converter station on these parcels is consistent with existing land uses and will minimize environmental impacts and disruptions to the community as the AC cables from the converter station are expected to be installed for only 0.3 miles in an unpaved town road.

7.3 Criteria for Assessing Alternatives

After making a determination that the Project could reliably interconnect to the ISO-NE system at the Coolidge Substation, TDI-NE evaluated a number of route alternatives from the Canadian border to the substation. Each alternative was evaluated in relation to the project's purpose and need, and only those alternatives that met the project's overall purpose were considered further.[5] For alternatives that met the Project purpose, factors including cost, logistics, and technology were considered to identify which alternatives were "practicable" based on TDI-NE's interpretation of the Guidelines and applicable precedent. In determining practicability, consideration was given to engineering constraints (e.g., steep slopes, narrow ROWs, existing structures), impacts to communities and associated anticipated public opposition, worker safety, reliability considerations, consistency with existing or future land use, and the scope of any land rights that would need to be acquired for a given alternative.[6] Additionally, only HVDC cable technology is considered because HVDC (as compared to HVAC) has the ability to transmit large amounts of power over long distances with lower energy losses.

With regard to the determination of whether an alternative is practicable based on its cost, the EPA has determined that an alternative is not practicable when it is unreasonably expensive to the applicant.[7] According to the USACE and EPA, "[t]he determination of what constitutes an unreasonable expense should generally consider whether the projected cost is substantially greater than the costs normally associated with the particular type of project."[8] Unlike traditional

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[5] For example, alternatives outside of the State of Vermont were not considered because the Project's stated purpose is to deliver renewable power into the State of Vermont. TDI-NE's decision to interconnect into Vermont was based on a number of factors, including the reliability benefits that would accrue to ISO-NE as a result of having this generation supply available to the western side of the regional transmission system and the anticipated closing of Entergy's Vermont Yankee generation facility.

[6] With regard to reliability considerations, some alternatives may adversely impact the performance and/or operation of the transmission line and, therefore, would be inconsistent with the Project purpose.

[7] Preamble to Guidelines for Specification of Disposal Sites for Dredged or Fill Material, 45 Fed. Reg. 85,336, 85,343 (Dec. 24, 1980) as referenced in U.S. Envtl. Prot. Agency & U.S. Army Corps of Engineers, *Memorandum: Appropriate Level of Analysis Required for Evaluating Compliance with the Section 404(b)(1) Guidelines Alternatives Requirements* § 3.b. (Aug. 23, 1993) ("Section 404(b)(1) Compliance Memorandum"), http://water.epa.gov/lawsregs/guidance/wetlands/flexible.cfm

[8] *See* U.S. Envtl. Prot. Agency & U.S. Army Corps of Engineers, *Memorandum: Appropriate Level of Analysis Required for Evaluating Compliance with the Section 404(b)(1) Guidelines Alternatives Requirements* § 3.b. (Aug. 23, 1993) http://water.epa.gov/lawsregs/guidance/wetlands/flexible.cfm.

utilities -- which recover their cost-of-service from captive wholesale customers -- the NECPL is a merchant transmission line and TDI-NE assumes the full risk of market development.[9] The Project, therefore, must be competitively-priced in order to attract potential transmission customers. As is true for other similarly-situated merchant developers, the cost of developing and constructing a transmission line could increase to such an extent that the transmission service no longer becomes attractive for power suppliers seeking to arbitrage power markets. Thus, consistent with previous EPA and USACE guidance, the cost of various alternatives takes into account the "merchant" nature of the Project.[10]

For alternatives found to be practicable, TDI-NE analyzed each route using publically-available GIS datasets to determine the scope of potential resource impacts. Even for those alternatives that were identified as not practicable, TDI-NE conducted a GIS-based resource impact assessment. The criterion used in the resource assessment for both practicable and non-practicable alternatives were selected based on consultation with the USACE, and their likely applicability to the Project's proposed construction and operation impacts, as well as availability of associated datasets. Publically-available GIS data was utilized for the assessment to ensure that results are replicable. See Table 7-1.

TABLE 7-1
ASSESSMENT OF ROUTING ALTERNATIVES:
ENVIRONMENTAL IMPACT ANALYSIS CRITERIA

Criteria	
AQUATIC ECOSYSTEMS	
NWI and VSWI	• Acres of wetlands within 100' of alternative

[9] See Allocation of Capacity on New Merchant Transmission Projects and New Cost-Based, Participant-Funded Transmission Projects; Property Rights to New Participant Funded Transmission, 142 FERC ¶ 61,038 at P 1 (2013) at http://www.ferc.gov/whats-new/comm-meet/2013/011713/E-2.pdf.
[10] See U.S. Env. Protection Agency and United States Department of the Army, *Regulatory Guidance Letter 93-02, Subject: Guidance on Flexibility of the 404(b)(1) Guidelines and Mitigation Banking* (August 23, 1993).

Wetlands	• 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 • Acres of RTE habitat within 100’ of alternative • Acres of RTE habitat within 50’ of alternative
Significant Natural Communities	• Acres of Significant Natural Communities within 50’ of route segment • Acres of Significant Natural Communities within 100’ of route segment
Uncommon Species	• # of Uncommon species within 100’ of alternative • # of Uncommon species within 50’ of alternative • Acres of Uncommon species habitat within 100’ of alternative • Acres 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

Each of these criterion is further described below.

7.3.1 Wetlands

For the desktop comparison, the TDI-NE analyzed both the National Wetlands Inventory (NWI) and the Vermont Significant Wetland Inventory (VSWI). These two datasets are described below. The NWI was developed by the U.S. Fish and Wildlife Service (USFWS) and provides mapping of wetlands and deepwater habitats (e.g., 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. 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. Both of these datasets provide an efficient means of comparing multiple alternatives. The analysis calculated acres of wetlands within 50 feet and 100 feet of the route alternatives.

7.3.2 Stream Crossings

River and stream crossings would be accomplished via crossing over or under existing culverts where feasible, trenching, or HDD / Jack and Bore.[11] The specific design of each crossing would need to consider site-specific conditions, and the Applicant would establish and implement a program whereby restoration would occur upon completion of the construction and stabilization activities. While 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, it would nonetheless represent an impact. This desktop

[11] In two instances, the cables will be attached to existing structures such as bridges.

analysis calculated the number of stream crossings for each of the route alternatives based on mapping developed by the U.S. Geological Survey.

7.3.3 RTE 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 alternatives on sensitive species and communities, the Applicant's desktop analysis evaluated not only the number of potential RTE species within proximity to 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 and an alternative which would bisect the occupancy range of one species. For significant natural communities, the Applicant evaluated the total acreage of these defined areas within proximity to an alternative.

7.3.4 Uncommon Species

The VFWD 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 an alternative, as well as the total acreage of the state-identified areas of potential occupancy for these species.

7.3.5 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 area 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 sites. 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.

7.3.6 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.

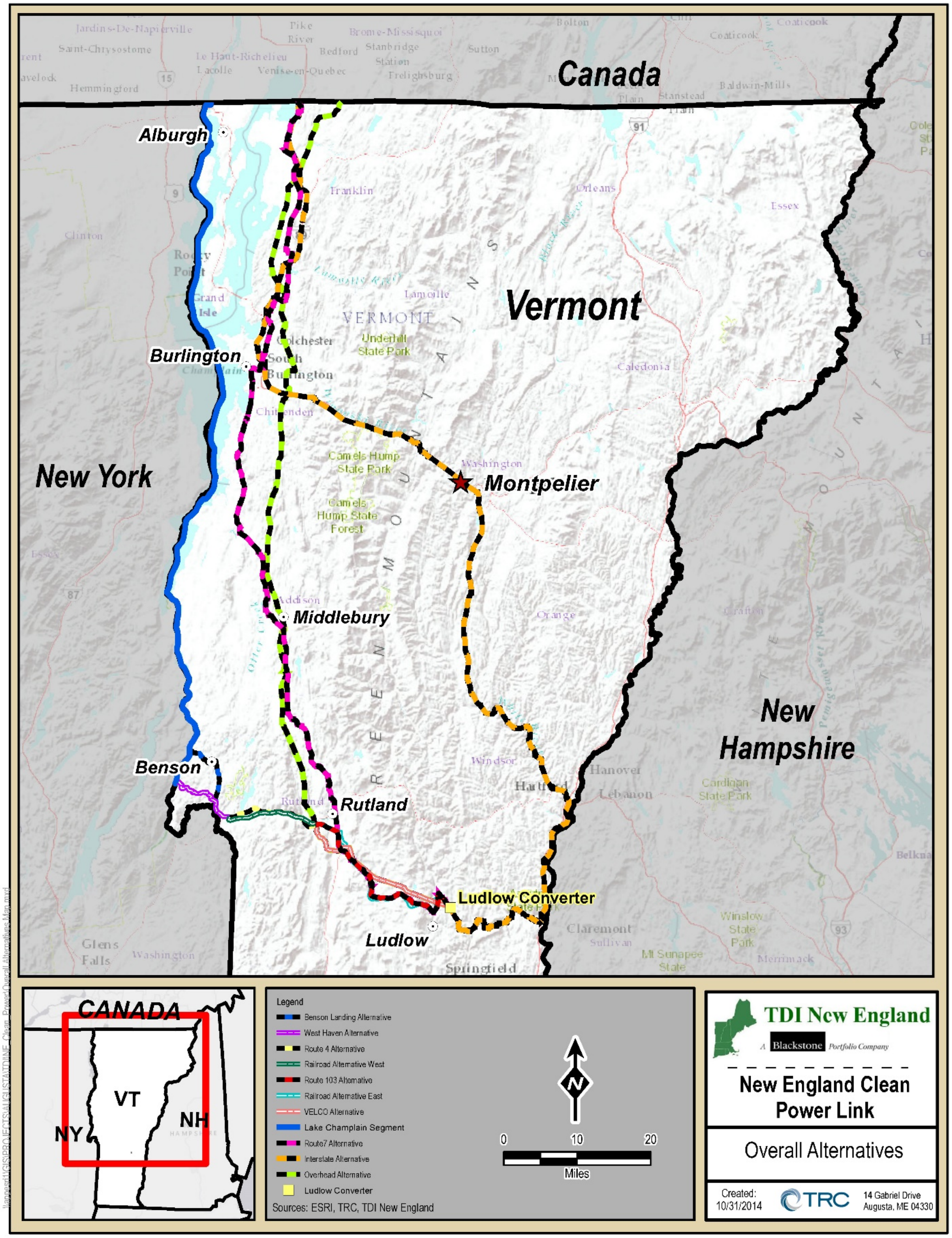
7.3.7 Hazardous Waste Sites

The VDEC maintains a point coverage database of known hazardous wastes sites or locations in Vermont where hazardous materials have been 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.

