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NOTE: Appendices B through F are provided on the CD-ROM. They are not included in this printed volume because of the large quantity of material. **The CD-ROM is complete**, with the Executive Summary, the entire EA, and all of the appendices available in Adobe PDF format. If you would like help with the CD-ROM, or require a paper copy of any portion of the appendices, please contact Mr. Peter W. Lind, VELCO, directly at 802-770-6292 or plind@velco.com, or Dr. Jerry Pell, DOE, at 202-586-3362 or jerry.pell@hq.doe.gov, and we will be glad to accommodate your needs.

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EXECUTIVE SUMMARY

INTRODUCTION

On September 2, 2003, Vermont Electric Power Company, Inc. (VELCO), filed an application with the U.S. Department of Energy (DOE) to amend two Presidential Permits (PP-66 and PP-82) for the construction, operation and maintenance of electrical facilities that cross the United States-Canada border in two places within Vermont: Derby Line (the "Derby Interconnection Facilities") and Franklin (the "Highgate Interconnection Facilities," so named because of the location in Highgate, Vermont, of the interconnection's terminal). The Secretary of Energy has the authority to grant or deny such amendments with concurrence by the Secretary of Defense and the Secretary of State.

Proposed Action

The Northern Loop Project proposed by VELCO involves upgrades in Vermont at three existing substation[1] locations (St. Johnsbury, Irasburg and Highgate), additional line equipment at two tap[2] points (Mosher's Tap in Newport and the St. Albans Tap) and an upgrade of an existing 6.47-mile, 48-kilovolt (kV) transmission line, located between VELCO's Irasburg Substation

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1 "Substation" means a structure, usually a small building on a fenced-off lot, that contains any combination of routing or cutoff switches, transformers, surge arresters, capacitors, power conditioners and other equipment needed to ensure smooth, safe flow of current. Substations are most commonly seen in residential and industrial areas, where one or more high-voltage lines can often be feeding into the station and any number of lower-voltage distribution lines spider out to serve customers in the surrounding area (Ref.: www.energyvortex.com).

2 A "tap" broadly refers to any terminal where an electric connection is established and most commonly refers to a terminal or connection that draws a certain amount of current from part of a circuit. Tapping a circuit can refer either to running a line or cable from a point in a circuit or to the drawing of electricity from that circuit. Just as a water tap allows one to draw a certain amount of water from the total supply, an electrical tap serves the same function for drawing electricity from a source of supply (Ref.: www.energyvortex.com)
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and Mosher's Tap, to accommodate a new 115-kV transmission circuit (see Figure ES-1 below). Power flows on the Derby Line and Highgate Interconnection Facilities may change, and the Highgate Interconnection would be tapped to allow VELCO to supply customers of Vermont Electric Cooperative, Inc. (VEC), located in northwestern Vermont, from sources of supply in Québec.

With these upgrades, VELCO proposes to integrate most of an existing, 120-kV, Derby-to-Highgate line, formerly owned by Citizens Communications Corporation (Citizens), into the VELCO system. Once connected, the 120-kV line, which would now be operated at the 115-kV voltage that is used on VELCO's system and the rest of the Northeast power grid, would convert radial transmission lines[3] in northern Vermont into a loop[4] between VELCO's Georgia Substation and the Public Service Company of New Hampshire substation located in Littleton, New Hampshire.

VELCO's Purpose and Need

VELCO's primary purpose for the Northern Loop Project is to improve reliability in northern Vermont by eliminating two radial electrical feeds, currently used to serve approximately 80 megawatts (MW) of load in northern Vermont supported by VELCO's system, by connecting VELCO's existing 115-kV lines terminating in Irasburg and Highgate with the existing 120-kV line, formerly owned by Citizens, between Highgate and Newport, Vermont. Approximately 35

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3 "Radial line" refers to a transmission line, distribution line or transmission/distribution subsystem that is not interconnected with other systems named because it radiates outward from another transmission system without bridging any other system (Ref.: www.energyvortex.com).

4 In the energy industry, a "loop" is a distribution or transmission circuit supplied by two sources of energy. One source serves as a back-up in case the primary source of energy is interrupted (Ref.: www.energyvortex.com).

MW of the load served by this line at Highgate Substation will be connected to the new, looped facilities. These now-looped facilities will also provide a back-up source of supply to the remaining radial portion of the load: approximately 35 MW served from Newport Substation and supplied from Québec over the Derby Interconnection Facilities.

A detailed explanation of the proposed project, complete with figures, is provided below ("Overview of the Proposed Action").

Environmental Review Process

NEPA Document

DOE is the federal lead agency for evaluating the Northern Loop Project under the National Environmental Policy Act (NEPA). As required by NEPA, this Environmental Assessment (EA) examines the expected individual and cumulative impacts of the project. The EA also identifies means to minimize potential adverse impacts (mitigation measures) and presents an evaluation of reasonable alternatives to the proposed project, including the "No Action" alternative.

This EA is designed to provide the public and responsible agencies with information about the proposed project and its potential effects on the local and regional environment. This EA was prepared in compliance with NEPA requirements.[5]

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5 Sec. 1508.9 of the President's Council on Environmental Quality's Regulations for Implementing NEPA states that:"Environmental assessment":

(a) Means a concise public document for which a Federal agency is responsible that serves to:

1. Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact.
2. Aid an agency's compliance with the Act when no environmental impact statement is necessary.
3. Facilitate preparation of a statement when one is necessary.

OVERVIEW OF THE PROPOSED ACTION

The electric system in northern Vermont (that portion essentially north of a line drawn from VELCO's Georgia Substation in the western portion of Vermont to a substation in the east located in Littleton, New Hampshire) is currently served by a potentially unreliable transmission system. The total load of approximately 150 MW in that area is supplied by two 115-kV and one 120-kV radial lines and a weak underlying 34.5-kV and 46-kV sub-transmission network. At intermediate-to-peak levels of electrical load, a loss of the 115/120-kV lines results in the inability to serve the entire electrical load in the area. The Northern Loop Project, as described in this EA, will substantially reduce or eliminate the loss-of-load exposure that exists today.

The three radial 115/120-kV lines are shown geographically in Figure ES-1 and schematically in Figures ES-2 through ES-5 (showing the current configuration of the three radial lines).

(b) Shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted.

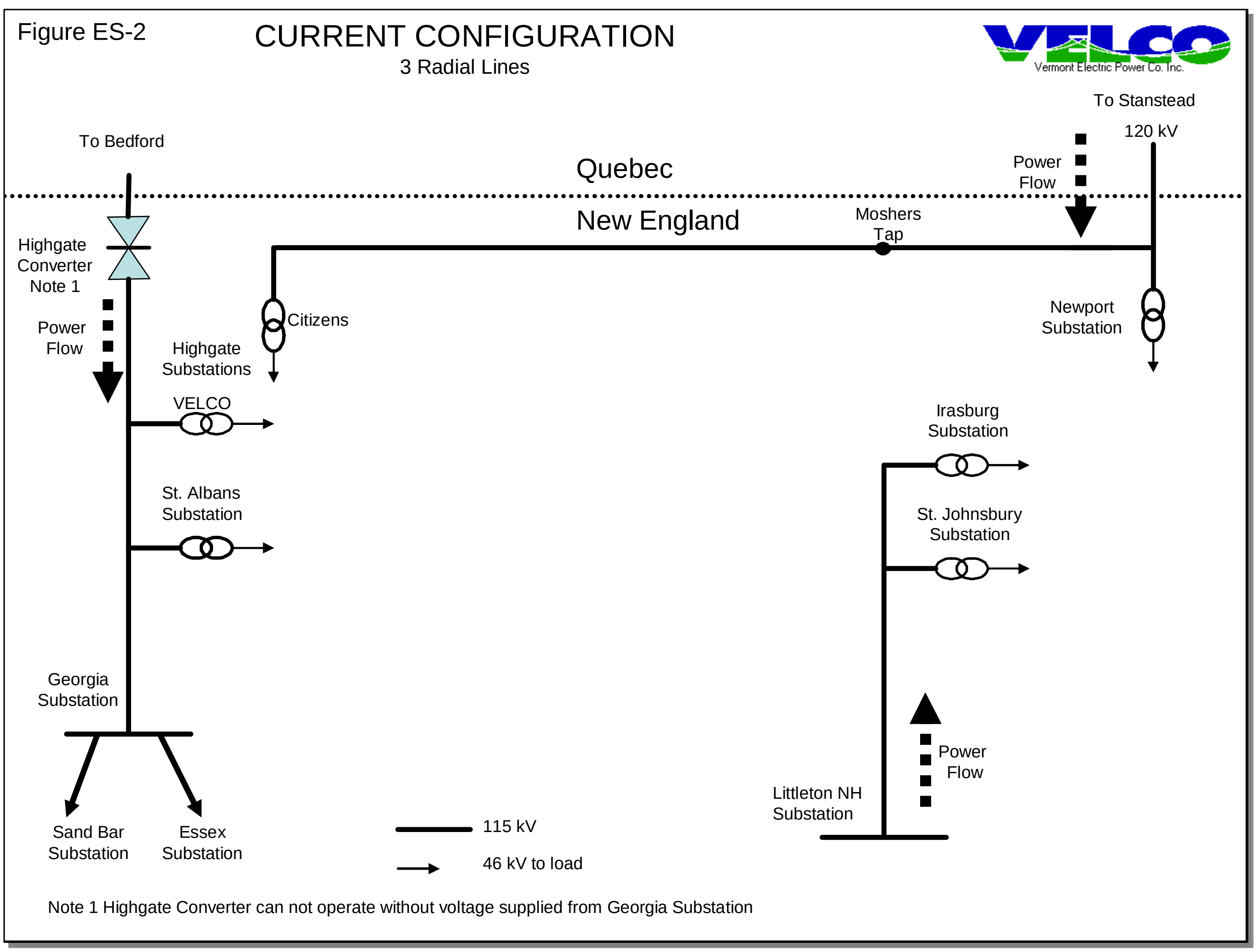
Figure ES-1

Beginning on the western side of the state and working clockwise around the northern Vermont area, the first radial line begins at Georgia Substation and terminates at the VELCO Highgate Substation. This line provides a voltage source for the Highgate Converter Station tap and serves the electrical load and generation at the VELCO Highgate and St. Albans Substations. A loss of this line renders the Highgate Converter Station inoperable and therefore interrupts a significant (normally up to 200 and as much as 225 MW) source of electrical supply to Vermont via the Highgate Interconnection Facilities from Bedford, Québec.

