Stream Alteration Individual Permit Narrative

TDI NEW ENGLAND (TDI-NE)

NEW ENGLAND CLEAN POWER LINK PROJECT (NECPL)

Grand Isle, Rutland, and Windsor Counties, Vermont

Prepared for **Champlain VT, LLC d/b/a TDI New England**
P.O. Box 155
Charlotte, VT 05445

Prepared by **VHB**
40 IDX Drive, Building 100
Suite 200
South Burlington, VT 05403

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Table of Contents

1.0 Introduction

On behalf of Champlain VT, LLC, d/b/a TDI New England ("TDI-NE" or "Applicant"), this Stream Alteration Permit narrative and supporting application materials, prepared by VHB and TRC Environmental, Inc. ("TRC"), comprise an application to obtain an Individual Stream Alteration Permit ("SAP") from the Vermont Department of Environmental Conservation ("VT DEC") for the construction of the proposed New England Clean Power Link ("NECPL" or "Project"). The NECPL is a proposed high voltage direct current ("HVDC") electric transmission line that will provide electricity generated by renewable energy sources in Canada to the New England electric grid. The transmission line will consist of two parallel cables run from the Canadian border at Alburgh, Vermont to Ludlow, Vermont along underwater and terrestrial or overland routes. The overland portion of the route will traverse through portions of one town in Grand Isle County, Vermont and thirteen towns in Rutland and Windsor Counties. Because of the breadth and complexity of the Project, it is assumed that the Secretary would require coverage as an individual permit rather than authorize coverage under the Stream Alteration General Permit (10 V.S.A. Chapter 41) for jurisdictional Project activities. Supporting materials are included with this Stream Alteration Permit Narrative, including a Stream Alteration Individual Permit Application, a fee check made payable to the State of Vermont, a Perennial Stream Crossing Index Map, a map series providing detailed information for each of the proposed crossings, typical details associated with the construction of stream crossings, and a list of abutters to the proposed crossings. The Stream Alteration Review Index Map included in Appendix 1 provides an overview of the overland portion of the proposed route.

The Stream Alteration Permit Narrative describes the locations and construction methods that would be used where the Project would cross perennial streams within the overland segment of the route within Rutland and Windsor Counties. There are no stream crossings proposed within the overland segment of the route in Grand Isle County. Field delineation of streams crossed by the Project were completed by VHB/TRC or its sub-consultants. Additional field studies related to natural resources, including delineation of wetlands, were also conducted and were presented to the Vermont Public Service Board in the Natural Resources Report for the Project (VHB 2014). Although the map series included in Appendix 1 contains natural resources information (such as wetlands) that are not discussed in detail within this report, the information provided may be useful for the purpose of evaluating the site context at each crossing location. Much of this information has been previously provided in support of the Project's petition to the Vermont Public Service Board ("PSB") for a Certificate of Public Good ("CPG") under 30 V.S.A. § 248(b)(5).

2.0 Project Description

From the US/Canadian border in Alburgh, Vermont, the high-voltage, direct current transmission line would be located underground for approximately 0.5 miles within public roadway right-of-way ("ROW") and then within a parcel owned by TDI-NE on the shore of Lake Champlain. The transmission line would then enter Lake Champlain via horizontal directional drill ("HDD") and would be constructed within the lake for approximately 97 miles. The HVDC transmission line would exit the lake in the town of Benson via HDD onto a parcel owned by TDI-NE. From there, the overland portion of the transmission line, approximately 57 miles in length, would traverse through thirteen towns from Benson to Ludlow. The transmission line would be buried approximately four to six feet underground within existing public (state and town) road rights-of-way ("ROWs") for most of its length, and a portion of the VTrans Railroad ROW that is currently leased by the Green Mountain Rail Corporation ("GMRC") railroad ROW for approximately 3.5 miles in the towns of Shrewsbury and Wallingford. The HVDC transmission line would terminate at a converter station that is proposed to be built on a parcel controlled by TDI-NE off Nelson Road in Ludlow, Vermont. A short segment of alternating current ("AC") cable would continue from the proposed convertor station to the nearby

Vermont Electric Power Company ("VELCO") Coolidge substation in Cavendish, where power from the transmission line would be connected to the New England electric grid.