7.4 Overview of Alternatives Considered

The Applicant developed alternatives based on a review of existing ROWs (roadway, railroad, and utility), as well as consultation with state and federal agencies as to routes to consider in this analysis. Three entirely overland routes were identified which followed existing road and/or utility ROWs. In considering alternatives which included an in-water segment, the Applicant identified three distinct segments, each of which in turn contained specific alternatives. For ease of review, these alternatives are presented as follows: (1) a Lake Champlain Segment (two alternatives); (2) a Western Segment (two alternatives); and (3) an Eastern Segment (three alternatives). The intent of this division is to identify the alternative within each segment that has the least environmental impacts, so as to arrive at a final alternative which would represent the least environmentally damaging routing. Figure 7-1 depicts all of the alternatives, which generally contain overland segments that are entirely within existing or proposed ROWs.

FIGURE 7-1
ROUTING ALTERNATIVES FOR NECPL



Overland Alternatives

- Route 7 Alternative: Overland buried from US/Canadian Border along Route 7 ROW to the converter station
- Interstate Alternative: Overland buried from US/Canadian Border along Interstates 89 and 91 ROWs to the converter station
- Overhead Alternative: Overland overhead from US/Canadian Border adjacent to existing utility ROWs to the converter station

Lake Segment Alternatives

- West Haven Alternative: Lake Segment Alternative – Lake Champlain to West Haven to Fair Haven to connect to Western Segment Alternatives
- Benson Landing Alternative: Lake Segment Alternative – Lake Champlain to Benson Landing to Fair Haven to connect to Western Segment Alternatives

Western Segment Alternatives

- Route 4 Alternative: Western Segment Alternative – Roadway ROW to Eastern Segment Alternatives
- Railroad Alternative West: Western Segment Alternative – Railroad ROW to Eastern Segment Alternatives

Eastern Segment Alternatives

- Route 103 Alternative: Eastern Segment Alternative – Roadway /Railroad ROW to the converter station
- Railroad Alternative East: Eastern Segment Alternative – Railroad/Roadway ROW to the converter station
- VELCO Alternative: Eastern Segment Alternative – VELCO ROW to the converter station

7.5 Alternatives Determined Not To Be Practicable

Applying the criterion from the Guidelines of cost, existing technology, and logistics in light of overall project purposes, the Applicant believes that the Route 7, Interstate, and Overhead Alternatives are not practicable.

7.5.1 Route 7 and Interstate Alternative[12]

The Route 7 Alternative would cross the U.S.-Canada border in Highgate, Vermont using an existing local road to connect to Route 7. The routing would follow Route 7 south for approximately 125.2 miles before entering the VELCO ROW in Clarendon to the north of the interconnection of Route 7 with Route 103. This alternative would then travel 17.8 miles to the east / southeast in the VELCO ROW to the proposed converter station location. The Interstate Alternative would cross the U.S.-Canada border in Highgate, Vermont and travel south within the Interstate 89 ROW for a distance of approximately 127.87 miles before connecting to Interstate 91 in White River Junction, Vermont. The route would travel in the Interstate 91 ROW for a distance of approximately 18.47 miles to Ascutney, Vermont. From Ascutney, the cables would travel for approximately 15 miles west to Proctorsville, Vermont along Route 131, then travel along town roads for approximately 4 miles north / northeast to the proposed converter station location Both alternatives are depicted in Figure 7-2.

[12] Route 7 and Interstate Alternatives are addressed together given the significant overlap in the analysis of these two alternatives.

FIGURE 7-2
ROUTE 7 AND INTERSTATE ALTERNATIVES

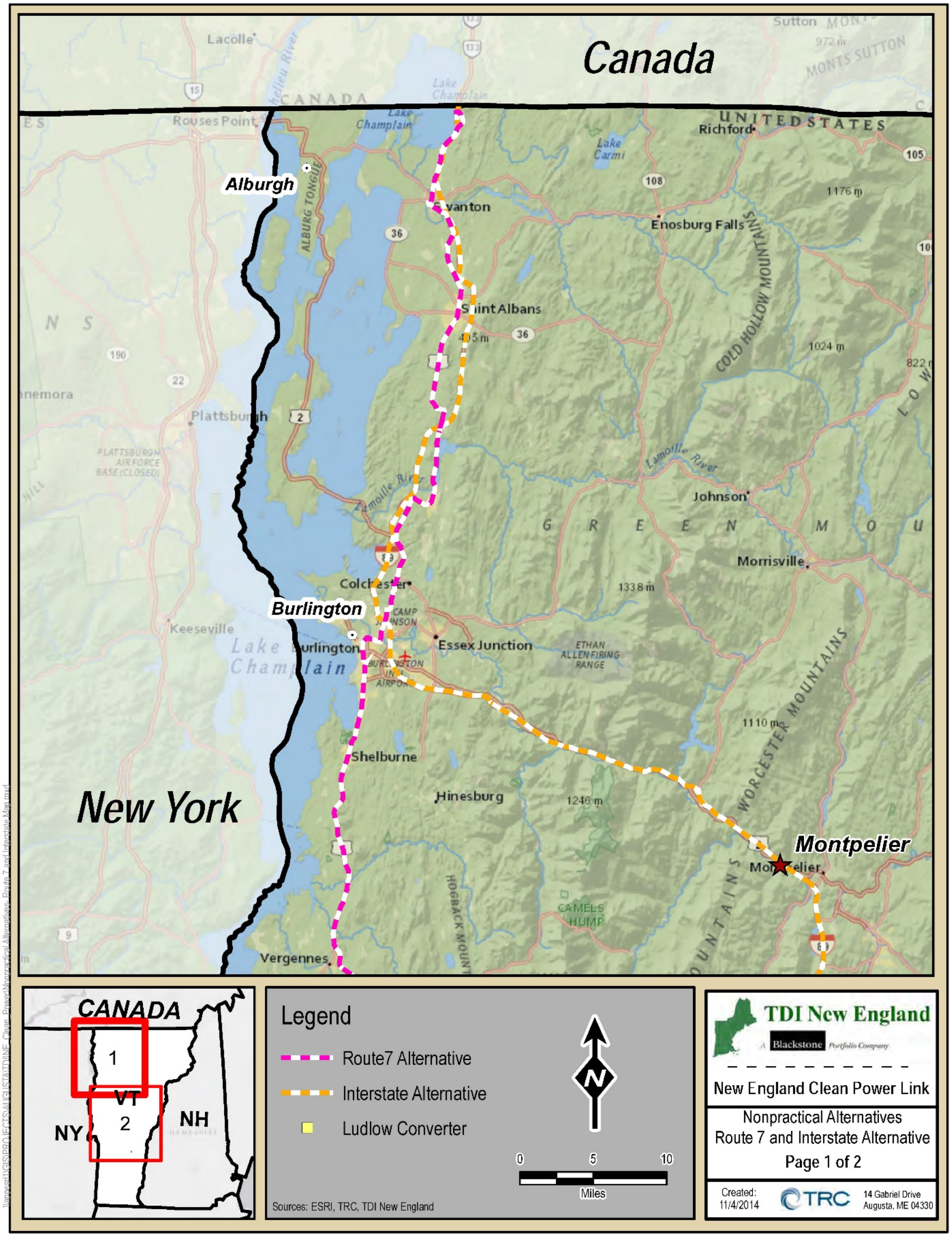
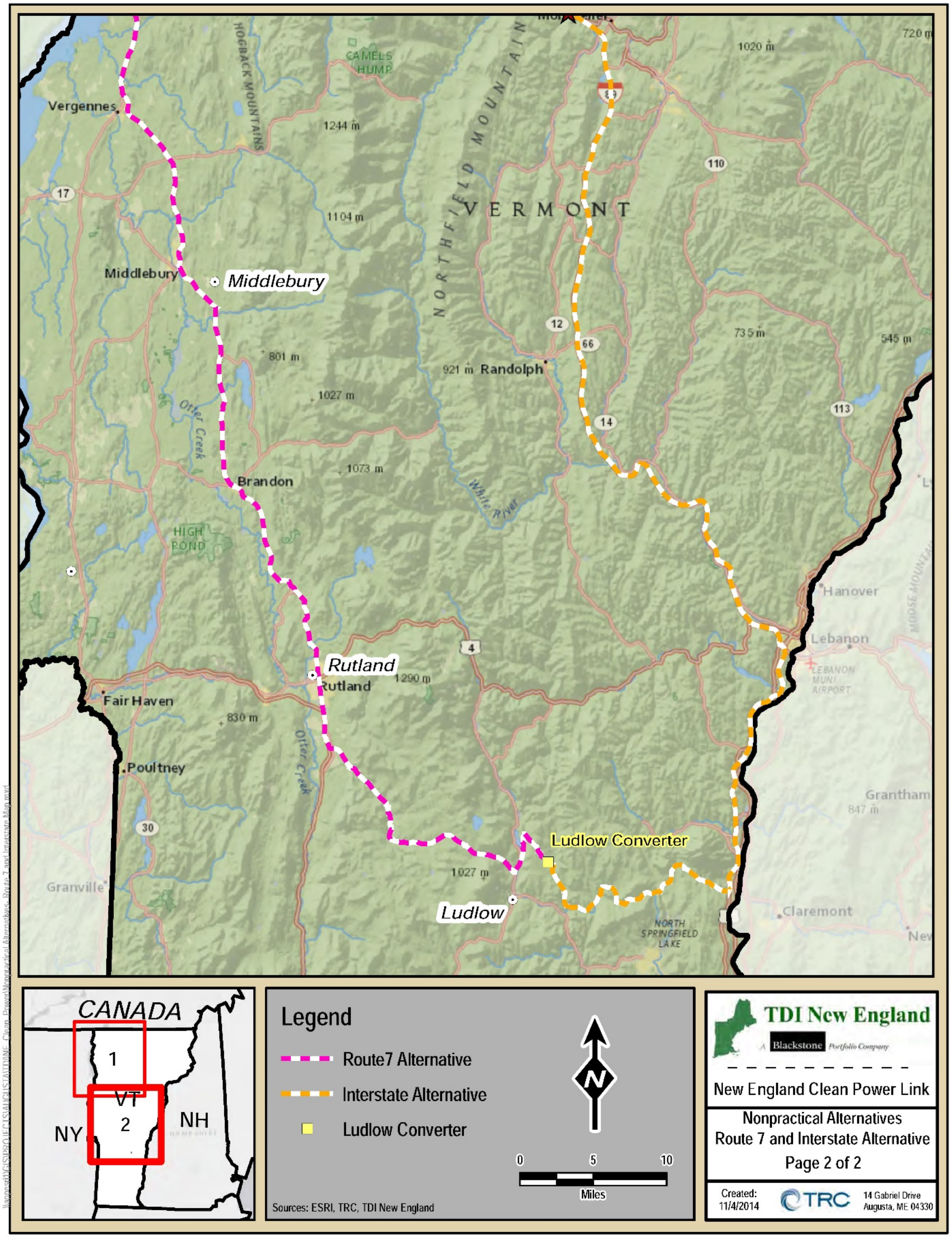


FIGURE 7-2 (CONTINUED)
ROUTE 7 AND INTERSTATE ALTERNATIVES



There are significant obstacles to developing and permitting the Route 7 alternative because of its potential adverse impacts to local communities. Specifically, the Route 7 Alternative would traverse some of Vermont's largest densely populated municipal areas (e.g., Burlington, South Burlington, Middlebury, and Rutland), as well as numerous smaller communities. Where the alternative would pass through the centers of these communities, the roadway is bordered on each side by dense residential and commercial buildings, so that construction associated with installation would be disruptive and would likely encounter public opposition. The construction corridor is particularly complicated in the largest cities due to the density of buildings adjacent to the roadway and the existing network of overhead and buried utilities. Additionally, Route 7 is a very busy travel corridor and the Route 7 Alternative would traverse several developed areas where existing infrastructure, as well as the density of business and residential development, would inhibit construction activities.