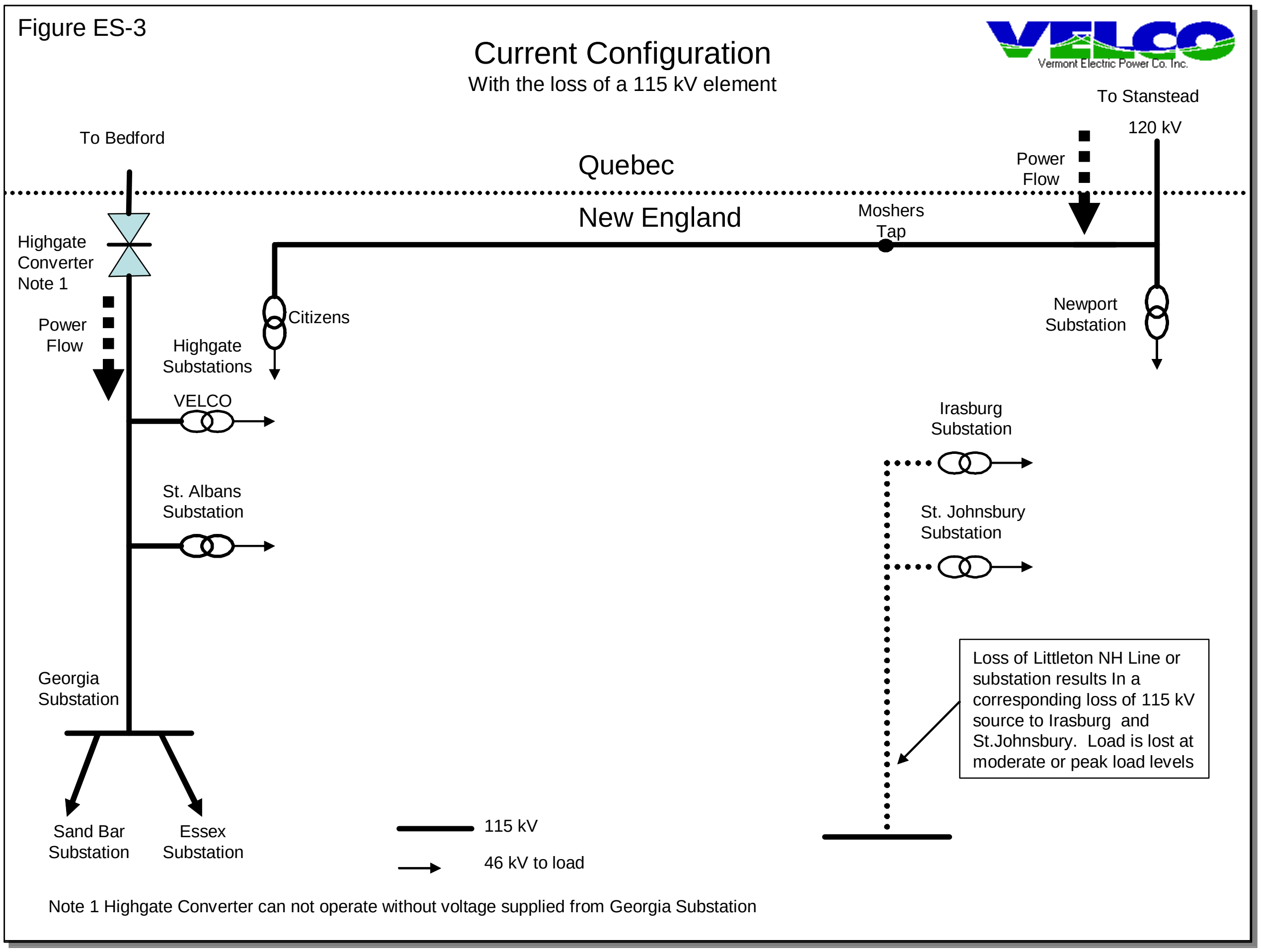
The next radial line terminates at the former Citizens (now VEC) Highgate Substation and extends easterly across the top of the state to the Derby Interconnection Facilities terminating at the border at Stanstead, Québec. This line serves electrical load at the VEC Newport and Highgate Substations and is commonly referenced as the "block load," which means that the load served by this line is isolated from the New England system and directly connected to the Québec system.

The third radial line terminates at VELCO's Irasburg Substation and is supplied out of Littleton, New Hampshire. This line serves the St. Johnsbury and Irasburg Substation electrical loads.

Figure ES-2 shows these radial-transmission lines in their current configuration schematically:



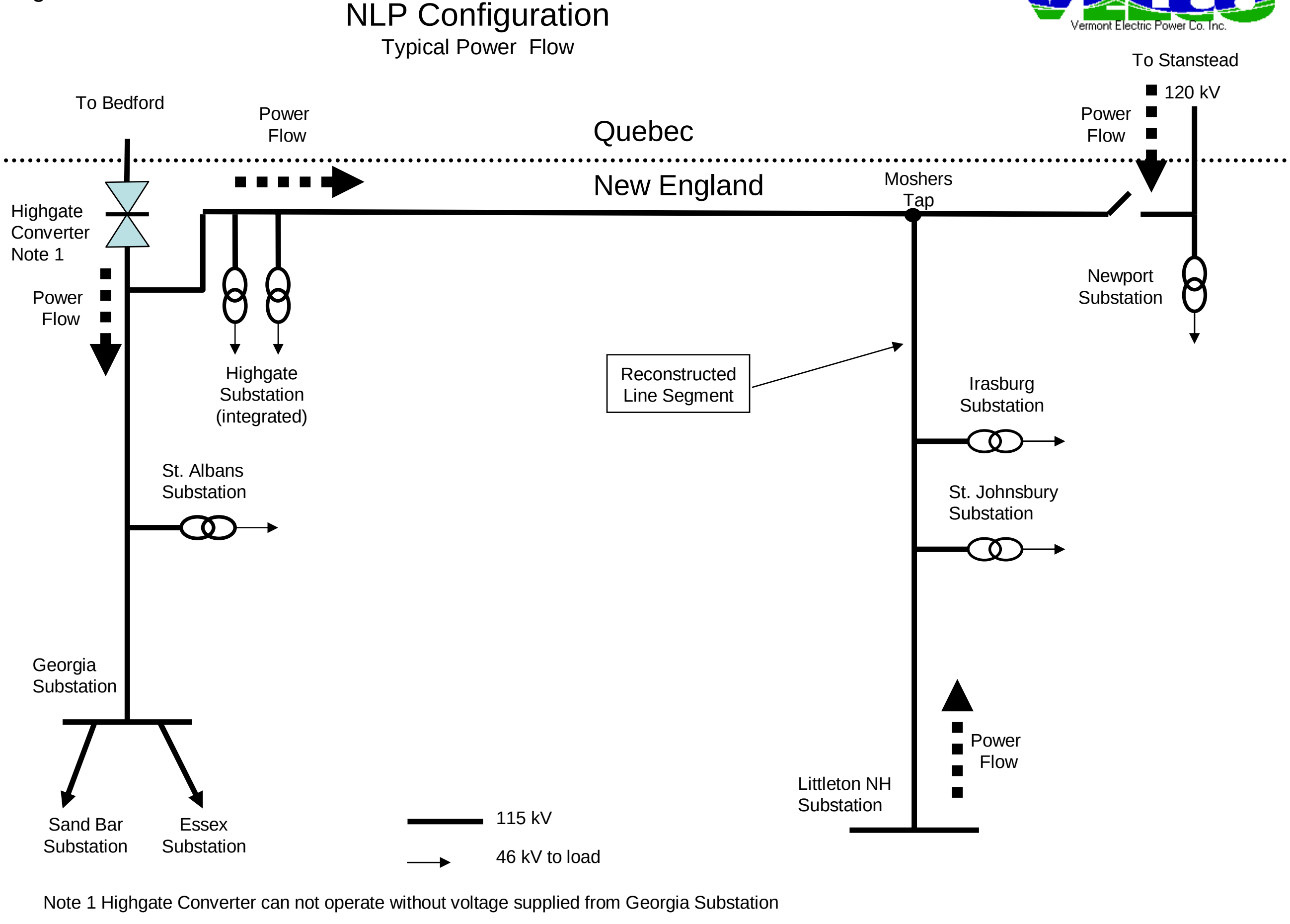
At intermediate or higher load levels, some portion of the load served by these lines cannot be served if the line is out since the underlying sub-transmission network is not sufficiently strong to support the entire load. **Figure ES-3** (Current Configuration with the loss of a 115 kV source element) demonstrates the results for a loss of the 115-kV line supplying the Irasburg and St. Johnsbury Substations. In this example, load would be shed[6] in the St. Johnsbury area under intermediate- or high-load conditions.



6 "Shed" means blocking of customer access to energy, usually due to a temporary shortage of supply. Load shedding is rare and is most commonly applied during times of emergency or severe shortage. In most cases, the first loads a utility will shed in these conditions are loads required by industrial and commercial customers. Institutional loads are typically the last to be shed since public institutions (hospitals, schools, municipal-lighting authorities, etc.) are considered to be a utility's most essential customers (Ref.: energyvortex.com).

Figure ES-4 describes the system configuration after the project is constructed:

Figure ES-4



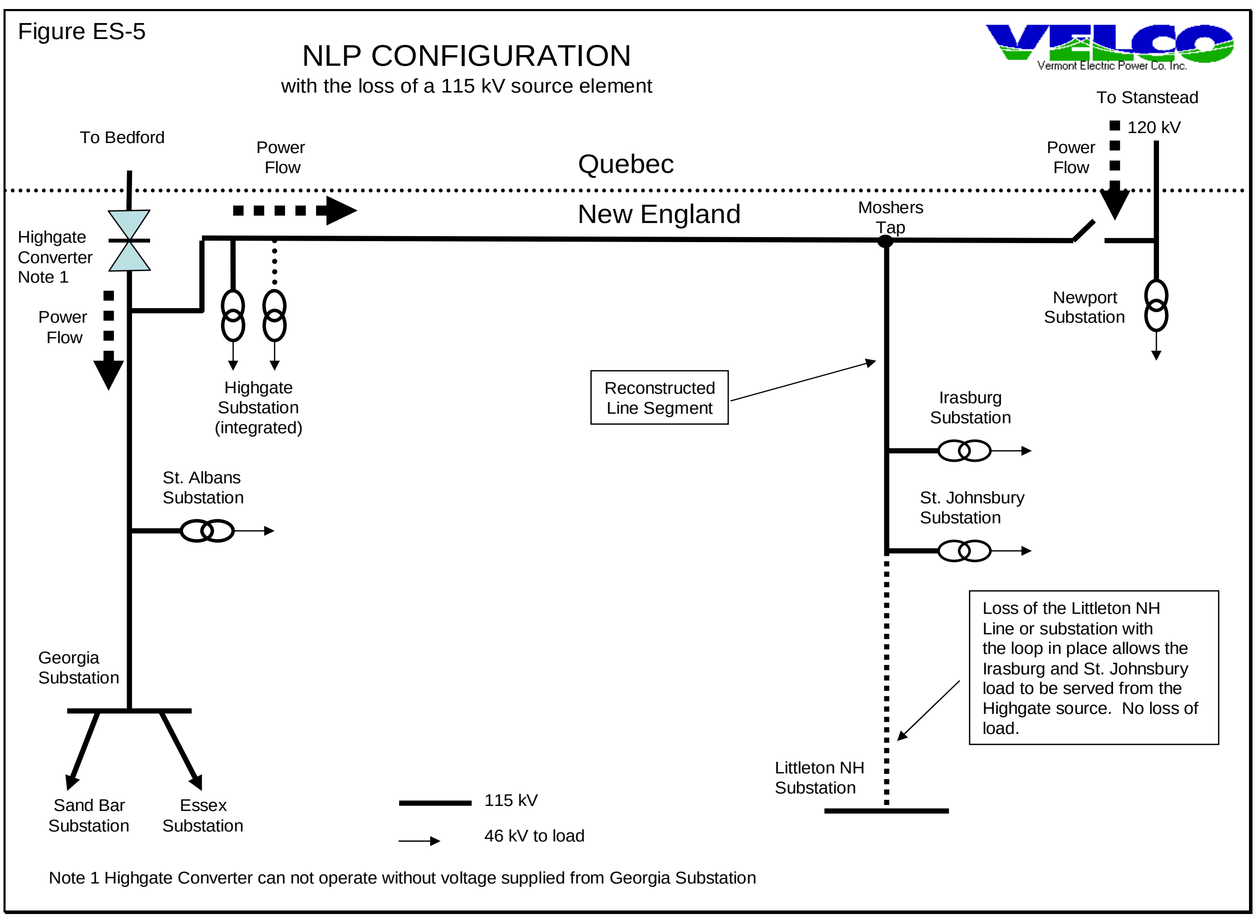
The project will convert the three radial transmission lines into a loop configuration providing a 115-kV backup source for all but 35 MW of the peak load in northern Vermont. The primary elements of the project include:

1. The replacement of an existing, 48-kV transmission line between Irasburg Substation and Mosher's Tap on the Newport-to-Highgate line with a single-pole, double-circuit, 115-kV/48-kV line;

2. Integration of the collocated Highgate VELCO and former Citizens Substations to facilitate the connection of the Newport-to-Highgate line to the Georgia-to-Highgate line; and

3. Upgrades at the existing St. Albans Tap, Irasburg and St. Johnsbury Substations to facilitate the isolation of electrical faults (interruptions of energy flows) on the line segments.