The HVDC transmission line will be comprised of two approximately 5-inch diameter cables – one positively charged and the other negatively charged – and will be solid-state dielectric and thus contain no fluids or gases. The nominal operating voltage of the line will be approximately 300 to 320 kilovolts ("kV"), and the system will be capable of delivering 1,000 megawatts ("MW") of electricity. A fiber optic cable will also be installed with the HVDC cables along the transmission line Overland Route (in the same trench).

As proposed, the cables would be installed underground within this section of the overland segment as follows:

- Benson town roads (in ROW or within road) west of Vermont Route 22A (4.2 miles[1])
- Vermont Route 22A ROW south to U.S. Route 4 in Fair Haven (8.2 miles)
- U.S. Route 4 ROW east to U.S. Route 7 in Rutland (17.4 miles)
- U.S. Route 7 ROW south to Vermont Route 103 in North Clarendon (2.7 miles)
- Vermont Route 103 ROW south/southeast to the Railroad Route in Shrewsbury (3.9 miles)
- VTrans Railroad ROW in Shrewsbury to Vermont Route 103 in Shrewsbury (3.5 miles)
- Vermont Route 103 ROW to Vermont Route 100 in Ludlow (10.6 miles)
- Vermont Route 100 ROW north to Ludlow town roads (0.8 miles)
- Ludlow town roads to HVDC converter station (4.3 miles)
- Proposed AC cable alignment from HVDC Converter Station in Ludlow to the existing VELCO Coolidge Substation in Cavendish along town roads (0.6 miles)

1. The route miles depicted herein may be slightly different compared to previous Project applications due to minor design changes.

Along the Overland Route, the transmission cables will be installed underground by utilizing a combination of open trench excavation, HDD, and jack-and-bore construction techniques. Along town roads (in Benson, Alburgh, and Ludlow), the cables are proposed to be installed in the existing roadways. Along state (VTrans) roads and railroads, the transmission line will primarily be installed along the edge of the existing VTrans ROWs, with some limited in-road installation proposed. Use of the previously disturbed roadway/railroad ROWs would allow the Project to avoid and minimize impacts to natural resource features. Furthermore, unavoidable impacts, when necessary, would occur primarily to natural resource features that have been previously impacted due to road/railroad construction and ongoing operational management activities. Several off-ROW laydown areas would also be required during the construction of the project. As proposed, these laydown areas avoid all wetland and buffer zone resources.

As previously described in the Natural Resources Report, the lands along the proposed transmission line drain to five major Vermont watersheds, including the Lake Champlain Direct Main Lake, Lake Champlain Direct South End, Poultney River, Otter Creek, and the Black River. Eleven named streams were identified that would be crossed by the proposed project alignment, including the Hubbardton River, Mud Brook, North Brenton Brook, Castleton River, Clarendon River, Otter Creek, Cold River, Freeman Brook, Branch Brook (crossed twice), Coleman Brook, and Black River. The project would also cross 40 unnamed tributaries that were identified and delineated in the field as perennial streams. A summary of relevant information about each of the stream crossings is included in Appendix 2.

3.0 Stream Crossing Analysis

Through a combination of field, database, and off-site resources review, VHB/TRC have assessed proposed stream crossings associated with the proposed project alignment. In addition, field and desktop studies included approximate mapping of an additional 50 feet on either side of the road or railroad right-of-way. This is to account for any resources that would not be captured by the detailed Study Area and which may retain buffers to be accounted for during Project planning and permitting, and/or to map approximate resources on private lands on which construction activity may be required. The following sections describe the field delineation and remote sensing methods that were used to identify streams that would be crossed by the Project.