While the Interstate Alternative largely avoids community impacts, it also poses permitting and engineering challenges. This alternative route would encounter 19 entrance/exit ramps associated with Interstates 89 and 91. Each of these intersections would likely require an HDD and thereby increase the Project's cost. Interstates 89 and 91 also cross multiple local and state roadways via bridges, so installation in these areas would require repeated utilization of expensive HDDs or similar approaches to facility crossings of these features. A review of the National Bridge Inventory[13] indicates that this alterative would cross several bridges with a total length of greater than 500 feet, some of which traverse steep river valleys. For example, along I-89 in Sharon, VT there are two bridges that span the White River. They are both over 800 feet long and are approximately 70 feet above the River. These long HDDS and deep valleys present significant engineering challenges and the Vermont Agency of Transportation (VTrans) has indicated that attaching the cables to State bridges is not acceptable.

[13] http://www.uglybridges.com/scripts/search.cgi

Both alternatives also are significantly more costly than the proposed route. See Table 7-2. The Route 7 Alternative results in an added cost of approximately $120 million, or 19% higher than the comparable costs for the proposed alternative. The Interstate 89 Alternative results in an increase of approximately $237 million, or 37% higher than the comparable costs for the proposed route.[14] Given the significant cost increases associated with these alternatives, the Applicant believes these alternatives are unreasonably expensive and, therefore, not practicable.

TABLE 7-2
COSTS OF PROPOSED PROJECT AND ROUTE 7 / INTERSTATE ALTERNATIVES[15]

	Project	Route 7 Alternative	Interstate Alternative
In-water Distance (miles)	97.6	0	0
Overland Distance (miles)	56.2	143.0	164.8
Total Distance (miles)	153.8	143.0	164.8
Total Cost ($millions)	$636.1	$756.5	$873.3
Cost Variance from Overall Project ($millions)		$120.4	$237.2
Cost Variance from Overall Project (%)		19%	37%

While TDI-NE does not believe either alternative is practicable, the Applicant nonetheless assessed the potential environmental impacts associated with both of these routes. The environmental analysis further demonstrates that these alternatives would be difficult to permit. As shown in Table 7-3, the acres of wetlands in close proximity to the proposed Project is less than that of either of the two alternatives. The number of stream crossings for the proposed

14 Both of these approximations are conservative and likely underestimate the cost increases associated with these alternatives given the expected number of HDDs and for Route 7 the complexities associated with construction in densely populated ROWs.
15 Installation costs based on following per-mile assumptions (millions of dollars): In-water: $3.44M; roadway ROW: $5.30M; railroad ROW: $5.68M; utility ROW: $5.23M

Project is 70, while the Route 7 Alternative and Interstate Alternative would have 171 and 233, respectively. For the remaining environmental criteria, the Route 7 Alternative and Interstate Alternatives are generally comparable or would result in greater impacts than the proposed Project, indicating that significant environmental impacts are likely to result from construction. Consequently, based on the expected costs of these alternatives, the community and logistical issues in siting these two routes, and the potential adverse environmental impacts, these alternatives were not pursued by the Applicant.

TABLE 7-3
ENVIRONMENTAL RESOURCES ASSOCIATED WITH OVERLAND ALTERNATIVES

CRITERIA	ROUTE 7 ALTERNATIVE	INTERSTATE ALTERNATIVE	PROPOSED PROJECT
AQUATIC ECOSYSTEMS			
Acres of Wetlands within 50’ of route segment (VSWI)	24.4	22.0	12
Acres of Wetlands within 100’ of route segment (VSWI)	70.3	50.7	37.2
Acres of Wetlands within 50’ of route segment (NWI)	22.2	36.4	6.3
Acres of Wetlands within 100’ of route segment (NWI)	56.6	77.3	19
# of Stream Crossings	171	233	70
NON-AQUATIC ECOSYSTEMS			
# of RTE species within 50’ of route segment	28	32	14
# of RTE species within 100’ of route segment	52	40	14
Acres of RTE species within 50’ of route segment	15.7	40.4	44.5
Acres of RTE species within 100’ of route segment	33.2	83.1	71.9
Acres of Significant Natural Communities within 50’ of route segment	0.6	3.6	0.6
Acres of Significant Natural Communities within 100’ of route segment	5.5	7.9	5.23
# of Uncommon species within 50’ of route segment	45	16	8
# of Uncommon species within 100’ of route segment	55	20	9
Acres of Uncommon species within 50’ of route segment	43.9	11.54	14.05
Acres of Uncommon species within 100’ of route segment	88.0	23.4	28.8
Acres of Deer Wintering Areas within 50’ of route segment	12.7	34.9	17.3
Acres of Deer Wintering Areas within 100’ of route segment	31.8	100.9	44.2

CRITERIA	ROUTE 7 ALTERNATIVE	INTERSTATE ALTERNATIVE	PROPOSED PROJECT
# of Public Water Source Protection Areas - Groundwater within 500' of route segment	26	23	18
# of Public Water Source Protection Areas – Surface Water within 500' of route segment	6	7	0
# of Hazardous Waste Sites within 500' of route segment	325	32	15

7.5.2 Overhead Alternative

The Overhead Alternative would cross the US / Canadian border in Highgate, Vermont and follow existing utility ROWs for a distance of approximately 131 miles to the proposed converter station location. For the purpose of assessing an overhead alternative, the Applicant assumed that the associated route would require the establishment of a new ROW or an expansion of an existing ROW in order to accommodate the infrastructure required for a 1000 MW HVDC transmission project. The overhead route would follow existing overhead electric transmission corridors that were identified with public documents and aerial photography. The route would travel along the western part of the state, to the east of Lake Champlain, traversing several larger communities including Winooski, South Burlington, Shelburne, New Haven, Middlebury, Brandon, and Rutland. The Overhead Alternative is depicted in Figure 7-3.

FIGURE 7-3
OVERHEAD ALTERATIVE

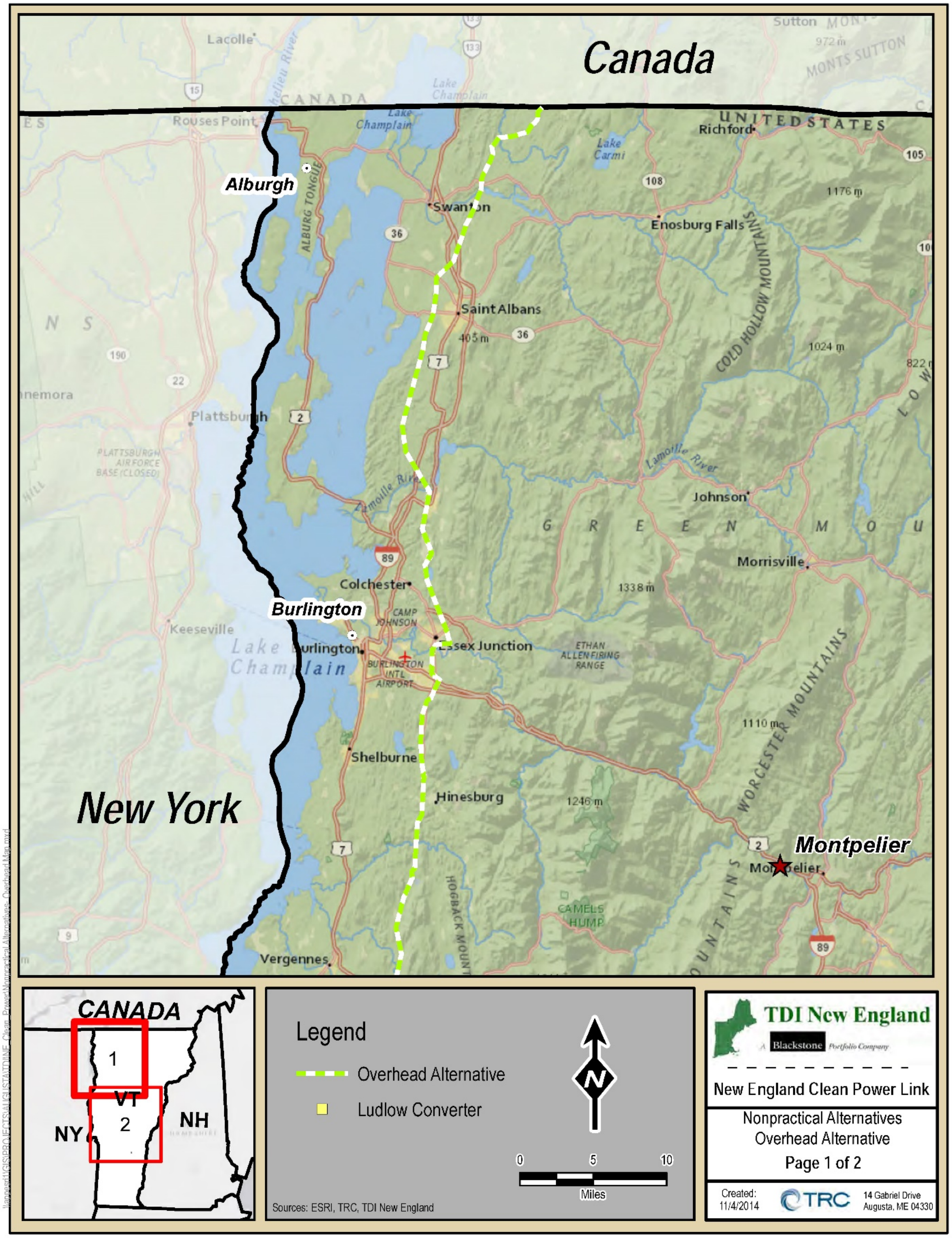
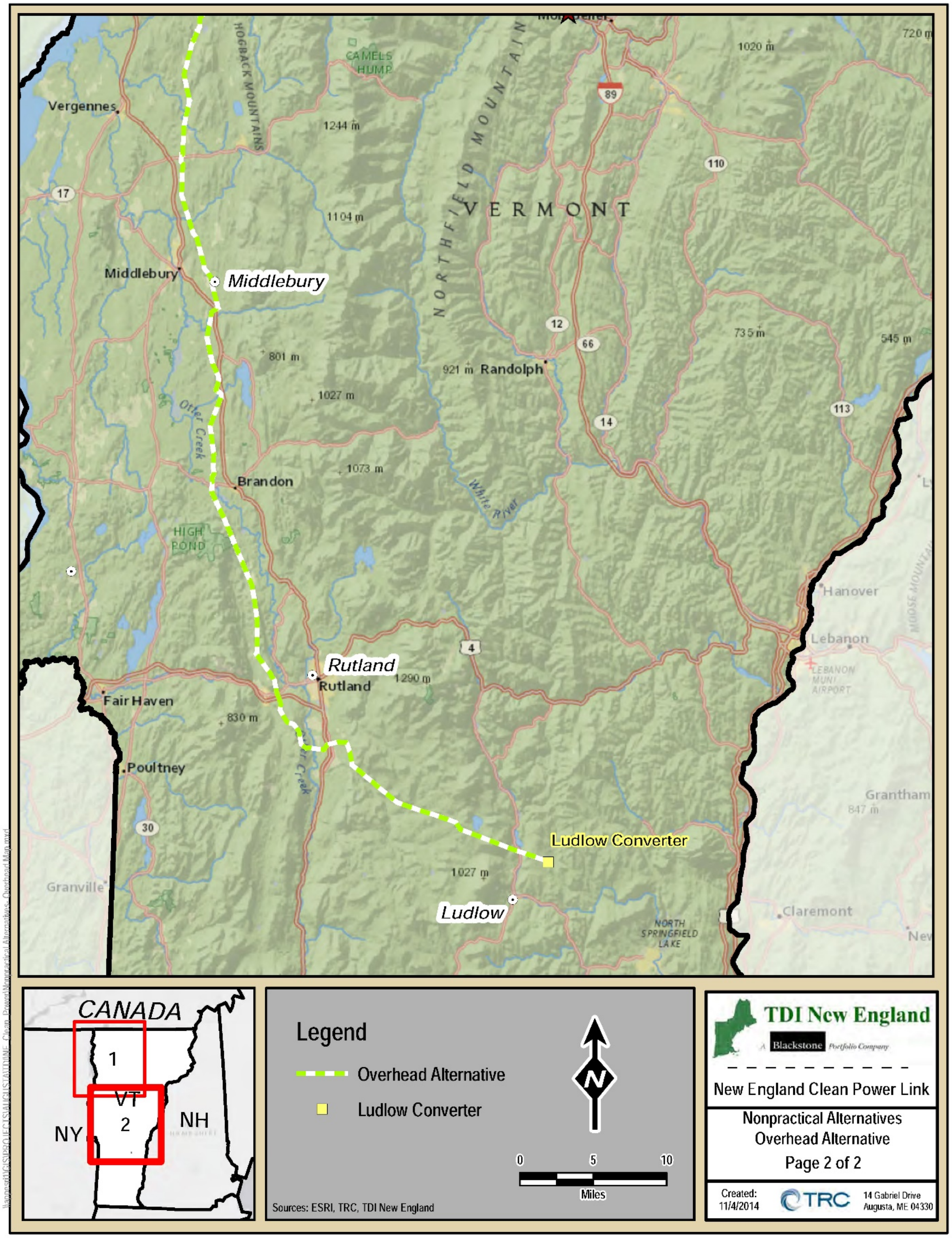