Figure ES-5 (NLP Configuration with the loss of a 115 kV source element) describes the performance of this system for the same loss of the Littleton-to-St. Johnsbury line described in Figure ES-3:



In this example, the reconfigured network provides a 115-kV, back-up source for the Irasburg and St. Johnsbury Substations via the transmission loop to Highgate, therefore eliminating the loss of load in the St. Johnsbury area previously described. This configuration also provides a 115-kV backup source for the remaining radial load served at Newport Substation if its supply from Québec is interrupted.

ALTERNATIVES TO THE PROJECT

Definition of Alternatives

Section 1508.9(b) of The Council of Environmental Quality regulations for implementing NEPA (40 CFR Parts 1500 – 1508) requires that an EA "Shall include brief discussions…of alternatives as required by §102(2)(E) [of NEPA], of the environmental impacts of the proposed action and alternatives …" The above-cited §102(2)(E) of NEPA requires that the agency "study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

DOE has considered various alternatives for the project through the EA process, including evaluation of issues raised during the EA's development. VELCO also considered a variety of alternatives in developing its proposal.

Alternatives Considered But Eliminated

The alternatives considered included:

- The construction of sufficient generation in northern Vermont that, coupled with the existing transmission system, could serve electrical load with the same reliability that would be achieved by the project–this alternative was eliminated from further consideration because of higher costs than the proposed project and significant environmental impacts, such as atmospheric emissions;
- Investments in conservation and efficiency measures that, coupled with the existing transmission system, could serve electrical load with the same reliability that would be achieved by the project–this alternative was eliminated from further consideration because of significantly higher costs than the proposed project and because such measures would have to eliminate more than half of existing, peak-electrical requirements to achieve the same reliability benefits of the proposed project;
- Locating the proposed Irasburg-to-Mosher's Tap line in a partially or entirely new corridor–this alternative was found to be viable; however, it was determined that the potential environmental impacts are in excess of those that could result from the preferred alternative within an existing right-of-way corridor, and hence the alternative is not desirable; and
- Reducing the capacity of the conductor, reducing the spacing between poles or changing the structure design for the Irasburg-to-Mosher's Tap line to reduce the power line's size and height–this alternative was eliminated from further consideration because it would have greater environmental impacts as compared to the proposed project—for example, more poles with associated visual and excavation impacts—and less capacity to meet

future electrical requirements, potentially requiring the line to be rebuilt in the near future with associated further environmental impacts.

No Action Alternative

Under the "No Action" alternative, DOE would deny the amendment requested by VELCO to Presidential Permits PP-66 and PP-82. In this case, the proposed project, described above, would not be implemented, and there would be no environmental impacts from construction, etc.

However, VELCO advises that "No Action" could prevent VELCO from proceeding with certain parts of the project by which electricity flows from the Hydro-Québec to the VELCO system (over the facilities authorized by the two Presidential Permits previously issued by DOE). If VELCO were unable to proceed with the project otherwise, significant electrical loads in northern Vermont would continue to be served by the existing radial transmission lines such that the lines' loss would, in many intermediate-to-peak conditions on the VELCO system, likely result in the electrical utilities in northern Vermont supplied by VELCO being unable to serve all customer load (particularly, customer loads occurring in cold winter months). Such inadequate capacity situations could result in "brownout" or "blackout" conditions that, in turn, could result in indirect environmental impacts.

For example, non-functioning traffic signals could cause traffic delays, and hence small amounts of increased atmospheric emissions, from vehicle engines in towns and cities such as St. Johnsbury or Newport. Public institutions, such as hospitals, might have to use back-up generators causing atmospheric emissions.

APPROACH TO ENVIRONMENTAL REVIEW

DOE has conducted a review of the potential environmental impacts that could result from implementation of the project in accordance with the requirements of NEPA, as noted earlier. DOE is required to consider whether the proposal or reasonable alternatives would result in significant impacts on the environment and, if so, what mitigating actions could be implemented to eliminate, avoid, compensate for or reduce those impacts to a less than significant level.

In conducting the environmental review, DOE examined and where necessary verified information provided by VELCO. DOE also examined other environmental reports relevant to power-line and substation impacts on the environment.

Feasible mitigation measures are identified in this EA for potentially adverse impacts; such measures are designed to reduce or eliminate adverse impacts. In several instances, VELCO proposed design features as part of the project that would reduce impacts. VELCO has agreed to implement all design and mitigation measures as part of the project.

AFFECTED ENVIRONMENT

Climate, Meteorology, and Air Quality

The climate in northern Vermont is characterized by cool summers and cold winters. Winter precipitation is usually in the form of snow, with occasional, severe ice-storm conditions.

Air-quality issues in northern Vermont relate primarily to long-distance transport of pollution from industrial facilities, particularly coal-fired power plants in the Midwest. Some pollutants derive from in-state sources. There are no identified air-quality problems at any of the four proposed project sites: Highgate, St. Albans, Irasburg/Mosher's Tap and St. Johnsbury.

Land Features and Use

The project areas are located in different regions of the state. St. Johnsbury is in the eastern Vermont piedmont, with rivers draining into the Connecticut River watershed. The Newport area is in the Lake Memphremagog basin, which drains north to the St. Lawrence River. The Highgate and St. Albans sites are in the Lake Champlain Valley west of the Green Mountains; Lake Champlain flows north to the St. Lawrence River.

Agriculture in Vermont is predominately dairy, with lands devoted primarily to growing feed crops or in pasture. The St. Johnsbury site has no active agricultural use nearby. A portion of the Irasburg-to-Mosher's Tap corridor crosses over areas that are currently farmed. There is no agricultural use in the immediate vicinity of Highgate Substation. St. Albans Tap is in the middle of a small field that is currently cropped with hay.

None of the project sites were found to interfere with forestry or with recreational activities enjoyed in the areas, such as snowmobiling, hunting, fishing, boating and camping. VELCO is working with adjacent landowners to obtain easements where needed. None of the three state airports in proximity to the project are adversely affected by the project.

Hydrology, Water Quality and Water Use

There are no surface waters in the vicinity of the St. Johnsbury facility other than ground water at a depth of five feet. There are several small streams and the Black River in the vicinity of the Mosher's Tap–Irasburg corridor; at its closest point, the corridor is approximately 500 feet distant to the east. Other than dug ditches, the only surface water in the vicinity of the Highgate facility is a dug stormwater pond. There are no surface waters in proximity to the St. Albans Tap site.

Of the four sites, only the Mosher's Tap site is within the 100-year floodplain. However, the proposed use of single-pole power-line structures would not exacerbate flooding; the poles would not impede floodwater movement or reduce floodwater-storage capacity.

None of these four sites lie within a public water-supply area. All of the sites except St. Johnsbury do lie within a potential aquifer-recharge area due to gravel underlayment.

There are no Class One wetlands affected by this project, and there are no identified water-quality problems at any of the four sites.

Ecology

The project is located primarily in the "northern hardwood forest" region of Vermont. The composition of the aquatic and wetland flora of the project area is influenced by the generally cool summer temperatures of the region, water chemistry and nutrient input from runoff.

The tables in Appendix F list species of mammals, birds, amphibians and reptiles that are known or are likely to occur in the various project regions. Habitat maps, published by the Vermont Department of Fish and Wildlife, are also appended in Appendix F. There are no federally-listed endangered species of plants or animals known within or near the project areas. One species that is listed as threatened in Vermont was noted at the Irasburg Substation site: Greene's rush (*Juncus greenei*). However, plants inventoried in 2001 and in July 2003 by VELCO consultants occurred outside the proposed building envelope and will be avoided during construction.

The State of Vermont's Department of Forest, Parks, and Recreation manages 33 designated "natural areas." Of these, none are within one mile of any of the project areas.

Socioeconomics

St. Johnsbury, Irasburg, Coventry, Newport City, Highgate and St. Albans are organized towns and cities in northern Vermont. In 2000, the population of the Town of St. Johnsbury was 7571; Irasburg, 1077; Newport City, 5025; Coventry, 1014; Highgate, 3397; and St. Albans Town, 5324.

The economies of Orleans and Caledonia Counties are closely connected to natural resources. Caledonia County provides a broader array of services and job opportunities. Franklin County has the strongest job growth in Vermont.

On February 20, 2003, public site visits and a public hearing were held by the State of Vermont Public Service Board with regard to the proposed project. No one from the public participated in the site visits, but several people, including two landowners affected by the project, attended the public hearing. Their main concerns were the aesthetic impact of the new double-circuit line and the electromagnetic-field (EMF) health implications of the new lines.

Visual Resources

In Caledonia and Orleans Counties, the land becomes a rural mosaic of farmland and forests, with concentrated development in the river valleys. The proposed rebuild of the Irasburg-to-Mosher's Tap line will be visible to nearby residences and persons traveling through the area at several locations.

The St. Johnsbury Substation is not visible from Interstates 91 or 93, and it is not visible from Higgins Hill Road where it is located. The Irasburg Substation is located off State Route 14, and it is not visible from the highway. The Highgate Substation is located off State Route 78 and will be visible from Route 78. The St. Albans Tap is not visible from a road.

Cultural Resources

In general, Native American occupation in northern Vermont runs throughout the Holocene Period, from roughly 11,000 years before the present down to the present. In the Irasburg-to-Mosher's Tap corridor, there are many lake-associated wetlands, along with several existing and former small lakes, and archaeological sites may be associated with these fresh-water marsh communities.

However, no Native American sites have been recorded within the transmission-line corridor from Irasburg to Mosher's Tap. At Highgate, the closest known site to the substations is 1150 feet away. Two other sites have been found within 1.2 miles of the substations.

In spite of a rich Euroamerican history in the general area of St. Johnsbury and the Irasburg-to-Mosher's Tap corridor, no known European American archaeological sites within the project corridor are recorded in the Vermont Archaeological Inventory. No European American sites are known to exist in the Highgate project area or at the St. Albans project site.

Finally, no Paleontological sites were identified in any project area.

ENVIRONMENTAL IMPACTS

Effects of the Proposed Action and Mitigation Measures

The likelihood of the proposed project to cause potentially significant impacts is dissipated by design and mitigation measures that would be implemented as part of the proposed project. Table ES-1 summarizes potential environmental effects of the project and the design or mitigation measures that are proposed to avoid or eliminate adverse effects. The mitigation measures have been incorporated into the project as conditions of approval to mitigate or avoid environmental impacts that could result from implementation of the proposed project. Accordingly, the project would not result in unavoidable, significant adverse impacts.