Field Delineation

VHB/TRC environmental scientists conducted field delineation and assessment of stream features during the period May 2014 to October 2014. Streams were identified according to federal delineation procedures (USACE 2005) and were flagged with blue survey tape. Flagging was coded with the consultant identification (T or V), Town Name Abbreviation (West Rutland, WR) and stream number, along with the specific flag number (e.g., T-WR-S-1-1). Generally, perennial and intermittent streams (channels > 6 feet or wider) are flagged along the stream Top-of-Bank ("TB") or Top-of-Slope ("TOS"), according to guidelines in the *Guidance for Agency Act 250 and Section 248 Comments Regarding Riparian Buffers* (ANR 2005). Narrow features, including most ephemeral channels, are flagged along the center line. Ditches or constructed ponds are typically not included in the delineation if such features are due to excavation from upland. However, such features were included in the delineation if these features were determined to be modified, naturally occurring streams or wetlands that would meet state or federal criteria for jurisdiction. Stream flags were located in the field using a Trimble® GPS unit capable of sub-meter accuracy and post-processed using Trimble® Pathfinder software.

Stream identification and ordinary high water ("OHW") width was also assessed, according to methods detailed in the "Regulatory Guidance Letter: Subject – Ordinary High Water Identification" (USACE 2005). The OHW width for each channel segment is determined from an average of measurements of bank-to-bank OHW widths taken at regular intervals along the surveyed portion of the watercourse. During field work, flow regimes are preliminarily classified as perennial, intermittent, ephemeral or jurisdictional ditch and are determined based on qualitative observations of in-stream hydrology indicators at the time of observation and existing geomorphic characteristics. The Summary of Proposed Stream Crossings table included in Appendix 2 provides information about each crossing, including:

- Mile Post
- Stream ID
- Stream Name (Geographic Names Information System ("GNIS"))
- Right of Way Name
- Town
- Average OHW Width
- Existing Structure Size
- Drainage Area (square miles)
- FEMA Floodplain / Floodway
- Proposed Crossing Method

Photographs of each of the perennial streams that is proposed to be crossed by the Project and representative views of the bridge or culvert structures that are in the vicinity of the crossing or which would be impacted by the crossing are presented in Appendix 3.

Approximate Delineations

In addition to the direct Study Area that VHB/TRC had access to in order to conduct detailed field delineations, an area 50-feet wide adjacent to the direct Study Area in most locations (e.g. the linear components within road or railroad ROW) was added in order to approximate the boundaries of potential water resources. Such "Approximate Streams" are indicated on the Natural Resources Report Maps and can be identified by the "AS" designation in the feature name. Approximated resources are based on a combination of information gathering from public ROWs regarding off-site lands during field site visits, with reconnaissance-level verification and mapping from off-site resource review/interpretation. Five perennial streams that would be crossed by the project were mapped as approximate: an unnamed tributary to Lake Champlain (V-BE-AS-3), an unnamed tributary to Mill River (T-MH-AS-45), an unnamed tributary to Hubbardton River (V-BE-AS-10), and two unnamed tributaries to the Black River (T-MH-AS-20 and T-MH-AS-23). All streams that were mapped as approximate are small streams (OHW width less than 5 feet) and cross beneath the roadway in culverts that extend outside of the ROW.

Based on the field delineation and approximate resource mapping that has been performed, the proposed project alignment would cross perennial streams at 52 locations.

Drainage Areas

The contributing drainage area tributary to each proposed perennial stream crossing location was assessed using the Stream Watershed Size maps available from the Vermont Agency of Natural Resources ("ANR") River Management Program (ANR 2011) or with the watershed delineation tool available on the U.S. Geological Survey StreamStats website (USGS 2014). The upstream drainage area for each crossing is provided in the Table of Proposed Stream Crossings included in Appendix 2. A summary of the proposed crossings is as follows:

- 10 of the stream crossings are located at sites with contributing drainage areas greater than 10 square miles.
- 10 of the stream crossings are located at sites with contributing drainage areas between 1 and 10 square miles.
- 5 of the stream crossings are located at sites with contributing drainage areas between 0.5 and 1 square miles.