**FIGURE 7-3 (CONTINUED)
OVERHEAD ALTERATIVE**



The overhead HVDC transmission system would likely utilize a bipolar configuration, consisting of two conductors per pole and a ground wire. In general, conductors would have a spacing of approximately 18 inches apart, and each conductor would have an overall diameter of approximately 1.75 inches. A metallic return conductor with a fiber optic core would be installed in the shield wire position above the electrical pole conductors to provide protection against lightning strikes. The return conductor would also provide a communication path between converter stations. A separate shield wire may be necessary on towers with a horizontal arrangement.

Several different transmission tower configurations may be utilized for overhead transmission lines. In general, the potential transmission tower types can be defined as "lattice" or "monopole" designs. Lattice towers are constructed of galvanized steel and are assembled on site. These freestanding towers are widely used as transmission line support structures across the United States.

In contrast to the lattice design, monopole towers have a single-shaft, tubular structure. Because of their smaller footprint, monopole towers are well-suited to right-of-way locations where space is limited and aesthetics are important. Notwithstanding these benefits, monopole towers tend to be more expensive;[16] one transmission study estimated that the total costs for monopole towers were 25% higher than for lattice towers.[17] The specific height and design of each monopole or lattice tower would be determined by the angle of the conductor bundles, the span between towers, and the topography. In general, the lattice or monopole steel support structures for +/-320-kV would be expected to vary from approximately 65 to 135 feet in height, although some

[16] Fabrimet, *Advantages of Lattice Towers*, http://www.fabrimet.com/advantages-lattice-towers.html (last visited Apr. 22, 2013).
[17] Joseph J. Seneca, Michael L. Lahr, James W. Hughes & Will Irving, *Economic Impacts on New Jersey of Upgrading PSE&G's Susquehanna-Roseland Transmission System* (May 2009), http://www.pseg.com/family/pseandg/powerline/pdf/rutgersjobreport.pdf.

configurations require greater than 150 feet in height. Spans would range from 600 to 700 feet between monopole towers and 800 to 1,000 feet between lattice towers.

The width of a transmission line's permanent ROW is generally determined by the voltage of the system and the need to provide for adequate setbacks for maintenance and reliability. A review of existing projects within Vermont indicates that typical width of an existing 345 kV ROW is approximately 150 feet wide. The transmission line clearing for construction purposes is dependent on the type of tower, topography, span, location, existing utility rights-of-way, and other factors. While the precise right-of-way would vary along sections of the lines, each transmission tower location would require a concrete foundation to ensure structural stability of the towers. The specific foundation requirements would be dependent on the geotechnical conditions at each tower location.

Constructing a new overhead transmission project, subject to the infrastructure requirements described above, in the State of Vermont would entail significant regulatory and permitting obstacles, encounter significant public opposition, require TDI-NE to acquire rights to (or condemn) hundreds of parcels of property, and substantially increase the impacts to the environment in comparison to the proposed project. While the Vermont Public Service Board has, in the last decade, approved two overhead transmission projects, the projects differed in significant aspects from the NECPL Project. Specifically, both projects had a significantly smaller footprint, are not HVDC, and are entirely Vermont-based projects.[18] Two overhead

[18] *See* Final Order Granting Certificate of Public Need at 11, *Petitions of Vermont Electric Power Company, Inc. (VELCO) and Green Mountain Power Corporation (GMP) for a certificate of public good, pursuant to 30 V.S.A. Section 248, authorizing VELCO to construct the so-called Northwest Vermont Reliability Project, said project to include: (1) upgrades at 12 existing VELCO and GMP substations located in Charlotte, Essex, Hartford, New Haven, North Ferrisburgh, Poultney, Shelburne, South Burlington, Vergennes, West Rutland, Williamstown, and Williston, Vermont; (2) the construction of a new 345 kV transmission line from West Rutland to New Haven; (3) the reconstruction of a portion of a 34.5 kV and 46 kV transmission line from New Haven to South Burlington; and (4) the reconductoring of a 115 kV transmission line from Williamstown to Barre, Vermont*, Docket No. 6860. January 28, 2005; Final Order Granting Certificate of Public Need at 4, *Joint Petition of Vermont Electric Power Company,*

projects of a similar scope to the NECPL Project were proposed in New York and New Hampshire and both encountered significant public opposition, regulatory uncertainty, and development risk.[19] Moreover, there would be a significant number of communities potentially impacted by the construction and operation of the Overhead Alternative. As with the Route 7 alternative, the Overhead Alternative would traverse some of Vermont's largest cities as well as numerous smaller communities. Where the alternative would traverse these communities, existing utility ROWs would, in many cases, need to be expanded to allow for construction access.

In addition to permitting and development risks, there would be significant logistical and environmental issues associated with the development of an overhead project. In particular, TDI-NE would likely need to site the 131 mile transmission line on a new transmission corridor or through an approximately 100' expansion of existing utility ROWs. Using publically available parcel databases which provided coverage for approximately 84% of the route, the Applicant identified that this alternative would cross 736 parcels. As such, the Applicant would be required to negotiate and execute or amend scores of easements with hundreds of landowners or condemn land through eminent domain. This would add significant burdens to the

Inc., Vermont Transco, LLC, and Central Vermont Public Service Corporation for a certificate of public good, pursuant to 30 V.S.A. Section 248, authorizing the construction of the Southern Loop Transmission Upgrade Project. Docket No. 7373. February 11, 2009.

[19] *See. e.g.*, New England States Committee on Electricity. Incremental Hydropower Imports Whitepaper. September 9, 2013 ("New Hampshire public officials note that the Northern Pass proposal faces significant hurdles to its implementation in its current form. Organized grass-roots opposition by citizens, advocacy groups and state and local elected officials, has led to apparent bipartisan opposition to the project in the New Hampshire Legislature."); NYRI Submits Notification that it is Suspending its Application filed under Article VII of the Public Service Law, *Application of New York Regional Interconnect, Inc. for a Certificate of Environmental Compatibility and Public Need Pursuant to Article VII for a high voltage direct current electric transmission line running between National Grid's Edic Substation in the Town of Marcy, and Central Hudson Gas & Electric's Rock Tavern Substation located in the Town of New Windsor*, Case No. 06-T-0650 (N.Y. P.S.C. Apr. 6, 2009), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={7241B9D8-8B9C-4A92-B19E-4446DF4D0F9D}.

development process, engender litigation, foment public opposition, cause significant delay, and significantly increase the costs and risks of development.

Further, the proposed Overhead Alternative would likely increase the scope and breadth of environmental impacts, because of the construction effects on wetlands and RTE and uncommon species. As with the previous two alternatives, the Applicant assessed the potential environmental impacts associated with both of these routes (see Table 7-4). The acres of wetlands within close proximity to the overhead route as well as the number of stream crossings is in the hundreds, and access roads would need to be constructed for long segments of the route resulting in permanent wetland and stream impacts. These impacts occur to a much lesser extent on alternatives sited next to roads, which can generally be accessed without building construction roads. Greater densities of other resources (e.g. uncommon species and RTE species) were also identified in the vicinity of the Overhead Alternative in comparison to the proposed route, which is not unexpected as much of the route traverses areas which do not encounter regular human disturbance. In addition, the Overhead Alternative would have heightened adverse effects on aesthetics, a highly valued resource in the State of Vermont. For all of these reasons, TDI-NE does not believe that an Overhead Alternative is a practicable alternative.