Table ES-1: Summary of Monitoring and Mitigation Considered as Project Conditions				
Impact Type	**Impact**	**Mitigation Measure**	**Level of Significance Without Mitigation**	**Level of Significance With Mitigation**
Air Quality	Fugitive dust emissions	**4.1.1; 4.3.1.** Much of the construction will take place in Winter; therefore, snow cover and frozen ground will lead to little dust being generated. When dust control is needed, water and calcium chloride will be applied. Construction vehicles will maintain a speed limit of 25 mph on dirt and gravel surfaces.	Potentially significant	Not significant
Land Features and Use	Soil erosion	**4.1.2; 4.3.2.** Erosion controls, such as hay-bale fences, silt dikes, and mats, will be used.	Potentially significant in specific areas	Not significant
Land Features and Use	Soil compaction	**4.1.2.** VELCO will rake or plow where necessary to support vegetation or prevent ponding or runoff.	Not significant	Not significant
Land Features and Use	Agriculture	**4.1.2; 4.3.2.** Disruption to agriculture will be mitigated by use of taller poles, which allow for longer spans, and by consulting with farmers as to pole placement.	Not significant	Not significant
Hydrology, Water Quality and Water Use	Rivers and streams	**4.1.3; 4.3.3.** VELCO will follow its normal vegetation-management protocol, which does not allow spraying of herbicides within 30 feet of standing water. Shrubs will be maintained along rivers and streams to avoid adverse impacts to surface water.	Potentially significant	Not significant
Hydrology, Water Quality and Water Use	Private wells	**4.1.3; 4.3.3.** VELCO will not allow any herbicide application closer than 100 feet to private wells.	Potentially significant	Not significant

Table ES-1: Summary of Monitoring and Mitigation Considered as Project Conditions				
Impact Type	**Impact**	**Mitigation Measure**	**Level of Significance Without Mitigation**	**Level of Significance With Mitigation**
Ecology	Fisheries	**4.1.4; 4.3.4.** Shrubs will be maintained along rivers and streams to provide shade to the waters, so that cold-water fisheries will not be adversely affected.	Potentially significant	Not significant
Ecology	Wetlands and flora	**4.1.4; 4.3.4.** Wetlands will be protected by silt fences. At Highgate Substation, some vegetation and a 0.91-acre wet pasture will be removed; however, plants on the undisturbed part will be carefully maintained in their present state, and VELCO will comply with the conditions imposed by the U.S. Army Corps of Engineers General Permit No. 58. VELCO will avoid the State-listed endangered plant on one project site, *Juncus greenei*.	Potentially significant	Not significant
Socioeconomics	Communities and individuals	**4.1.5; 4.3.5.** VELCO will encourage contractors to hire locally when possible. VELCO has communicated and will communicate with town selectboards and planning commissions, landowners and State agencies. VELCO, or its consultant, will approach each affected landowner if a reasonable change in pole placement, within the ROW, could mitigate impacts.	Not significant	Not significant

Table ES-1: Summary of Monitoring and Mitigation Considered as Project Conditions				
Impact Type	**Impact**	**Mitigation Measure**	**Level of Significance Without Mitigation**	**Level of Significance With Mitigation**
Visual Resources	Visual aesthetics	**4.1.6; 4.3.6.** VELCO will screen the clearing close to the Djanikian and Bennett residences by planting pines along the edge of the lawn, if acceptable to the landowners. VELCO will use selective cutting in the clearing to reduce the exposure of the hillside. VELCO will allow other species to grow selectively and introduce additional plants at the transmission corridor on the hillside above the Djanikian and Bennett properties.	Potentially significant	Not significant
Visual Resources	Visual aesthetics	**4.1.6; 4.3.6.** VELCO will consult affected landowners on pole placements, which present an opportunity to move poles a short distance to mitigate any impact. Where wood or laminated poles cannot be used, VELCO will use Corten steel poles that oxidize and blend into the surrounding environment.	Potentially significant	Not significant
Visual Resources	Visual aesthetics	**4.1.6; 4.3.6.** VELCO will plant White Pines to fill the 100-foot right-of-way at the beginning and end of the clearing on Mosher's property to screen their view of the line. The existing VELCO access drive at the Highgate Substation will be graded, seeded and screened by planting conifers. Also, VELCO will plant a 4- to 5-foot cedar hedge along the south and east side of the substation.	Potentially significant	Not significant

Table ES-1: Summary of Monitoring and Mitigation Considered as Project Conditions				
Impact Type	**Impact**	**Mitigation Measure**	**Level of Significance Without Mitigation**	**Level of Significance With Mitigation**
Cultural Resources	Potential to affect undiscovered resources	**4.1.7; 4.3.7.** If unanticipated archaeological or human remains are encountered during construction, all construction will be halted in that area and the remains protected intact until the Vermont Division of Historic Preservation decides if further mitigation is necessary.	Potentially significant	Not significant
Cultural Resources	Potential to affect Native Americans	**4.1.7; 4.3.7.** Mr. Douglas Frink of Archaeological Consulting Team presented the project to April Rushlow of the Abenaki people; she did not identify any cultural resources that would be affected or raise other concerns.	Not significant	Not significant
Health and Safety	Noise impacts of construction	**4.1.8; 4.3.8.** The audible noise level, due principally to the synchronous condensers if installed at Highgate Substation, would be less than 55 dBA at the property line (which compares to the typical noise level in a suburban living room).	Not significant	Not significant
Health and Safety	Herbicide use	**4.1.8; 4.3.8.** VELCO will only use those pesticides and herbicides that are approved by the U.S. Environmental Protection Agency and the Vermont Agency of Agriculture, upon the advice of the Vermont Pesticide Council. All state regulations will be followed for herbicide application near open water, wetlands and water supplies or homes. The public will be notified in advance of herbicide application.	Potentially significant	Not significant

Table ES-1: Summary of Monitoring and Mitigation Considered as Project Conditions				
Impact Type	**Impact**	**Mitigation Measure**	**Level of Significance Without Mitigation**	**Level of Significance With Mitigation**
Health and Safety	Electro-magnetic fields (EMF)	**4.1.8; 4.3.8.** At peak loads, the predictable EMF level at the right-of-way's edge is 16 mG which is well below any existing U.S. standard.	Not significant	Not significant
Nuisance	Radio and Television Interference	**4.1.8; 4.3.8.** No interference is anticipated; however, should any occur, VELCO will work with nearby homes and businesses complaining of interference to determine the cause and mitigate any interference.	Not significant	Not significant

Cumulative Impacts

NEPA requires that potential, cumulative impacts be assessed. The discussion of cumulative impacts in Chapter 4 of this EA describes the potential cumulative impacts for each resource topic, such as cumulative air-quality impact at all sites and cumulative impacts on agriculture, forestry and wildlife habitat relative to the total availability of these resources in the area.

Most of the project's effects will be temporary, such as the potential impacts associated with construction. Many of the long-term effects are either not additive to the effects of other projects, or are so minor as cumulatively to not be significant, and the project will be sited entirely at substation sites or power-line corridors that exist today.

Unavoidable Adverse Effects

Unavoidable adverse effects related to the project are described in Chapter 4. There would not be any unavoidable adverse impacts by virtue of the inclusion of the above-listed design and mitigation measures as conditions of the proposed action.

Irreversible/Irretrievable Commitment of Resources

Irreversible and irretrievable commitment of resources is described in Chapter 4. The project would not cause any irreversible or irretrievable commitments of resources since substations and power lines may be removed in the future and their sites restored to natural conditions.

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Chapter 1. PURPOSE AND NEED

A glossary of the terms, acronyms and abbreviations used in this Environmental Assessment (EA) is provided in **Appendix A**.

1.1. Introduction

On September 2, 2003, Vermont Electric Power Company, Inc. ("VELCO"), filed an application with the U.S. Department of Energy ("DOE") to amend two Presidential Permits (PP-66 and PP-82) for the construction, operation, maintenance, and connection of electrical facilities that cross the United States – Canada border in two places within the State of Vermont. The Secretary of Energy has the authority to grant or deny such an amendment with concurrence by the Secretary of Defense and the Secretary of State. VELCO's Notice of Application was published in the Federal Register on October 9, 2003 (68 FR 58320). The facilities would be constructed, operated, and maintained by VELCO for itself and pursuant to agreements with the Vermont electric utilities that own a portion of the facilities. The two interconnections would be used to transmit electric energy between Hydro-Québec in Canada and VELCO in the United States.

Upon issuance of a Presidential permit, no material change may be made in the way the facilities are operated unless such change has been approved by the Department of Energy (DOE). Before a Presidential Permit may be issued or amended, DOE must determine that the proposed action would not adversely impact on the reliability of the U.S. electric-power-supply system. In addition, DOE must consider the environmental impacts of the proposed action (i.e., granting the Presidential Permit with any conditions and limitations, or denying it) pursuant to the National Environmental Policy Act of 1969 (NEPA). DOE also must obtain the concurrence of the Secretary of State and the Secretary of Defense before taking final action on a Presidential Permit application.

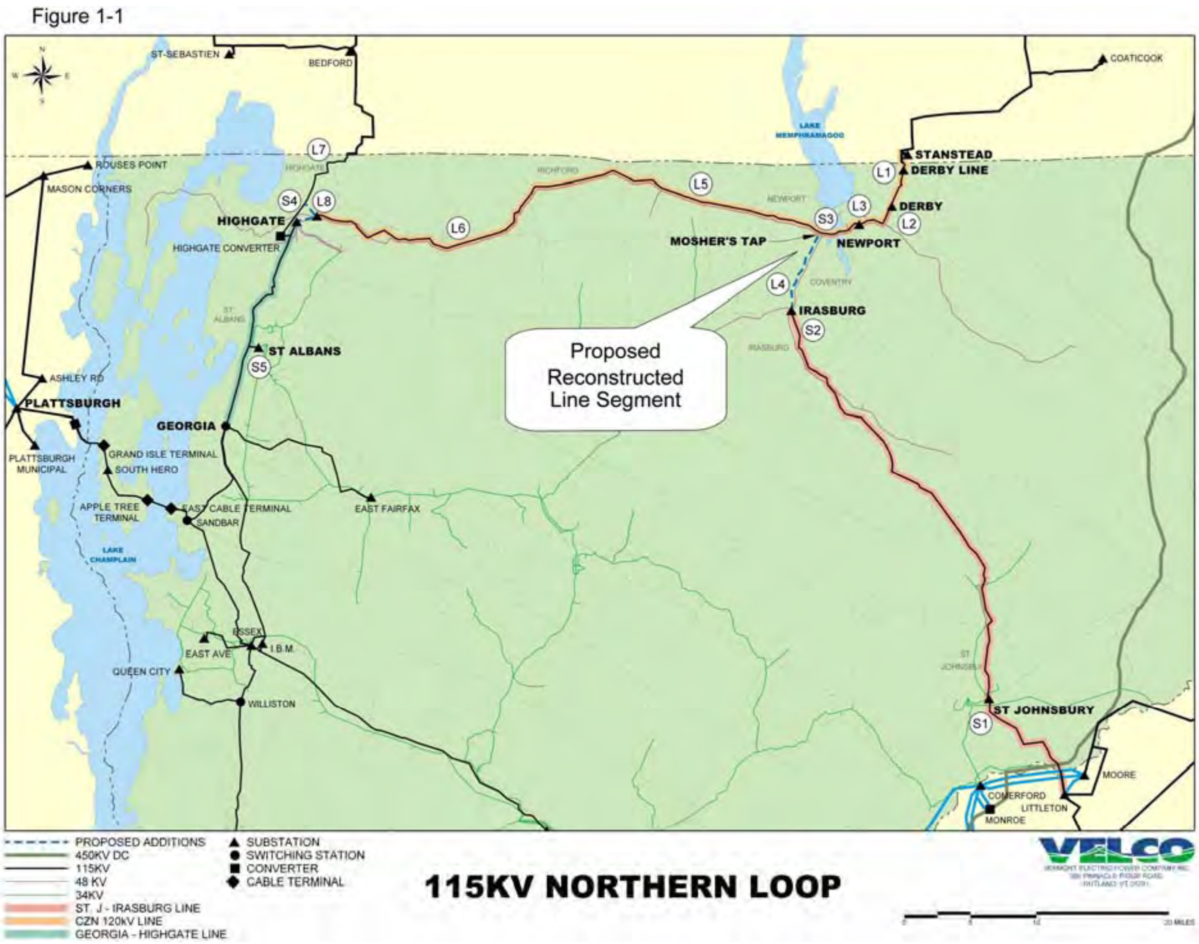
This Environmental Assessment (EA) is intended to be a concise public document that assesses the probable and known impacts to the environment from VELCO's Proposed Action and alternatives and reaches a conclusion about the significance of the impacts. This EA was prepared in compliance with NEPA regulations published by the Council on Environmental Quality (40 CFR 1500-1508) and implementing procedures of DOE (10 CFR 1021).

1.2 Project Summary

The electric system in northern Vermont (that portion essentially north of a line drawn from VELCO's Georgia Substation in Vermont to a substation located in Littleton, New Hampshire) is currently served by a potentially unreliable transmission system. The total load of approximately 150 megawatts (MW) in that area is supplied by two 115-kV and one 120-kV radial lines and a weak underlying 34.5-kV and 46-kV sub-transmission network. At intermediate-to-peak levels of electrical load, a loss of the 115/120-kV lines results in the inability to serve the entire electrical load in that area. The Northern Loop Project, as described in this EA, will substantially reduce or eliminate the loss of load exposure that exists today.

The three radial 115/120-kV lines are shown geographically in Figure 1-1 below, and schematically in the subsequent Figure 1-2 (showing the current configuration of the three lines).