- 26 of the stream crossings are located at sites with contributing drainage areas less than 0.5 square mile.

Fluvial Erosion Hazard Areas and River Corridors

As part of the Vermont's River Management Program, Fluvial Erosion Hazard Areas and River Corridors have been identified by ANR for certain streams and rivers. The Vermont Flood Hazard Area and River Corridor General Permit ("State Floodplain Permit") has been recently established (Effective March 1, 2015) to regulate development activities within flood hazard areas and river corridors. The State Floodplain Permit was established pursuant to Vermont Environmental Protection Rules ("EPR"), Chapter 29, and the Project will apply for a separate permit in accordance with this program. As stated in EPR Chapter 29, the purpose of the Rule is to ensure that development within flood hazard areas and river corridors is safe and does not impair stream equilibrium, floodplain functions, or the river corridor. Because the identification, evaluation, and design considerations associated with these areas is ultimately intended to protect the stream and to avoid the need for future stream alteration activities, assessment of these areas is relevant to the discussion of the Stream Alteration Permit and is addressed within this Narrative.

The fluvial erosion hazard area ("FEH") or meander belt is the lateral width of a stream corridor that is considered susceptible to fluvial erosion from lateral migration of a stream channel over time. According to the *Technical Guidance for Determining Floodway Limits Pursuant to Act 250 Criterion 1(D)*, the FEH is determined by geomorphic assessments of channel bankfull width, meander centerline, confining lateral topography, channel type, and current channel adjustments; the resultant FEH is typically defined by a channel-width to belt-width ratio, and is dependent on stream sensitivity type and adjacent landform (ANR 2009). For larger streams with watershed areas greater than 2 square miles, a delineated FEH is expanded by incorporating an additional 50 foot buffer from the edge of the meander belt and is referred to as the River Corridor. For smaller streams, the River Corridor is usually represented as a simple 50 foot buffer from the top of bank that is assumed to provide both FEH and riparian corridor functions.

The *River Corridor Protection Guide* (ANR 2008) details the application of these principles and identifies existing transportation corridors (roads and railways) as limiting the ability of streams to fully express their plan form and to migrate laterally across the valley floor. In these situations, the public infrastructure that will be maintained serves as the valley wall and constrains the River Corridor. The proposed project alignment is located within the roadway or railroad embankment along the majority of its length. Because the River Corridor is truncated at the toe of the embankment, installation of the transmission cable within that embankment would therefore not impact to the River Corridor.

In those locations where the transmission cable would cross beneath a stream or river channel beyond the toe of the ROW embankment, the cable would be buried at a sufficient depth below the stream channel to prevent future downcutting or channel migration from exposing the cable. At locations where the cable would cross beneath an existing culvert that carries a perennial stream, the proposed cable burial depth would be sufficient to allow the culvert to be replaced with one that fully meets the Stream Alteration Permit design criteria. The proposed cable profile and burial depth for each crossing will be incorporated into the final design plans. Descriptions of each of the construction methods proposed for stream crossings are provided in Section 4.0.

ANR provided FEH polygons for 10 locations where the proposed alignment would cross or run parallel to a perennial stream. River corridor polygons were generated in for the remaining 41 crossings by buffering each side of the OHW by 50 feet. These FEH and River Corridors are shown on the Perennial Stream Crossings Maps included in Appendix 1.

Floodplains and Floodways

The Federal Emergency Management Agency ("FEMA") has mapped floodplains and/or floodways that are associated with streams and rivers that would be crossed by the Project. However, as proposed the Project would involve the installation of underground transmission cables and would therefore not result in the placement of fill within floodplains or impacts to floodways. A review of the FEMA mapping indicates that floodplains and/or floodways are associated with 22 of the streams that would be crossed by the Project. The FEMA floodplain and floodway polygons are shown on the Perennial Stream Crossings Maps included in Appendix 1.