TABLE 7-4
ENVIRONMENTAL RESOURCES ASSOCIATED WITH OVERHEAD ALTERATIVE

CRITERIA	OVERHEAD ALTERNATIVE	PROPOSED PROJECT
AQUATIC ECOSYSTEMS		
Acres of Wetlands within 50’ of route segment (VSWI)	150.0	12
Acres of Wetlands within 100’ of route segment (VSWI)	300.0	37.2
Acres of Wetlands within 50’ of route segment (NWI)	112.6	6.3
Acres of Wetlands within 100’ of route segment (NWI)	226.2	19
# of Stream Crossings	204	70
NON-AQUATIC ECOSYSTEMS		
# of RTE species within 50’ of route segment	75	14
# of RTE species within 100’ of route segment	79	14
Acres of RTE species within 50’ of route segment	90.3	44.5
Acres of RTE species within 100’ of route segment	176.3	71.9

CRITERIA	OVERHEAD ALTERNATIVE	PROPOSED PROJECT
Acres of Significant Natural Communities within 50’ of route segment	5.4	0.6
Acres of Significant Natural Communities within 100’ of route segment	14.7	5.23
# of Uncommon species within 50’ of route segment	57	8
# of Uncommon species within 100’ of route segment	59	9
Acres of Uncommon species within 50’ of route segment	158.6	14.05
Acres of Uncommon species within 100’ of route segment	311.8	28.8
Acres of Deer Wintering Areas within 50’ of route segment	3.8	17.3
Acres of Deer Wintering Areas within 100’ of route segment	31.2	44.2
# of Public Water Source Protection Areas - Groundwater within 500’ of route segment	12	18
# of Public Water Source Protection Areas – Surface Water within 500’ of route segment	2	0
# of Hazardous Waste Sites within 500’ of route segment	9	15

7.6 Comparison of Practicable Alternatives

For the alternatives which were identified by the Applicant as practicable, TDI-NE evaluated each alternative’s potential impacts to aquatic and terrestrial resources and other sensitive resources such as RTE species, wildlife habitat, or other resources.

7.6.1 Application of Criteria to Practicable Alternatives

TDI-NE evaluated the environmental impacts associated with the following alternatives as a part of three distinct geographic segments:

Lake Segment Alternatives

1. West Haven Alternative: Lake Champlain to West Haven
2. Benson Landing Alternative: Lake Champlain to Benson Landing *(Preferred Alternative)*

Western Segment Alternatives

3. Route 4 Alternative: Roadway ROW *(Preferred Alternative)*
4. Railroad Alternative West: Railroad ROW

Eastern Segment Alternatives

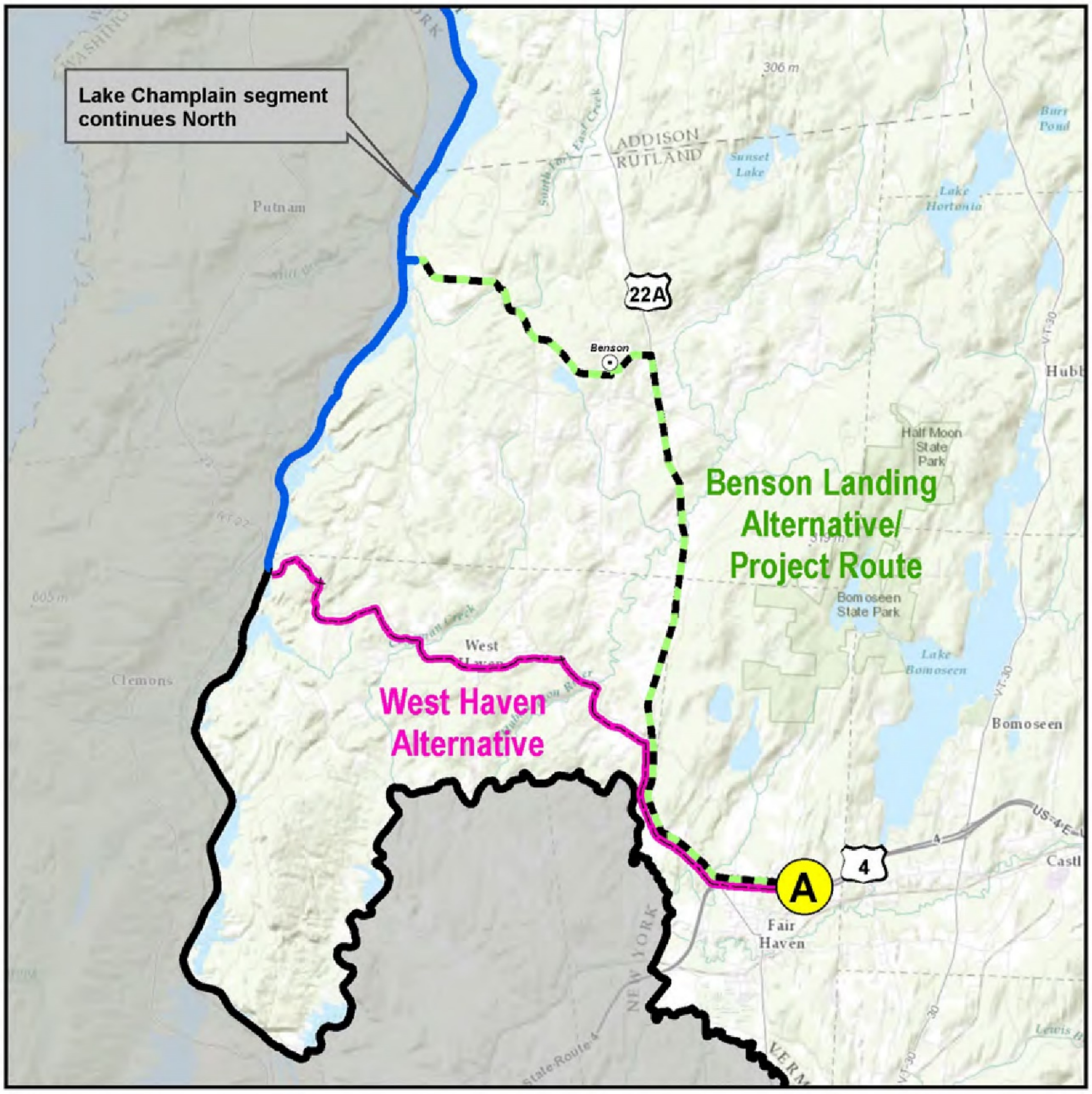
5. Route 103 Alternative: Roadway /Railroad ROW *(Preferred Alternative)*
6. Railroad Alternative East: Railroad/Roadway ROW
7. VELCO Alternative: VELCO ROW

For the three "Segments," the environmental impact of each alternative was assessed based on the environmental criteria discussed above. The results of the comparative impact analysis of the Project route and the identified alternatives are presented below.

7.6.2 Lake Champlain Segment (West Haven and Benson Landing Alternatives)

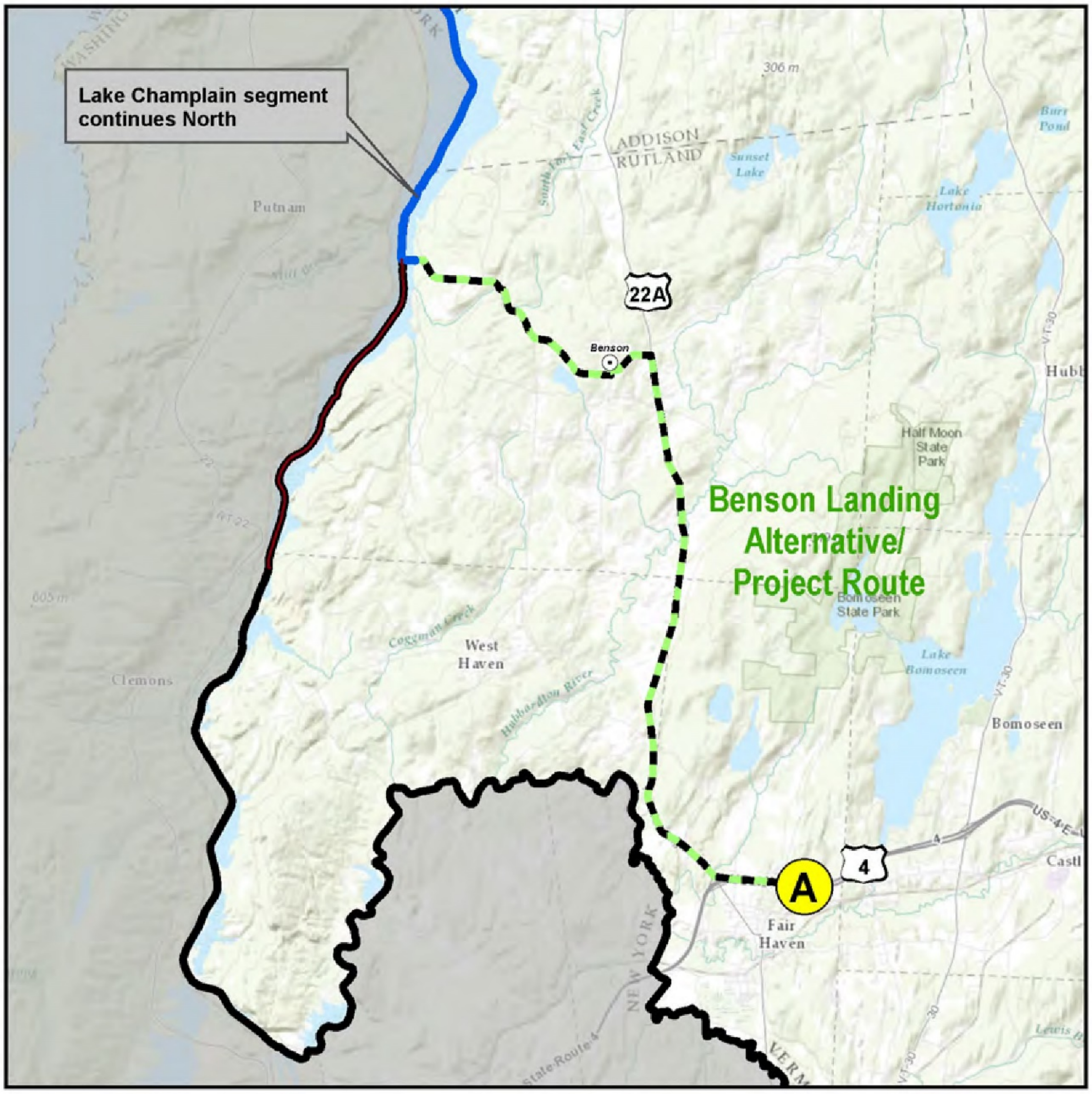
The West Haven Alternative would involve an approximately 0.3 mile underground segment in Alburgh, Vermont followed by approximately 100 miles south in Lake Champlain, entirely within the jurisdictional waters of the State of Vermont, exiting the lake via HDD in West Haven, Vermont. The routing would proceed east through West Haven along local roads (Grant Road, Cold Spring Road, Pettis Road, Burr Road, and Main Street) for approximately 8 miles before transferring to the Route 22A ROW. At this point the alternative would travel approximately 3.4 miles south to Route 4 in Fair Haven. This alternative is illustrated in Figure 7-4.