Figure 1-1



Beginning on the western side of the state and working clockwise around the northern Vermont area, the first radial line originates at the Georgia Substation and terminates at the VELCO Highgate Substation. This line provides a voltage source for the Highgate converter-station tap and serves the load and generation at the VELCO Highgate and St. Albans Substations. A loss of this line renders the Highgate Converter Station inoperable and therefore interrupts a significant source (normally up to 200 and as much as 225 MW) of electrical supply to Vermont via the Highgate Interconnection Facilities from Bedford, Québec.

The next line extends from the Highgate Substation (formerly owned by Citizens Utilities) and easterly across the northern part of the state to the Derby Interconnection Facilities located at the border at Stanstead, Québec. This line serves electrical load at the Newport and Citizens Highgate Substations and is commonly referenced as the “block load,” which means that the load served by this line is electrically isolated from the New England system and supplied directly by the Québec system.

The third line originates at Littleton, New Hampshire, and terminates at VELCO’s Irasburg Substation. This line serves the St. Johnsbury and Irasburg Substation electrical loads.

Figure 1-2 shows these lines in their current configuration schematically:

Overview.

The Northern Loop Project involves substation[1] upgrades at three existing substation locations (St. Johnsbury, Irasburg, and Highgate), additional line equipment at two tap[2] points (where

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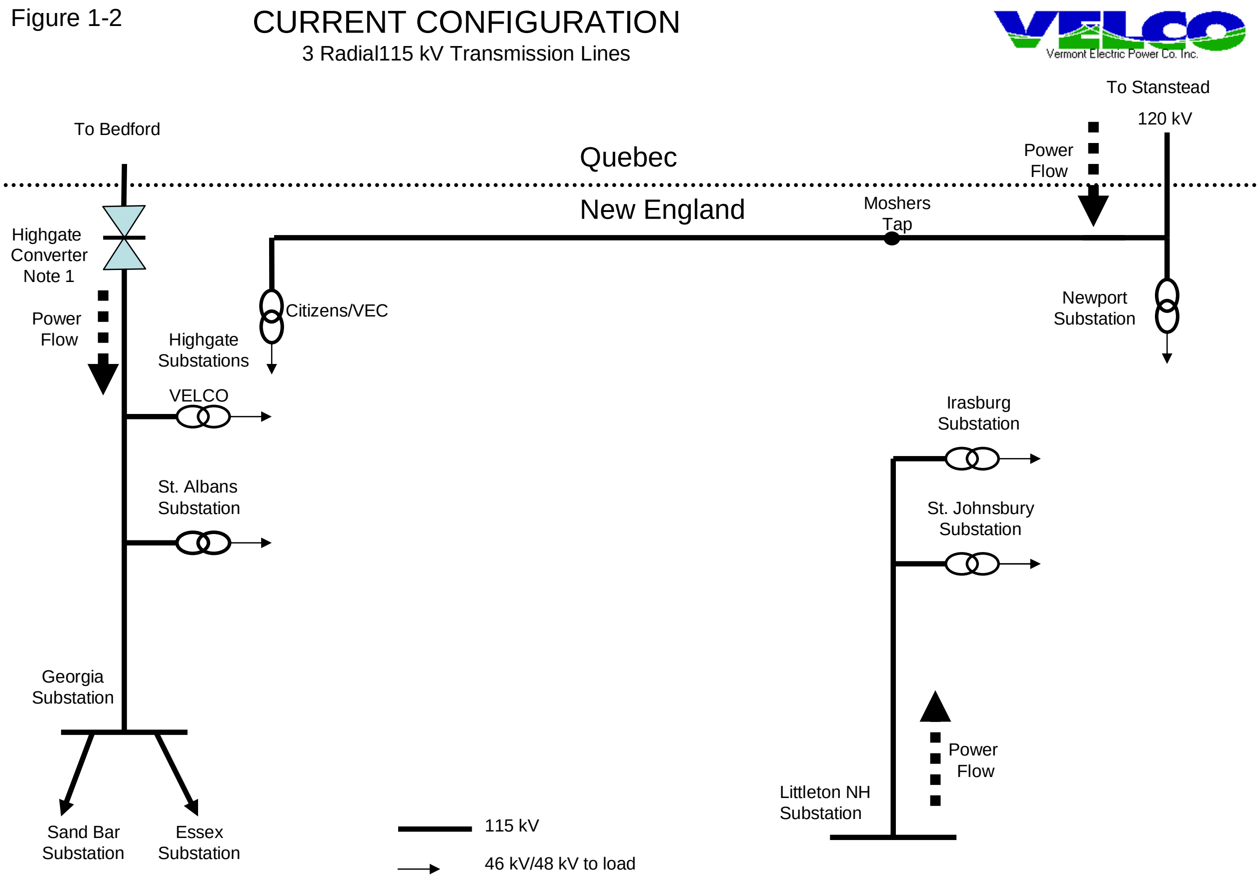
1 “Substation” means a structure, usually a small building on a fenced-off lot, that contains any combination of routing or cutoff switches, transformers, surge arresters, capacitors, power conditions and other equipment needed to ensure smooth, safe flow of current. Substations are most commonly seen in residential and industrial areas, where one or more high-voltage lines can often be feeding into the station and any number of lower-voltage distribution lines spider out to serve customers in the surrounding area (Ref.: www.energyvortex.com).

Figure 1-2



Note 1 Highgate Converter can not operate without voltage supplied from Georgia Substation

transmission lines are connected to other transmission lines without circuit breakers and associated protection equipment) – Mosher's Tap in Newport and the St. Albans Tap – and an upgrade of an existing 6.47-mile, 48-kilovolt ("kV") radial[3] transmission line, located between VELCO's Irasburg Substation and Mosher's Tap, to accommodate a new 115-kV transmission circuit (see Figure 1-1).

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2 A "tap" broadly refers to any terminal where an electric connection is established and most commonly refers to a terminal or connection that draws a certain amount of current from part of a circuit. Tapping a circuit can refer either to running a line or cable from a point in a circuit or to the drawing of electricity from that circuit. Just as a water tap allows one to draw a certain amount of water from the total supply, an electrical tap serves the same function for drawing electricity from a source of supply (Ref.: www.energyvortex.com).

3 "Radial line" refers to a transmission line, distribution line or transmission/distribution subsystem that is not interconnected with other systems, so named because it radiates outward from another transmission system without bridging any other systems (Ref.: www.energyvortex.com).

With these upgrades, VELCO proposes to integrate most of an existing 120-kV, Derby-to-Highgate line, formerly owned by Citizens, into the VELCO system. Once connected or "looped,"[4] the 120-kV line, would be operated at 115-kV (the voltage used on VELCO's system and on the rest of the Northeast power grid), and would convert radial transmission lines in northern Vermont into a loop between VELCO's Georgia Substation and the Public Service Company of New Hampshire (PSNH) substation in Littleton, New Hampshire.

Utilities serving northern Vermont supply approximately 150 MW of peak load – about 15% of Vermont's peak requirements – through three radial 115-kV/120-kV lines: (1) the 115-kV transmission line between Littleton, New Hampshire, and Irasburg, Vermont, with about 30 MW of load; (2) the VELCO 115-kV line between Georgia and Highgate, Vermont, serving about 50 MW of load; and (3) the former Citizens' 120-kV line between Derby and Highgate, Vermont, with about 70 MW of load.

Of the total 150 MW, 80 MW is fed radially from the VELCO system and has no effective back-up. The 70 MW balance is supplied directly by Hydro-Québec and radially fed from 120-kV tie at Stanstead, Québec, operated by the TransEnergie division of Hydro-Québec. The transmission-line system supplying the 70 MW cannot be connected to the New England system at the same time because the Hydro-Québec system is not electrically synchronized with other systems in the Northeast.

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4 In the energy industry, a "loop" is a distribution circuit supplied by two sources of energy. One source serves as a back-up in case the primary source of energy is interrupted (Ref.: www.energyvortex.com).

Radial lines are lines that are connected to the New England power grid at only one end. As such, outages on these lines would result in load that could not be served because electric power could not be supplied by way of an alternative transmission path.

Existing Facilities.

Citizens' Vermont distribution system – now purchased by Vermont Electric Cooperative, Inc., (VEC) – is normally fed from TransEnergie's Stanstead tie. The Stanstead tie connects to what was Citizens' 120-kV network (120 kV is the nominal voltage used in the Québec system *vs.* 115 kV which is typically used in New England) at the Derby Interconnection Facilities that normally feed VEC's "Northeast-Central Load" and the "Northwest Load" (defined below in Section 1.3.1). That line currently crosses the border at Derby Line, Vermont, to supply a substation located about 565 feet from the border and also Newport Substation. These facilities, which operate at 120 kV, in turn connect to a double-circuit (120-kV/48-kV) transmission line 52 miles in length that connects the Newport Substation and VEC's Highgate Substation located in northwestern Vermont; see Figure 1-1.

This line's higher-voltage, 120-kV, circuit steps down to lower voltages at both Newport and Highgate Substations; the lower-voltage, 48-kV, line serves both substations and several additional substations between Newport and Highgate. At Mosher's Tap, located approximately three miles west of Newport Substation, a 48-kV line runs six miles south to VEC's Irasburg Substation and then connects into VELCO's Irasburg Substation.

VEC can be tied at 48 kV to the VELCO system either through the VELCO Highgate or Irasburg Substations. However, because the TransEnergie system is asynchronous with VELCO's transmission system, VEC must electrically separate its load from one system in order to interconnect with the other. This process is commonly referred to as "block loading."

One of the disadvantages of block loading the VEC system is that VEC must operate its system as a radial extension of either VELCO's or TransEnergie's system in lieu of networking its system. VEC's current, 120-kV, radial connection at Stanstead is the sole feed for its entire (70 MW) Northeast-Central and Northwest Load. Currently, the VELCO and VEC systems are configured for VEC to block load off TransEnergie's system.

VEC has contractual as well as native-load obligations to supply 70 MW of Hydro-Québec power. Only in situations where it is either in the economic interest of VEC's customers to connect to VELCO (which occurs in off-peak hours and with just certain segments of its load), or where part or all of its block of load cannot be served by TransEnergie, does VEC connect some or all of its load to VELCO. There are switching capabilities at both VEC's Highgate and Newport Substations to allow for portions or all of its system to be connected to VELCO. However, insufficient capacity in the VELCO system currently exists to feed both the normally-connected Vermont load and VEC's entire 70-MW load at intermediate- to peak-load levels in Vermont.

VELCO's 115-kV Irasburg line originates in Littleton, New Hampshire; runs north to St. Johnsbury, Vermont, to supply (by this radial line) about 30 MW of peak load in the St.

Johnsbury area; and terminates 36 miles further north at Irasburg, where it feeds the underlying sub-transmission system and provides the back-up feed for VEC's Northeast-Central Load. VELCO's Highgate line originates in Georgia, Vermont, and runs 17 miles north to its termination in Highgate where it supplies local load and provides a back-up feed for VEC's Northwest Load; it supplies (radially) about 50 MW of peak load via a tap that serves the St. Albans area, located seven miles north of Georgia.

New Facilities.

By rebuilding 6.47 miles of the existing, 48-kV transmission line to 115-kV from Irasburg to a tap position on the 120-kV line (which would now be operated at 115 kV) purchased by VELCO from Citizens and then connecting the line at Highgate Substation, VELCO would create a 115-kV transmission loop from the PSNH substation in Littleton, New Hampshire, to VELCO's substation in Georgia, Vermont. At the same time, the VEC sub-transmission system (which it purchased from Citizens) would be enhanced by segregating it into two components, each capable of supplying approximately one-half of the total VEC load, with one component continuing to be served off the Stanstead, Québec, interconnection over the Derby Line Interconnection Facilities (subject to PP-66-1) and the other being served from the Bedford, Québec, interconnection over the "Highgate Interconnection Facilities" (subject to PP-82).