The proposed HVDC converter station in Ludlow is the largest above-ground feature of the project and is located away from stream or wetland resources and is outside of any floodplain, floodway, FEH, or River Corridor. The proposed alignment also involves two locations where the cable would be above ground for short distances, both of which are associated with stream crossings, specifically crossings of T-LU-S1 (Black River) and T-LU-S20 (Unnamed Tributary to Black River). According to the effective FEMA floodplain map (Map Number 50027C0587E), there is a floodplain and floodway associated with the Black River at the proposed crossing location T-LU-S1 in Ludlow. This crossing is proposed to be completed by attaching the transmission cable to the downstream face of the East Lake Road Bridge. By attaching the cable to the bridge, the Project will not have any impact on the floodplain or floodway associated with this crossing. According to the effective FEMA floodplain map (Map Number 50027C0580E), there is no mapped floodplain or floodway associated with T-LU-S20.

4.0 Proposed Crossing Methods

Six different construction methods are proposed to be used for crossing streams within the project area: Aerial, At Culvert, Over Culvert, Duct bank, HDD crossings, and open trench excavation ("OTE") crossings. Typical construction details for these crossing techniques have been excerpted from the Erosion Prevention and Sediment Control ("EPSC") plan set and are included in Appendix 4. Narrative descriptions of these methods and the locations that they will be used are described below.

Aerial Crossings

At aerial crossings, the transmission cable would be suspended above the stream being crossed in two locations where the fascia of an existing bridge or the headwall of an existing culvert provides a suitable face for attachment and the structure owner allows this configuration. With the current project alignment and layout, there are two locations where this type of stream crossing would be used, both located on East Lake Road in the Town of Ludlow. One is the bridge crossing of the Black River immediately downstream from the Lake Rescue Dam (T-LU-S1) and the other in a culvert headwall over an unnamed tributary to the Black River (T-LU-S21) that crosses beneath East Lake Road in a culvert. No in-stream work is proposed for these crossings. Construction details for these crossings are included on sheet TD-3 of Appendix 4.

At Culvert Crossings

As previously described, many of the streams that would be crossed by the Project are already conveyed beneath an existing public road or railroad within a culvert. Where feasible, the Project proposes to complete "At Culvert" crossings by excavating a trench within the roadway or within the embankment adjacent to the roadway and installing the transmission cable a minimum of five feet beneath the existing culvert. This burial depth would be continued for 15 feet on either side of the stream OHW width before returning to the standard project burial depth for upland work areas. The additional burial depth and width has been incorporated into the project design in order to provide sufficient separation between the transmission cable and culvert for future culvert maintenance activities to be conducted without impacting the cable, including the replacement of the culvert with a structure that fully complies with the Stream Alteration Permit criteria. At one location in

Benson, (V-BE-S-8), the existing culvert is located entirely within the ROW and is proposed to be replaced as part of the Project with a structure that fully meets the Stream Alteration Permit criteria.

To complete this type of installation, the existing culvert would either be supported in place and a trench excavated beneath it to the required depth, or a segment of the culvert would be removed and replaced following installation of the transmission cable. Pipe bands or other appropriate construction techniques would be used to secure the segment of culvert that was being replaced to the remaining undisturbed segments of the culvert. This approach would avoid direct disturbance of the natural channel.

Eighteen of the proposed perennial stream crossings would be constructed using this method. The largest culvert that is proposed for an "at culvert" crossing is 6 feet in diameter and the largest stream OHW that is proposed for this type of crossing is 7 feet wide. The majority of streams proposed for this type of crossing have OHWs of 2 to 5 feet and are currently carried in culverts that are between two and four feet in diameter. Typical construction details for these crossings are included on sheet TD-5 of Appendix 4.

Over Culvert Crossings

At over culvert crossings, the proposed cable would be installed in the roadway embankment above an existing culvert. This is proposed to occur at three locations where site constraints restrict the ability of the cable to be installed beneath the culvert. These locations are described below.