FIGURE 7-4
WEST HAVEN ALTERNATIVE



For the Benson Landing Alternative, the HVDC transmission line would be located underground within the Town of Alburgh, Vermont for approximately 0.5 miles. 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, entirely within the jurisdictional waters of the State of Vermont, to the Town of Benson, Vermont. The cable system would be installed underneath town roads for approximately 4.4 miles to Route 22A, at which point the transmission system would be within the Route 22A ROW south for approximately 8.1 miles to Route 4 in Fair Haven. This alternative is illustrated in Figure 7-5.

FIGURE 7-5
BENSON LANDING ALTERNATIVE



As shown in Table 7-5 below, the potential environmental impacts of the two alternatives are relatively similar, which is to be expected based on the similarities of settings (i.e. town and state roadways).

TABLE 7-5
COMPARISON OF LAKE CHAMPLAIN ALTERNATIVES

CRITERIA	BENSON LANDING ALTERNATIVE	WEST HAVEN ALTERNATIVE
Overland Length (miles)	**110.6**	**111.9**
Estimated Total Cost ($millions) (including Lake Champlain installation)	**$405.8**	**$408.2**
Construction Access	Existing (TDI-NE property, public roads)	Public Roads; Unknown property for HDD.
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

In terms of wetlands, the VSGI and NWI acreages of wetlands within close proximity to the Benson Landing Alternative are higher than those for the West Haven Alterative. Based on consultations with Benson Town Officials, however, the Applicant intends to bury the cables within Benson town roadways so there would be minimal impact on wetlands along these roads.

Consequently, as demonstrated in Table 7-6, the difference in acreage of wetlands is minimal using VSWI data (i.e. .88 acres to .47 acres) and identical using NWI datasets.

TABLE 7-6
COMPARISON OF LAKE CHAMPLAIN ALTERNATIVE SEGMENTS
WETLANDS ALONG ROUTE 22A

CRITERIA	BENSON LANDING ALTERNATIVE	WEST HAVEN ALTERNATIVE
Acres of Wetlands within 50' of Town Roads route segment (VSWI)	1.86	0.27
Acres of Wetlands within 50' of Route 22 /Route 4 segment (VSWI)	0.88	0.47
Acres of Wetlands within 50' of Town Roads route segment (NWI)	1.16	0.13
Acres of Wetlands within 50' of Route 22 / Route 4 segment (NWI)	0.1	0.1

In looking at potential impacts to nearby natural resources and other sensitive features, each alternative has areas where it is superior or inferior to the other. The number of potential RTE and uncommon species is less for the Benson Landing Alterative but the potential acreage in close proximity is greater. As no detailed field studies have been conducted for West Haven, these impacts can be considered equivalent. The acres of Significant Natural Communities are comparable for the two routes, while the Benson Landing Alternative has less potential impact as measured by nearby acres of deer wintering acres.

The West Haven Alternative also poses certain environmental concerns that are not reflected in Table 7-5. The three mile in-water segment south of Benson Landing includes the Narrows of Lake Champlain Federal Navigation Channel which may require deeper burial. Deeper burial will increase temporary impacts to water quality associated with installation. Additionally, there are potential land use issues associated with the West Haven Alternative's proposed utilization of Grant Road, the closest Town Road to the lake. Based on aerial photography (see Figure 7-6), lakeside locations for an HDD staging area would likely require forest clearing near the Lake.[20]

[20] The only nearby location that would not require clearing is an apparent sand or gravel pit located to the south of the roadway. The installation of a HVDC transmission system, however, is incompatible with an area where excavation activities are regularly occurring. Moreover, the Applicant has no agreement with any landowner of a

As such, the Applicant believes that the Benson Landing Alternative represents preferred alternative in this segment.

FIGURE 7-6
NARROWS OF LAKE CHAMPLAIN NEAR GRANT ROAD
WEST HAVEN, VERMONT

7.6.3 Western Segment (Route 4 and Railroad ROW Alternatives)

From Fair Haven, the Route 4 Alternative would travel east within the Route 4 ROW to West Rutland for approximately 13 miles. This alternative is illustrated in Figure 7-7.

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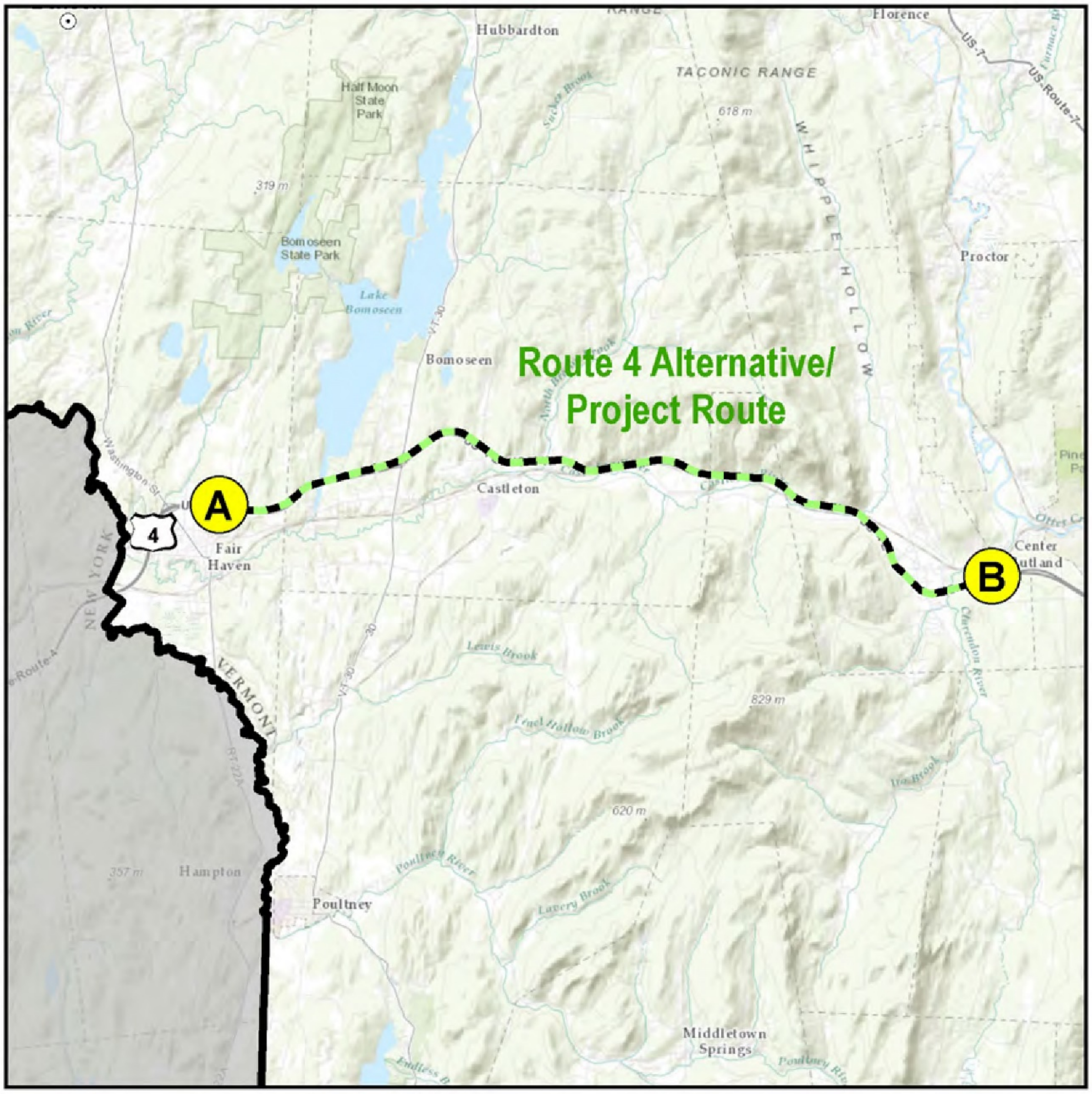
parcel that both borders the lake and Grant Road, which may render this alternative not practicable.

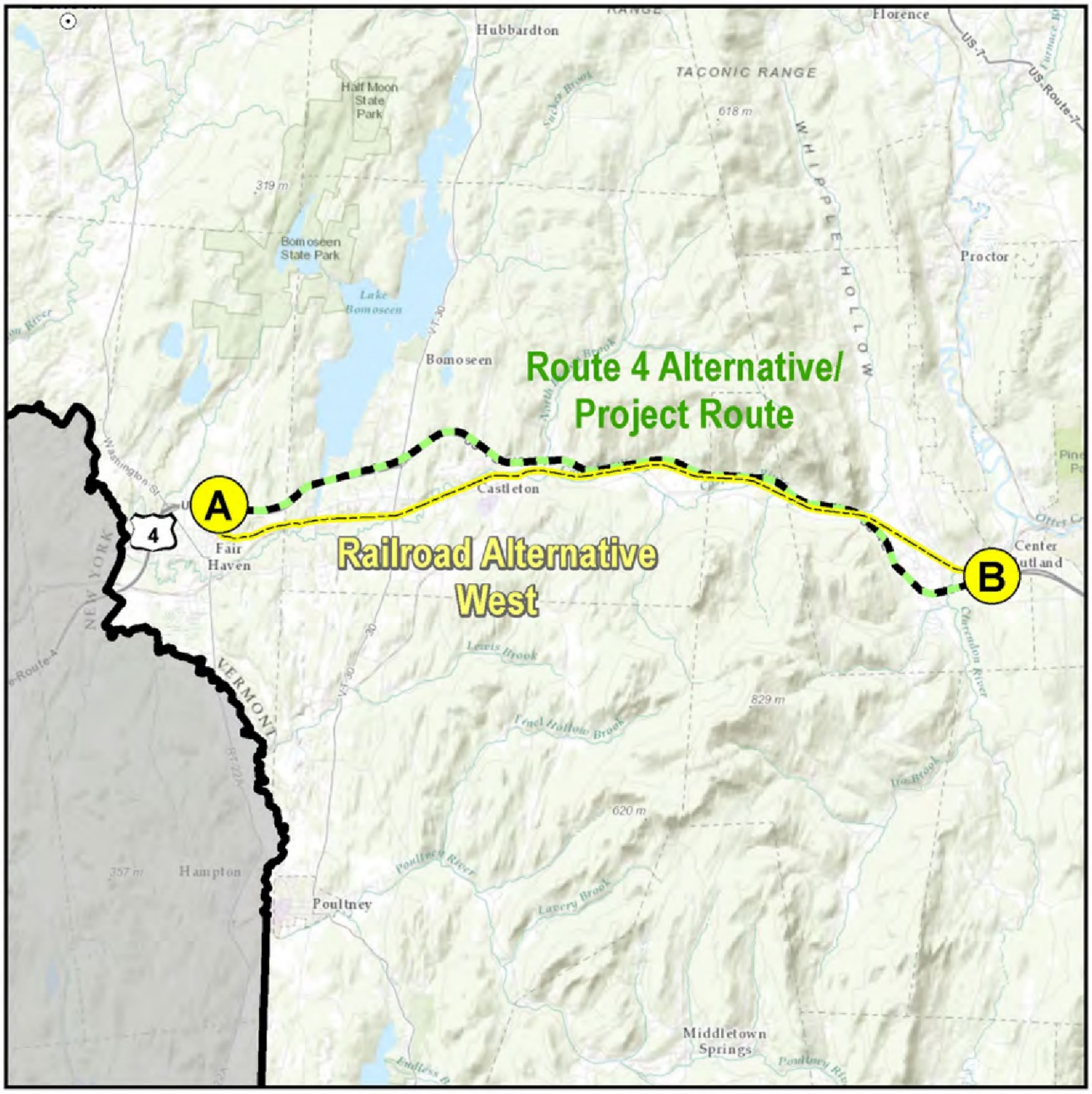
FIGURE 7-7
ROUTE 4 ALTERNATIVE



The Railroad Alternative would follow Route 4 from Fair Haven until its intersection with Route 4A, at which point the alternative would follow Route 4A and then enter the VTrans railroad ROW for approximately 11 miles. The cables would intersect with the Route 4 Alternative in West Rutland after a total distance of approximately 13 miles as well. This alternative is illustrated in Figure 7-8.