1.3 Purpose And Need

1.3.1 Applicant's Purpose and Need

The purpose of the Northern Loop Project is to improve reliability by eliminating two of the radial feeds described in the previous section, currently used to serve approximately 80 MW of load supplied by VELCO's system, by connecting VELCO's existing 115-kV lines terminating in Irasburg and Highgate with the existing 120-kV line formerly owned by Citizens – and before Citizens sold its distribution system to VEC – and then providing VEC with two feeds (instead of only one today) for the remaining 70 MW of load. VELCO's looped facilities would also provide back-up service to the VEC load that is normally block-loaded to TransEnergie to serve the "Northeast-Central Load" (VEC's service area in the eastern and central part of northern Vermont) and the "Northwest Load" (VEC's service area in northwest Vermont). At the same time, VEC's 48-kV sub-transmission system would be enhanced by segregating the system into two components – one component continuing to be fed through interconnection facilities at Derby, Vermont (the "Derby Interconnection Facilities") and the other being fed from Highgate Substation – rather than the one feed that supplies all of the electric load today.

Today, VELCO's existing bulk-transmission facilities, allowing for the capacity of the underlying sub-transmission facilities (operated by electric utilities serving retail customers in northern Vermont) are not capable of providing service for the full 150 MW of load at peak and even intermediate conditions on the VELCO system. At intermediate or higher load levels, some portion of the load served by these lines cannot be served if the line is out since the underlying sub-transmission network is not sufficiently strong to support the entire load.

Figure 1-3 (Current Configuration with the loss of a 115 kV source element) demonstrates the results for a loss of the 115-kV line supplying the Irasburg and St. Johnsbury Substations. In this example, load would be shed[5] in the St. Johnsbury area under intermediate- or high-load conditions:

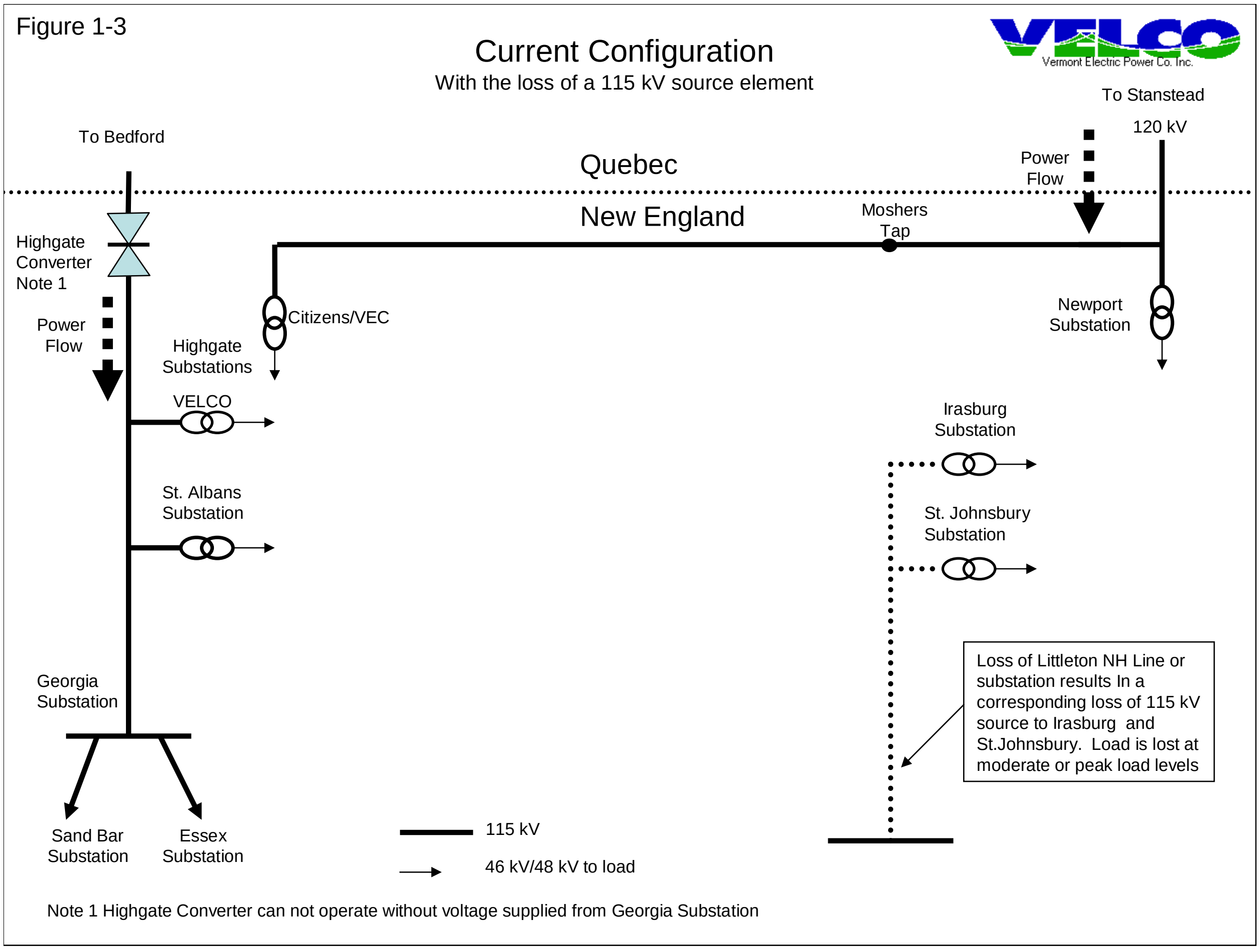

Figure 1-4 describes the system configuration after the project is constructed.

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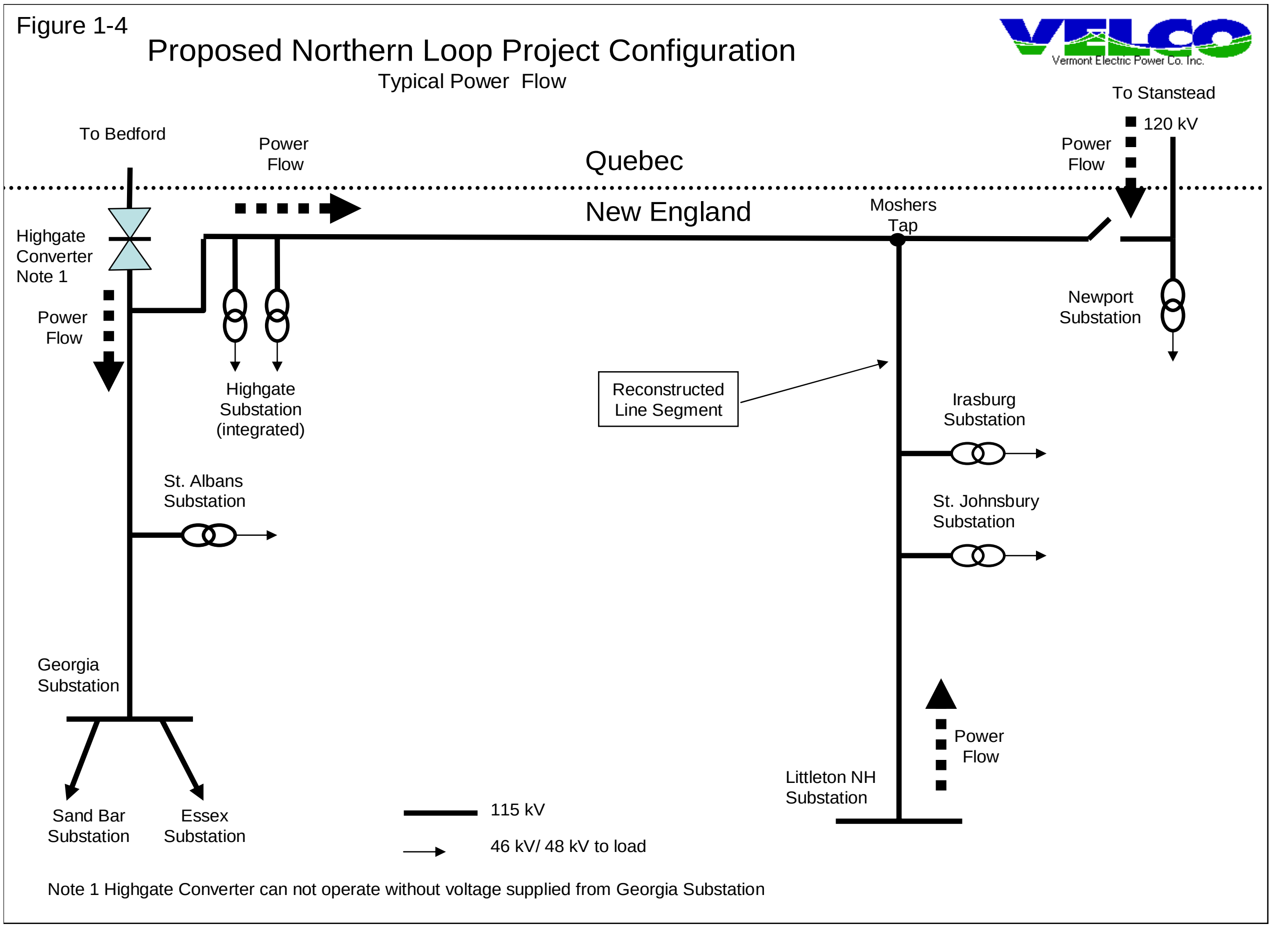
5 "Shed" means blocking of customer access to energy, usually due to a temporary shortage of supply. Load shedding is rare and is most commonly applied during times of emergency or severe shortage. In most cases, the first loads a utility will shed in these conditions are loads required by industrial and commercial customers. Institutional loads are typically the last to be shed since public institutions (hospitals, schools, municipal-lighting authorities, etc.) are considered to be a utility's most essential customers (Ref.: energyvortex.com).



The project will convert the three radial lines into a loop configuration providing a 115-kV backup source for all but 35 MW of the peak load in northern Vermont. The primary elements of the project include:

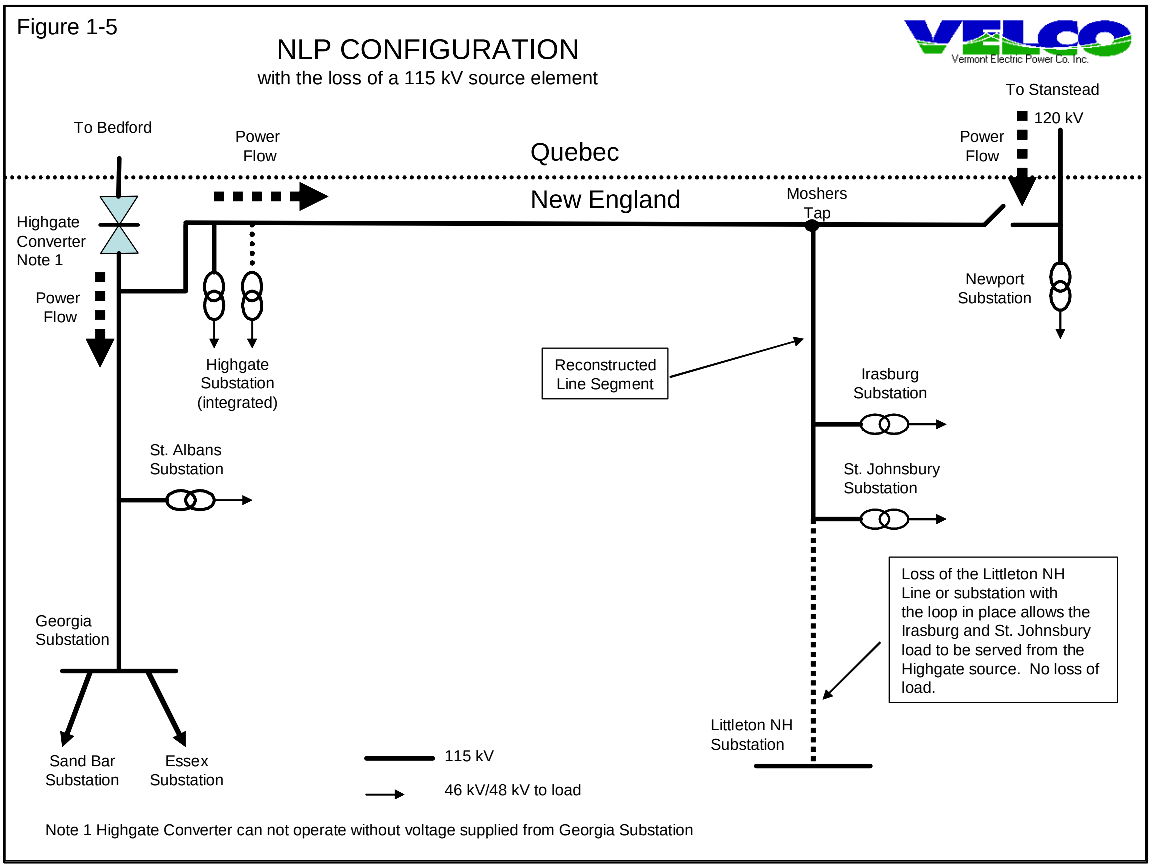
1. The replacement of an existing, 48-kV transmission line between Irasburg Substation and Mosher's Tap on the Newport-to-Highgate line with a single-pole, double-circuit, 115-kV/48kV lines;

2. Integration of the collocated Highgate VELCO and former Citizens Substations to facilitate the connection of the Newport-to-Highgate line to the Georgia-to-Highgate line; and

3. Upgrades at the existing St. Albans Tap; Irasburg and St. Johnsbury Substations to facilitate the isolation of electrical faults (interruptions of energy flows) on the line segments.