In Benson, an unnamed tributary to the Hubbardton River (V-BE-S-102) crosses through the VT Route 22A embankment in a 6-foot wide concrete box culvert. Rolling topography and a narrow ROW limit the ability of the project to construct the crossing outside of the embankment and it is not practicable to excavate beneath a structure of this size. In

Shrewsbury, an unnamed tributary to the Mill River (V-SH-S-14) crosses through the Route 103 embankment in a concrete box culvert located near the toe of the embankment with approximately 20 feet of fill over the top of the culvert. Applying the typical trench construction approach at this location would result in a prohibitively deep excavation. In Mount Holly, an unnamed tributary to Branch Brook (T-MH-S14) crosses beneath Route 103 in a concrete box culvert. The stream channel at this location is deeply incised, private residential structures and road crossings are in close proximity to the culvert, and there is insufficient room in the ROW to construct an alternative crossing type.

Typical construction details for these crossings are included on sheet TD-2 of Appendix 4.

Duct Bank Crossings

In Ludlow, an unnamed tributary to Black River (T-LU-S5) crosses beneath Route 100 in an existing 42-inch corrugated metal pipe ("CMP") culvert. A duct bank is proposed to be installed beneath the road surface in conjunction with a VTrans roadway improvement project along this portion of Route 100. The existing culvert may be replaced as part of the roadway improvement project, however, the cable would be installed inside the duct bank, thereby avoiding any additional disturbance to the stream.

A construction detail for this crossing is included on sheet TD-4 of Appendix 4.

Horizontal Directional Drilling

The use of HDD techniques for stream crossings generally allows in-stream impacts to be completely avoided. HDD typically requires that two boreholes (a drill pit and a receiving pit) be excavated on either side of the drilled segment, and cleared areas at each end of the drill to provide sufficient distance for the drill string and cable to be handled and fed through the drill borehole. The specific requirements for the entry and exit angle of the cables, the channel width, and the required depth below the channel bottom will be evaluated at each site during final design. HDD crossings will be a minimum of 20 feet below the stream channel in order to provide sufficient depth to allow dynamic stream processes to continue and to allow future bridge or culvert construction projects to be completed without disturbing the cable. This method is proposed for use at 18 crossings where suitable soils, topography, and alignment permit it to be used. With the exception of the Black River crossing (T-LU-S1) described above as an Aerial crossing, all 10 stream crossings with watersheds greater than 10 square miles would be crossed using HDD construction methods. For the majority of these large stream crossings, the HDD would fully span the FEH identified by ANR. The exceptions are crossings of Hubbardton River (V-BE-S-106), Otter Creek (T-RU-S2), and Clarendon River (T-WR-S36). At the Hubbardton River crossing, the available topography shows that the ground surface is approximately 10 feet higher on one side of the mapped FEH than on the other, in an area that is otherwise dominated by low gradient wetland features. The proposed HDD at this location stops short of fully spanning the FEH on the higher, southern side of the Vermont Route 22A culvert crossing. At the Clarendon River crossing, the available topography shows that the ground surface is approximately 8 feet higher on one side of the mapped FEH than on the other. The proposed HDD at this location stops approximately 5 feet short of fully spanning the FEH on the higher, eastern side of the U.S. Route 4 culvert crossing. At the Otter Creek crossing, a segment of the Creek and its associated FEH run parallel to the U.S. Route 4 ROW, extending the FEH approximately 1,500 feet beyond the active channel crossing associated with the U.S. Route 4 bridge opening. The proposed HDD stops short of fully spanning the FEH on the eastern side of the bridge in order to avoid and minimize impacts to forested wetlands located within this portion of the FEH.

Typical construction details for these crossings are included on sheet TD-5 of Appendix 4.

Open Trench Excavation

The alternative method for stream crossings involves deploying temporary in-stream flow diversion structures, digging an OTE across the stream channel, installing the transmission cable, backfilling with suitable materials, and restoring the stream bank and channel bottom. This construction method resembles the method used to construct the remainder of the transmission cable through upland areas, but involves added EPSC measures and increased burial depth to avoid and minimize impacts to the waterway. Timber matting will be used to protect bordering wetlands and smaller stream channels from impacts by mechanized equipment. Typical details for dewatering, such as using diversion flumes or coffer dam and pump-around systems, will be included in the EPSC plan set to illustrate the proposed management of flow associated with the OTE crossings.