FIGURE 7-8

RAILROAD ALTERNATIVE (WEST)



Although the two alternatives are essentially equivalent in terms of length, the Route 4 Alternative is generally superior to the Railroad Alternative West in terms of the environmental resource categories (see Table 7-7). Most significantly, the acreage of wetlands within close proximity to the Railroad Alternative West are significantly greater than those reported for the Route 4 Alternative (i.e. .7 acres of VSWI wetlands within 50' vs. 60.8 acres for the railroad Alternative). Further, based on visual observations of the railroad route during a "high-line" tour of this route in 2014, it is probable that significant impacts would occur during the installation of the cable as wetlands are often present on both sides of the railroad track ballast. In the majority of other categories, the Route 4 Alternative has the same or less resources within the selected assessment area. For those areas where the Railroad Alternative West showed less potential environmental impact, the values reported are sufficiently close. Further, the road ROW is maintained via ongoing vegetation maintenance by VTrans and so any known resources are already likely to be impacted. In contrast, the railroad ROW tracks and ballast are the only areas that receive ongoing maintenance. Accordingly, it is the Applicant's belief that the Route 4 Alternative represents the preferred alternative.

TABLE 7-7
COMPARISON OF WESTERN SECTION ALTERNATIVES

CRITERIA	ROADWAY ALTERNATIVE	RAILROAD ALTERNATIVE
Overland Length (miles)	**13**	**13**
Estimated Total Cost ($millions)	**$68.9**	**$73.1**
Construction Access	Roadway	Roadway, access roads likely needed
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

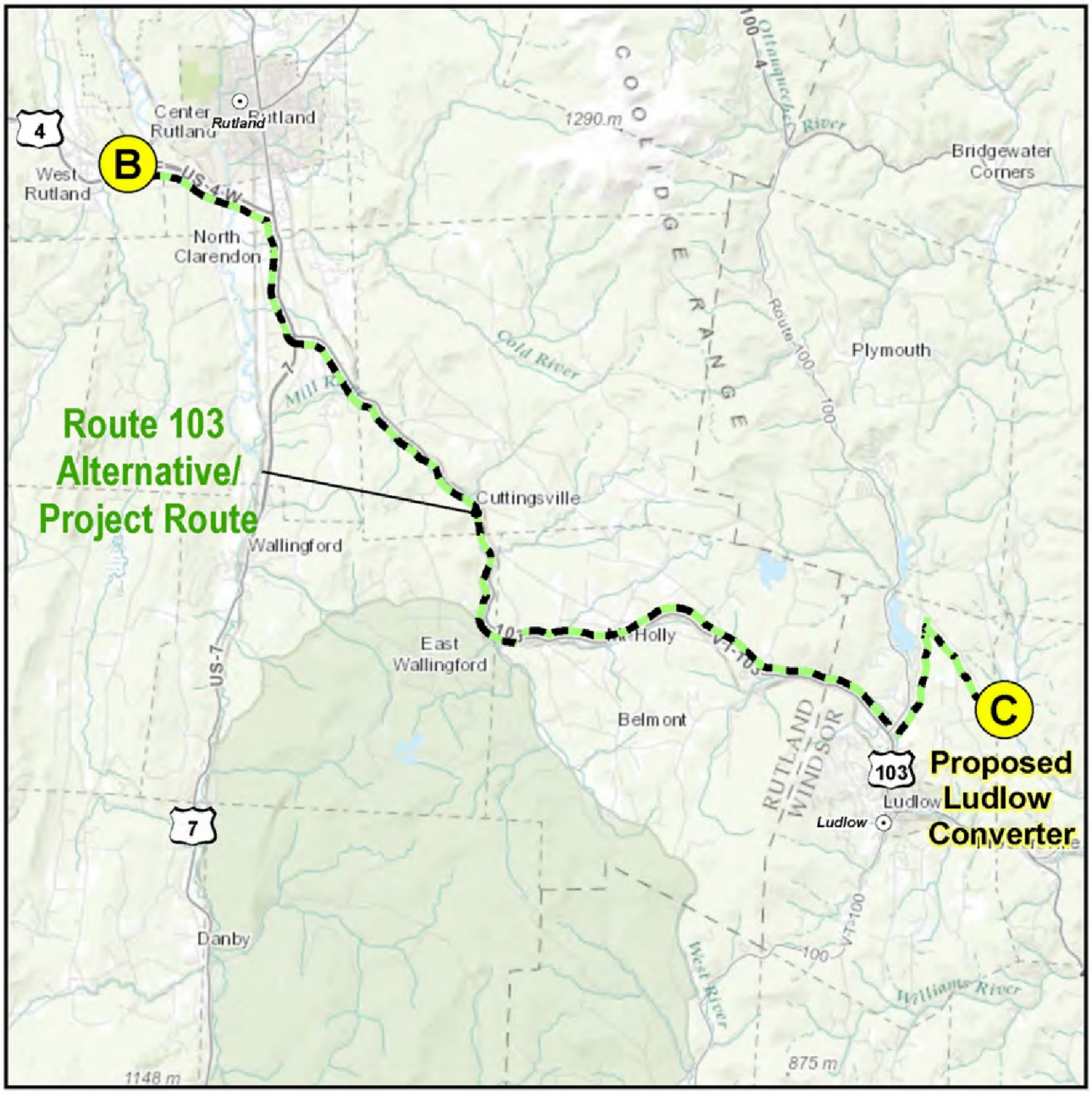
7.6.4 Eastern Segment (Route 103, Railroad ROW, VELCO ROW)

The Route 103 Alternative would travel within the Route 4 ROW for approximately 4.2 miles east to Route 7 in Rutland, then approximately 2.6 miles south to Route 103 in North Clarendon.

The transmission system would travel approximately 3.9 miles in the Route 103 ROW, and then enter the VTrans Railroad ROW in Shrewsbury, Vermont to bypass the historic village of Cuttingsville.[21] The route would be within the railroad ROW for approximately 3.5 miles, then re-enter the Route 103 ROW in Wallingford, Vermont. After approximately 10.4 miles along the Route 103 ROW, the route would travel north on Route 100 for almost one mile before intersecting with a town road. The cables will be laid within the ROW or underneath town roads for approximately 4.8 miles before reaching the Ludlow HVDC Converter Station. The total length of this alternative would be approximately 26 miles with 22.5 miles along road ROWs and 3.5 miles along the railroad ROW. This alternative is illustrated in Figure 7-9.

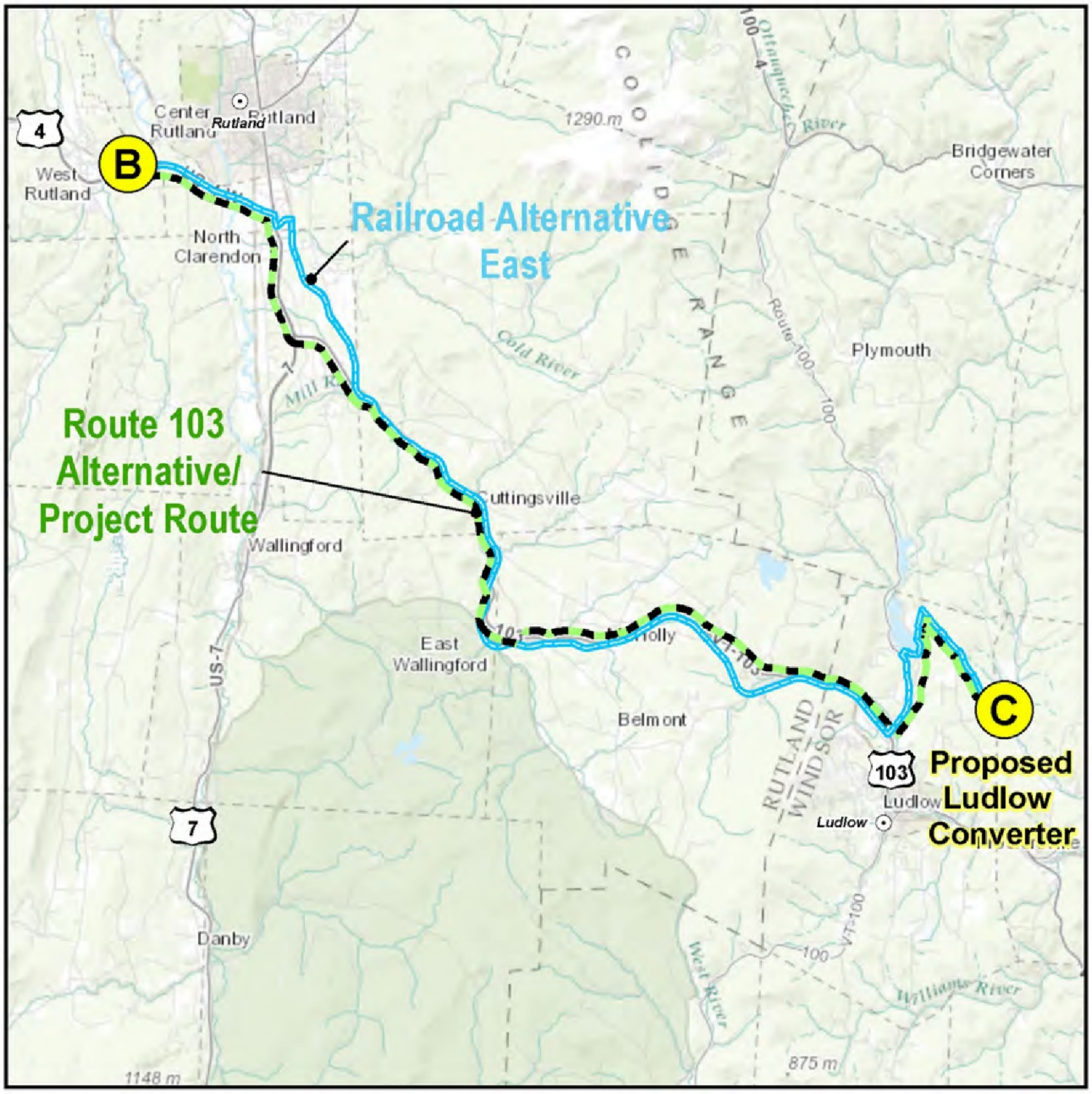
[21] For the Route 103 Alternative, the Applicant originally proposed to have this route continue on Route 103 through Cuttingsville rather than utilize the nearby segment of railroad ROW. The original routing proposal was reflected in the Applicant's application for a Presidential Permit pending before the U.S. Department of Energy. However, after further investigation and evaluation, the Applicant has determined that the original routing would involve construction in a narrow section of VTrans ROW within one of the most densely populated stretches of the entire route with multiple businesses. In addition, the relocation to the railroad ROW avoids two very challenging HDDs that could potentially impact existing bridges. In addition, large stretches of the original routing are within Fluvial Erosion Hazard and Floodplain areas. Lastly, the Village of Cuttingsville is a Vermont Historic District that has over 30 potential or listed historic structures, many very close to the roadway, raising the potential for temporary or permanent impacts to these cultural resources due to the narrow area available for construction.