Figure 1-5 (NLP Configuration with the loss of a 115kV source element) describes the performance of the system for the same loss of the Littleton-to-St. Johnsbury line described in Figure 1-3:

Figure 1-5



In this example, the reconfigured network provides a 115-kV, back-up source for the Irasburg and St. Johnsbury Substations via the loop to Highgate, therefore eliminating the loss of load in St. Johnsbury previously described. This configuration also provides a 115-kV backup source for the remaining radial load served at Newport Substation if its supply from Québec is interrupted.

Overall, VELCO states that the Northern Loop Project would address the type of problem shown in Figures 1-3 through 1-5 and provide both reliability and loss-savings improvements to the regional system and the Vermont system, which in turn would benefit VEC, Central Vermont Public Service Corporation, Green Mountain Power Corporation, Burlington Electric Department, various municipal electric departments, and all of their customers, because:

- It reconfigures St. Johnsbury, Irasburg, Highgate and St. Albans Substations from a radial to a loop feed, which directly benefits approximately 80 MW of load;
- It has the potential to help protect northwestern Vermont in the event of a "contingency," i.e., an event on the transmission system–usually an equipment failure or a weather-related incident–that causes a line to open up on two of the system's most important ties (loss of the PV20 tie to New York or loss of the Highgate-converter tie to Québec)—either event, the Northern Loop Project would provide a path for power to be imported from the Littleton, NH, area;
- It would provide VEC with two feeds (east and west) instead of solely depending on the eastern feed, thus improving its reliability for its block load of 70 MW;
- By looping the 120-kV line, the existing facilities could be rolled into the New England Pool Transmission Facilities ("PTF").
- Currently, maintenance on the Highgate-to-Georgia line is very difficult to schedule because the existing line is radial, and taking it out of service compromises the area's reliability so maintenance has to be scheduled for either evening hours or weekends when the load is low—closing the loop would enable maintenance outages to be taken on all the new looped facilities; and

- This project would reduce losses in both the VEC system and the VELCO system ranging from about ½ MW to 4 MW, depending on loads and system operating conditions.

Vermont continues to pursue programs to encourage conservation, such as funding Energy Efficiency of Vermont, a utility established to operate efficiency and conservation programs for almost all of Vermont's electric utilities. Even with a fairly aggressive program in place, however, load in Vermont continues to grow. As mentioned above, 80 MW of load currently supplied by radial lines serves customers in load pockets that are experiencing some of the highest electric-growth rates in the state. Through the proposed Northern Loop Project, VELCO indicates that those load areas would be supplied by looped transmission facilities, thus increasing the reliability of the area not just for current load but for future demand as well.

1.3.2 The Department of Energy's Purpose and Need

NEPA requires Federal decision makers to consider the environmental effects of their actions. An agency's statement of purpose and need defines the reason and context for that agency's action, i.e., it explains what the agency is called upon to do, given its authority. The purpose and need for DOE action is to determine whether it is in the public interest to grant or deny VELCO's application to amend two Presidential Permits (PP-66 and PP-82) for the construction, operation and maintenance of electrical facilities that cross the United States–Canada border in two places within the State of Vermont, as described on the preceding pages. Like all Federal agencies, DOE must comply with NEPA.

In determining whether a proposed action is in the public interest, DOE considers the impact of the proposed project on the environment and on the reliability of the U.S. electric power supply system. DOE also must obtain the concurrence of the Departments of State and Defense before it may grant a Presidential Permit. If DOE determines that granting a Presidential Permit is in the public interest, the information contained in this Environmental Assessment (EA) will provide a basis upon which DOE decides which alternative(s) and mitigation measures are appropriate for inclusion as conditions of the permit. In a process that is separate from NEPA, DOE will determine whether the proposed project will adversely impact the reliability of the U.S. electric system. Also, before authorizing imports from Canada over the facilities, DOE must ensure that the imports will not impair sufficiency of electric supply within the United States and will not impede, or tend to impede, the coordinated use of the regional transmission system. Issuance of a Presidential Permit only indicates that DOE has no objection to the project, but does not mandate that the project be completed.

1.3.3 Purpose of Environmental Assessment

In accordance with DOE's NEPA Implementing Procedures (10 CFR Part 1021), the proposed project requires preparation of an Environmental Assessment or "EA." An EA is a concise public document which serves to (a) briefly provide sufficient evidence and analysis for determining whether to prepare an EIS or a Finding of No Significant Impact (FONSI); (b) aid an agency's compliance with NEPA when no EIS is necessary; and (c) facilitate preparation of an EIS when necessary. The purpose of this EA is to describe the potential impacts associated with the proposed project. This EA has been prepared to be consistent with the Council on Environmental

Quality (CEQ) regulations implementing the procedural provisions of the NEPA (40 CFR 1500 - 1508).

1.4 Detail Of Proposed Project

1.4.1 Purchase and Use of Citizens' Communications Transmission Assets

Citizens and VELCO entered into a purchase-and-sale agreement, dated March 18, 2003, pursuant to which Citizens subsequently transferred to VELCO its right, title and interest in the following Vermont transmission facilities (the "Transmission Facilities"):

1. Approximately 3 miles of a single-circuit, 120-kV, transmission line between the international border at Derby Line and Derby, Vermont;

2. Approximately 29.4 miles of a double-circuit transmission line constructed at 120 kV between Derby and Richford, Vermont, of which currently one circuit is operated at 120 kV and the other circuit is operated at 48 kV;

3. Approximately 6.47 miles of a single-circuit, 48-kV line located between the Mosher's Tap switching structure in Newport and Irasburg, Vermont;

4. Approximately 23 miles of a single-circuit, 120-kV line located between the termination of the double-circuit, 120/48-kV line at Richford Substation and Highgate Substation; and

5. All assets located in the Border Substation, located at the international border in Derby Line, Vermont.

This change (utilization of the purchased Citizens assets) would reduce peak imports from TransEnergie in Québec over the interconnection facilities so that certain of the Transmission Facilities formerly used by Citizens–and now used by VELCO after its purchase of these facilities from Citizens–to transmit part of the imported energy to Highgate, Vermont, instead may be used to electrically connect facilities operated by VELCO in northeastern Vermont (terminating at its Irasburg Substation) to facilities operated by VELCO in northwestern Vermont (terminating at Highgate Substation).

This operational change requires:

1. Replacement of the existing, 48-kV, transmission line within the existing ROW between VELCO's Irasburg Substation and the so-called "Mosher's Tap" – on the existing line between Newport and Highgate Substations – with a new, double-circuit (115-kV/48-kV) line;

2. Connection of this line's 115-kV circuit to one circuit of the existing Mosher's Tap-Highgate Substation line, now operated at 120 kV but to be operated thereafter at 115 kV;

3. Connection of this 115-kV circuit at Highgate Substation to VELCO's existing 115-kV bus;

4. Consolidation of now-separate substations in Highgate, a project that would connect the Highgate Interconnection Facilities (north of the converter terminal) to the 120-kV bus in Highgate Substation (the "Highgate Tap"); and

5. Related improvements to three VELCO substations (St. Johnsbury, Irasburg and St. Albans).

Looping VELCO's system means that one circuit between Mosher's Tap and Highgate Substation (currently operated at 120 kV) can no longer be used to supply approximately 35 MW of the Northwest Load by energy imported from TransEnergie over the Derby Interconnection Facilities. These facilities are normally synchronized to TransEnergie's system, whereas the looped facilities would be synchronized to the other systems in the Northeast with which VELCO is interconnected.

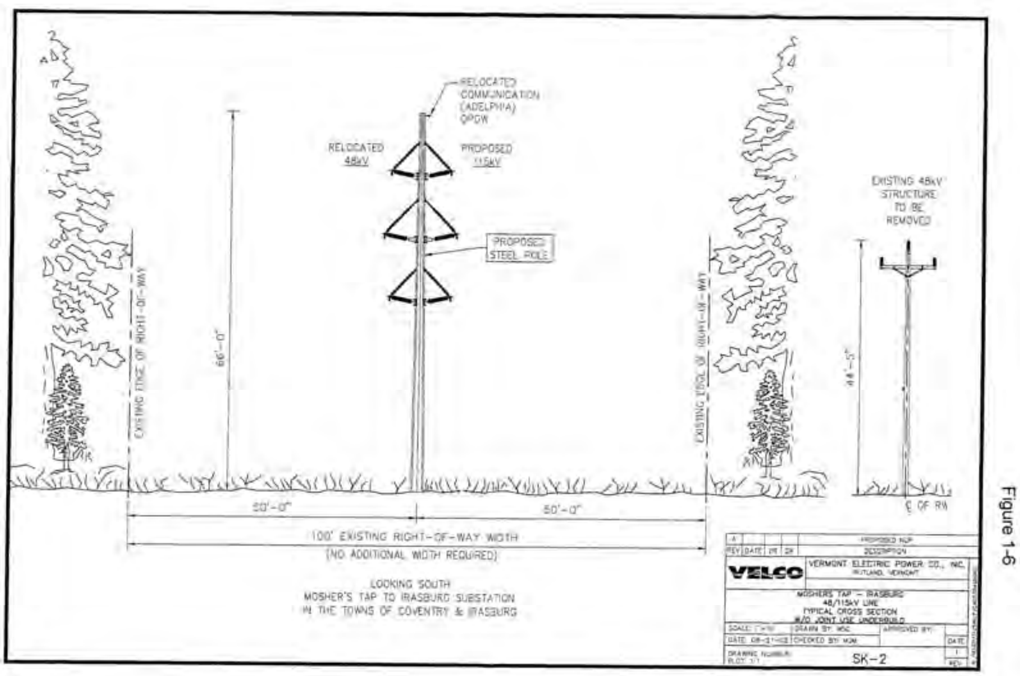
As a result, VELCO would disconnect the 120-kV circuit at Mosher's Tap, so that it would no longer be connected to the Derby Interconnection Facilities, and these facilities would thereafter be used only to import energy from TransEnergie to Newport Substation to supply the Northeast-Central Load and not to serve the Northwest Load; the change would reduce peak flows over the Derby Interconnection Facilities to approximately 35 MW as compared to around 70 MW today.

After the change, the Northwest Load could be served either by imports from TransEnergie over the Highgate Interconnection Facilities or by VELCO from its own system at Highgate. If the Northwest Load is served over the Highgate Interconnection Facilities (i.e., block-loaded to Canada), it may be necessary to increase imports over these facilities from the 225 MW currently authorized by PP-82 to 250 MW.[6] Up to 35 MW of load would flow over the Highgate Tap to serve the Northwest Load.