This method is proposed for use at nine stream crossings and is generally limited to sites with smaller channels (OHW width less than 10 feet). Three crossings larger than 10 feet are proposed to be completed with OTE construction methods and would occur at locations where substrate and channel geometry would allow the cable to be installed with minimal stream impacts: unnamed tributary to Otter Creek T-CL-S4, unnamed tributary to Mill River T-SH-S3, and unnamed tributary to Mill River T-MH-S28. The cable would be buried a minimum of 5 feet below the channel bottom where OTE construction methods are proposed. This burial depth would be maintained for a minimum of 15 feet beyond each bank in order to allow for some natural channel migration to occur. Burying the cable for a greater depth or greater width is not practicable due to the topography adjacent to these crossings, operational constraints associated with the cable, and the fact that the crossings are located adjacent to an existing roadway crossing structure (bridge or culvert) that will continue to direct the stream through the project area.

During the construction of the OTE crossings, stream bed and bank materials would be segregated from sub-surface mineral soils and the sediment profile would be recreated to the extent practicable following installation of the cable. Disturbed stream banks would be restored using stockpiled materials, seeded with a riparian and wetland seed mix, and protected with a rolled erosion control product (“RECP”) for a distance of 25 feet beyond each top of bank. Additional measures, such as staked coir logs, may be used where necessary to restore preconstruction bank contours. Dewatering of the stream would be accomplished by means of a diversion flume or a bypass dam and pumps. Additional EPSC measures would be deployed in the vicinity of these crossings to avoid and minimize the release of sediment associated with this work.

Typical construction details for these crossings are included on Sheets TD-4 through TD-8 of Appendix 4. Plan and profile views of the OTE crossings are shown on Sheets T-8, T-13, T-15, T-28, T-55, T-67, T-68, T-71, and T-75 that are included in Appendix 4.

5.0 Summary

The project alignment for the NECPL was evaluated for locations where crossings of perennial streams would occur and suitable construction methods were identified for each site. The project team is aware that many of the existing bridges and culverts that carry perennial streams beneath town and state roadways may be undersized with respect to the Stream Alteration and River Management criteria and that future upgrades by the agencies responsible for these structures may result in their replacement with wider and potentially deeper structures. Furthermore, existing structures that interrupt the stream profile (i.e. an upstream sediment wedge and/or a perched outlet) have also been taken into consideration and the proposed design accommodates these concerns and would allow future construction to restore the natural stream profile through the reach to the degree feasible.

It is anticipated that the structural condition of some structures will preclude their modification during the construction of this project. Therefore, as appropriate some structures in poor condition may need to be replaced in their entirety. In these cases, TDI-NE will work with the responsible agencies to identify the degree to which the replacement structure could be sized to accommodate the full bankfull width of the channel and be installed according to the requirements of the Vermont Stream Alteration General Permit. Replacement of existing culverts may require the acquisition of private property easements in some locations because the extents of the ROW would be insufficient to complete the culvert installation and grading necessary to restore continuity between the reaches upstream and downstream of the structure.

Of the 52 perennial streams that would be crossed by the project, 43 of these crossings would be conducted without disturbing the natural stream bed, either by using HDD construction, by installing the cable above or below an existing culvert, or by attaching the cable from the side of an existing structure. In locations where in-stream construction activities are proposed, the use of appropriate EPSC measures and construction details will minimize the impact to aquatic resources. The Project alignment was designed to minimize impacts to streams and rivers by proposing to construct the transmission cable within existing road and railroad ROWs. This approach avoids creating placing new infrastructure within otherwise unconstrained River Corridors and minimizes the amount of in-stream work by installing crossings at the locations of existing culverts and bridges.

6.0 References

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