FIGURE 7-9
ROUTE 103 ALTERNATIVE (PROJECT ROUTE)



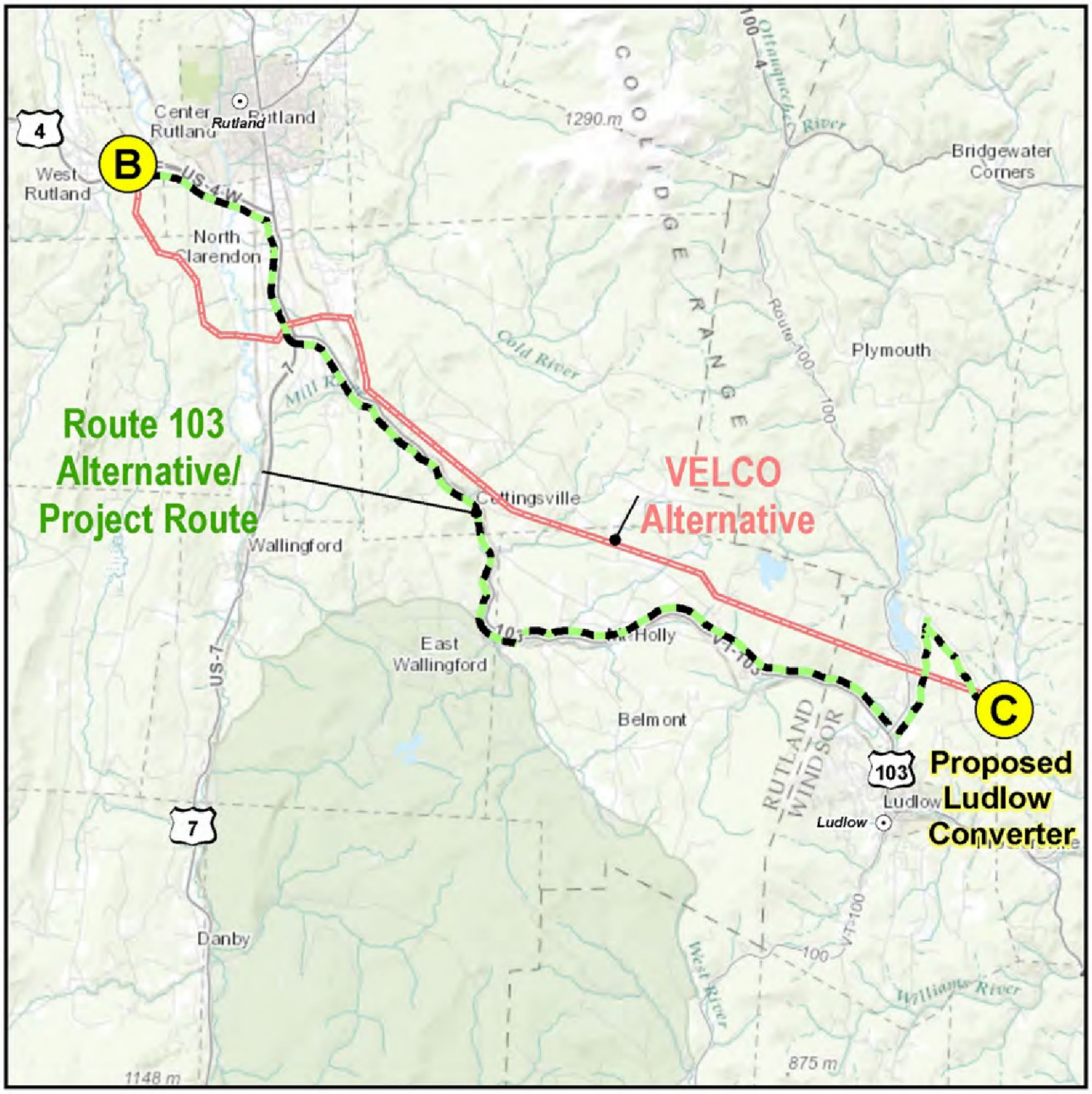
For the Railroad Alternative (East), the first 6.8 miles of this alternative would be the same as the Route 103 Alternative, but would enter the railroad ROW south of the intersection of Route 4 and Route 7 in Rutland, traveling south, then east, for 20.3 miles to Route 103 in Ludlow where the final 5.8 miles would follow Route 100 and local roads as depicted in the Route 103 Alternative. 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. This alternative is illustrated in Figure 7-10.

FIGURE 7-10
RAILROAD ALTERNATIVE EAST



The VELCO Alternative would transition from the Route 4 ROW in West Rutland to enter the VELCO ROW. The cable system would then travel south / south east for approximately 24 miles to the proposed converter station location within this existing ROW. This alternative is illustrated in Figure 7-11.

FIGURE 7-11
VELCO ALTERNATIVE



The comparison of the three alternatives in terms of the potential impacts to aquatic and non-aquatic ecosystems indicated that the Route 103 Alternative is generally superior to the other two (see Table 7-8) across all criteria except for streams crossed, deer wintering areas, groundwater public water source protection areas and hazardous waste sites. The Applicant believes that the resource impacts associated with the Route 103 Alternative will actually be lower than the GIS analysis suggests. The majority of the streams along the Route 103 Alternative are in culverts and therefore the Applicant will generally avoid in-stream activities. Deer wintering areas will likely not be impacted, because the cables are generally proposed to be installed in existing cleared areas. The number of surface water public water source protection areas does not significantly differ among the three options and any hazardous waste sites near the Route 103 Alternative will be identified and appropriate construction practices would be followed. In comparison to the Route 103 Alternative, the VELCO ROW has very little existing infrastructure (e.g. bridges, culverts, and existing roads) that the Applicant can utilize to minimize impacts to streams and wetlands. As such, greater resource impacts would be anticipated along the Railroad Alternative (East) and VELCO Alternatives.

TABLE 7-8
COMPARISON OF EASTERN SECTION ALTERNATIVES

CRITERIA	ROUTE 103 ALTERNATIVE	RAILROAD / ROADWAY ALTERNATIVE	VELCO ALTERNATIVE
Overland Length (miles)	29.6	30.8	24.0
Estimated Total Cost ($millions)	$156.3	$172.18	$125.41
Approximate Number of Permanent Easements	0	0	120
Construction Access	Roadway	Roadway, Railroad, new access roads	New access roads
AQUATIC ECOSYSTEMS			
Acres of Wetlands within 50’ of route segment (VSWI)	8.6	16.0	21.2
Acres of Wetlands within 100’ of route segment (VSWI)	24.5	37.4	41.2
Acres of Wetlands within 50’ of route segment (NWI)	3.9	14.0	6.2
Acres of Wetlands within 100’ of route segment (NWI)	11.8	32.2	11.8
# of Stream Crossings	34	43	22
NON-AQUATIC ECOSYSTEMS			
# of RTE species within 50’ of route segment	4	4	8
# of RTE species within 100’ of route segment	4	4	8
Acres of RTE species within 50’ of route segment	12.4	18.6	26.0
Acres of RTE species within 100’ of route segment	24.3	37.2	50.8
Acres of Significant Natural Communities within 50’ of route segment	0.60	11.7	3.2

CRITERIA	ROUTE 103 ALTERNATIVE	RAILROAD / ROADWAY ALTERNATIVE	VELCO ALTERNATIVE
Acres of Significant Natural Communities within 100’ of route segment	5.2	23.4	5.5
# of Uncommon species within 50’ of route segment	2	3	6
# of Uncommon species within 100’ of route segment	2	3	7
Acres of Uncommon species within 50’ of route segment	0.75	9.2	1.6
Acres of Uncommon species within 100’ of route segment	2.2	11.4	2.7
Acres of Deer Wintering Areas within 50’ of route segment	17.0	19.9	0.0
Acres of Deer Wintering Areas within 100’ of route segment	39.0	47.1	4.5
# of Public Water Source Protection Areas - Groundwater within 500’ of route segment	8	6	4
# 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

In addition, the VELCO Alternative has similar practicality concerns as the Overhead Alternative, albeit on a smaller scale. In terms of the likely number of easements, 60 parcels were identified along the 11.64 miles (48%) of the route where parcel coverage existed. As the areas without coverage are in the greater Rutland area, it is reasonable to assume at least another 60 more landowners for a total of approximately 120 easements would need to be executed or amended in order to gain access to the VELCO ROW.[22] Moreover, construction access roads would need to be built along stretches of the VELCO ROW and to a lesser extent the Railroad ROW. These access roads would likely result in permanent impacts to streams and wetlands and

[22] The Applicant has been informed by VELCO that, due to certain legal uncertainties, it should be assumed that the existing VELCO easements would not allow for a buried transmission line.

temporary impacts to sensitive species and habitats. Moreover, VELCO has not granted permission to put the transmission line within its ROW. If permission is granted, TDI-NE expects that additional forested ROW would need to be cleared to accommodate the ROW, as VELCO would not want to encumber its existing cleared ROW with a buried transmission line. This required clearing would be expected to result in additional impacts to natural resource features. Accordingly, the Applicant believe that the Route 103 Alternative is the preferred alternative for this segment.

7.7 Conclusion

Pursuant to the Guidelines implementing Section 404(b)(1) of the CWA, the USACE must determine whether a proposed project is the least environmentally damaging practicable alternative. To assist in the USACE's analysis, TDI-NE evaluated the practicability of various alternatives, and analyzed the resource impacts associated with each alternative. Based on the analysis set forth above, TDI-NE believes the preferred alternative satisfies the requirements of Section 404 (b)(1) of the CWA as the least environmentally damaging practicable alternative.