1.4.2 Mosher's Tap to Irasburg 115/48kV Double Circuit Build

VELCO plans to acquire better easements and the appropriate permits to replace an existing 6.47-mile, 48-kV, transmission line with a 115-kV/48–kV, double-circuit, line between Mosher's Tap and Irasburg Substation. The new 115-kV circuit would utilize type "1272 ACSR" conductor[7]. The 48-kV circuit would be re-conductored with new conductor (type "556 ACSR"). Conceptually, the line is being designed for wood or laminated-wood poles – with some Corten™ steel poles –and side-by-side, symmetrical, 115-kV insulators. Figure 1-6 shows how the new line would appear.

Figure 1-6



[6] No change to maximum flows through the converter terminal (which has a continuous-overload capacity of 225 MW) would result.

[7] ACSR: Aluminum conductor, steel reinforced. The number 1272 refers to the cable size, i.e., 1272K circular mils.

Where possible, the new poles would be located as close to the current pole locations as feasible. Where environmentally beneficial, and if the line design permits relocation of poles already in sensitive areas, VELCO will do so.

There now exist two sections of this line that are under-built with a 12.5-kV distribution line. The first section is 1.1 miles, and the other section is 1.3 miles. VEC would be responsible for the capital carrying costs and for the maintenance of these distribution facilities. VELCO and VEC would work with Adelphia Cable or its successor to remove the existing All Dielectric Self-Supporting (ADSS) fiber-optic communications cable and replace it with Optical Ground Wire (OPGW) to minimize wires on the pole; OPGW provides both fiber-optic communications and shield-wire capability in one wire, thereby eliminating a second wire.

1.4.3 Highgate Expansion

Currently, there are two substations located almost back-to-back at Highgate: VELCO has a 4-breaker, 48-kV, radial bus, and Citizens had a 5-breaker, 48-kV, ring bus (now owned by VELCO) located directly behind VELCO’s substation. It is VELCO’s intent to combine the substations, as described below.

VELCO has purchased the real estate and all of the 120-kV and 48-kV assets within what was previously Citizens’ Highgate Substation. VEC would continue to own the 48-kV lines terminating at the substation. The 48-kV ring bus would be reconfigured to continue to provide

VEC with the operating flexibility VEC currently has for serving its customers. One additional 48-kV breaker would be inserted in the present ring bus to aid in this purpose.

Additionally, to supply the reactive power now necessary to support VEC's ability to feed its Northwest Load from the east, the 6.14-MVAR[8] capacitor bank that currently resides in the VELCO bus would be moved over to the combined, 48-kV bus. A new 5.4-MVAR capacitor bank would also be installed at the 48-kV bus. Two 15-MVAR synchronous condensers (explained below), located within the substation, may also be necessary to support the new configuration as well as two 120-kV capacitor banks supplying a total of 30 MVAR.

VELCO would rebuild its existing radial bus into a 5-breaker, 115-kV, ring bus for increased reliability and flexibility. This new ring bus would become the terminus for the 115-kV line from Newport as well as for the VELCO line coming from the U.S. side of the Highgate Converter Station and the VELCO line going south toward St. Albans. Additionally, a normally-open feed to the VEC system would also exist to supply a back-up feed from the VELCO system when necessary. The two substations, currently located within 120 feet of each other, would be combined into one, with a security fence around all equipment. Figure 1-3 is an orthophoto[9]

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8 MVAR: Mega Volt Ampere Reactive. Reactive power is the component of power that is a by-product of alternating current and is expressed in VAr (Volt-Ampere reactive). Reactive power is produced when the voltage is out of phase or is at 90 degrees with the current. It establishes and sustains electric and magnetic fields of various alternating-current equipment, such as motors and transformers (Ref.: www.energyvortex.com).

9 An "ortho photo" is a short form of photochromatic, which the Merriam-Webster OnLine Dictionary defines as, "of, relating to, or producing tone values of light and shade in a photograph that correspond to the tones in nature."

showing the existing two-substation plan, while Figure 1-4 is an orthophoto that show the combined substation's plan**.**

1.4.4 Improvements at Other Substations

At VELCO's St. Johnsbury Substation, there would be two new 115-kV circuit breakers added along with protection and control equipment for those new breakers. This would require an addition to the existing control building. All of this work would be done within the existing substation fence. Additionally, a new septic system would be installed.

Additions to Irasburg Substation would include two 115-kV circuit breakers, one located on the line coming north from St. Johnsbury and the other located on the new section of line going toward Mosher's Tap. With the addition of these new breakers, protection and control equipment would need to added, which would require the enlargement of the existing control building.

VELCO plans to install two motor-operated disconnect (MOD) switches on its 115-kV line at St. Albans where the line that supplies St. Albans is tapped into the VELCO Highgate-to-Georgia line. The purpose of these MOD switches is to protect the St. Albans area load from extended outages due to permanent faults on the St. Albans-to-Georgia line as well as provide the ability to perform scheduled and unscheduled maintenance on that line segment. The disconnect switches would be located one structure north and south of the tap. Additionally, a storage hut of approximately 10 ft. x 10 ft. would be added to house the battery supply, "SCADA RTU" (Supervisory Controlled And Data Acquisition Remote Terminal Unit), switching station, fiber optics, heater and air conditioner, AC-distribution panel and a wall-mounted motor-operated disconnect “MOD” control panel.

1.5 State Proceedings

In addition to a Presidential Permit from DOE, VELCO needed and has received a Certificate of Public Good (CPG) from the Vermont Public Service Board (PSB) as required by Vermont law (Section 248 of Title 30, Vermont Statutes Annotated). Paraphrased, Section 248 requires VELCO to demonstrate that the project would promote the general good of the state, specifically, that the project: (1) would not unduly interfere with orderly development of the region; (2) is required to meet present and future demand for service; (3) would not adversely affect system stability and reliability; (4) is economic; (5) would not have an undue adverse affect on aesthetics, historic sites, air and water purity, the natural environment and the public health and safety; and (6) complies with the Vermont Twenty Year Electric Plan or, if not, that there exists good cause to permit the proposed action.

Hearings in the Section 248 proceedings were held during May 2003, and the PSB’s Order and CPG approving the project were issued on July 17, 2003. Appendix B contains a copy of the decision, order, and CPG approving the Northern Loop Project. The PSB found that the project was consistent with the requirements of Section 248 of Title 30 and would promote the general good by improving the reliability of the electrical systems in the northern part of the state, thus benefiting consumers throughout the northern part of Vermont. The PSB also found that the proposed project would not have an undue adverse affect on the aesthetics or scenic and natural beauty of the area.

VELCO has also applied for and received several other Vermont and federal permits required for the Northern Loop Project, including waste-water permits for the Irasburg and St. Johnsbury Substations, a wetlands Conditional Use Determination permit (CUD) from the Vermont Agency of Natural Resources (ANR), and an Army Corps of Engineers (COE) permit. Copies of these four permits are included in Appendix B. No other local or state approvals are required for the project to be constructed. VELCO has, however, worked closely with the Vermont Department of Public Service, numerous divisions within the Vermont Agency of Natural Resources, the Vermont Agency of Agriculture, the Vermont Division for Historic Preservation, the Vermont Non-game and Natural Heritage Program and the Vermont Department of Fish and Wildlife as well as officials of the affected towns and regional planning commissions and COE. In addition, the Department of Public Service also conducted an independent review of VELCO's proposal, representing the interests of all affected state agencies and working with the individual communities. Appendix B contains copies of all associated letters.

Chapter 2. PROPOSED ACTION AND ALTERNATIVES

The "Proposed Action," which is VELCO's preferred alternative, and other alternatives, including the "No Action Alternative," are discussed in the following sections.

2.1 Proposed Action

The Proposed Action, which is the applicant's preferred alternative, is to amend the Presidential Permit to be issued for the Derby Interconnection Facilities (now subject to PP-66-1) and, as agent for the HJO, to amend PP-82, as follows:

VELCO has applied to amend the first permit to authorize it to change operation of the Derby Interconnection Facilities as part of the Northern Loop Project. The change would reduce peak imports from TransEnergie in Québec[10] over the Derby Interconnection Facilities so that certain of the transmission facilities now used to transmit part of the imported energy to Highgate, Vermont, instead may be used to electrically connect or "loop" facilities operated by VELCO in northeastern Vermont (terminating at its Irasburg Substation) to facilities operated by VELCO in northwestern Vermont (terminating at its Highgate Substation).

The second amendment would increase imports under PP-82 to 250 MW. This would allow VELCO to import energy from Hydro-Québec to serve the Northwest Load without affecting (and potentially increasing) flows through the Highgate Converter Station, even though the now-

[10] TransEnergie is the transmission division of Hydro-Québec.

looped, Mosher's Tap-Highgate line, currently used to feed the Northwest Load, can no longer be synchronized to the Hydro-Québec system at Derby Line to supply that load.

2.1.1 Proposed Route

Irasburg to Mosher's Tap

VELCO proposes to co-locate the new 115-kV circuit with the former Citizens 48-kV circuit (now owned by VELCO) on single-pole structures and thus would rebuild the existing 6.47-mile, 48-kV transmission line with a 115-kV/48-kV line using double-circuit construction.

The new line is designed for wood or laminated-wood poles and for single, Corten™-steel poles in certain locations, which are rust-inducing poles that, once the color conversion has taken place, according to VELCO would blend well with the dark green of conifers and the brown of deciduous trees in winter.

The new line would be rebuilt approximately pole-for-pole along the alignment of the existing 48-kV line (see orthophotos in Appendix C) except where impacts on identified sensitive areas (wetlands and/or archaeological areas, identified on the Survey provided in Appendix C) would be minimized with selective placement of new poles.

VELCO states that it would construct the new line in accordance with the conditions set forth in the Vermont Agency of Natural Resources' Conditional Use Determination #2003-062 (see Appendix B). If, in the course of final design of this line, any pole relocation is found to be desirable for any reason, VELCO would be required under that ANR permit to notify the Vermont Wetlands Office in writing and to obtain written approval before proceeding. VELCO would also be subject to U.S. Army Corps of Engineers General Permit (GP-58) for this project and would be required to comply with all the terms and conditions set forth in it (see Appendix B).

In addition to co-locating its 115-kV circuit with the existing 48-kV circuit, VELCO proposes to utilize the existing 100-foot transmission corridor right-of-way ("ROW"), even though VELCO's general practice is to maintain a wider 150-foot ROW for 115-kV circuits. Co-locating the transmission circuits on the same pole structures, while maintaining the same 100-foot ROW width, would require the new poles to be approximately 20 feet higher (about 66 feet above ground) than the existing structures in most locations because of the required electrical clearances between the two circuits. (See previous Figure 1-6 for the appearance of the old and new structures.)

There now exist two sections of this line that are under-built with distribution (the distribution line is attached to the poles below the 48-kV transmission line). In the two sections of this line where VEC's existing 12.5-kV distribution line is co-located on the existing 48-kV structures, the poles would need to be approximately 30 feet higher (to about 76 feet). The first section is approximately 1.1 miles long, from the Irasburg Substation to the Linton Parcel, and the other section is approximately 1.3 miles long, along Alderbrook Road in Coventry from the Knight Parcel to the W. & G. Lawson Parcel. The segments are shown in green on Ortho Sheets 1 and 3 in Appendix C. VELCO maintains that, because of the single pole and insulator symmetry, the change to the existing situation would not be significant. The second 1.3-mile segment occurs along Alderbrook Road near Mosher's Tap (Ortho Sheet 3 in Appendix C).

Description of Preferred Alternative Route

The existing transmission-line corridor, which has been in this location since the 1920s for many years, extends approximately 6.47 miles. From south to north, the line departs Irasburg Substation and continues north to Mosher's Tap. As shown on Ortho Sheet 1 of the orthophoto maps included in Appendix C, the existing 48-kV circuit departs Irasburg Substation heading northeast to an angle structure located on the hillside above State Route 14.

From this point, the existing corridor heads north, paralleling Route 14 for a distance of approximately 1000 feet for several spans before it disappears into a thickly wooded area. The line then remains out of sight for approximately one mile before it again reappears at the hillside behind the Djanikian and Bennett residences (mile 1.0 as depicted by a marker shown on Ortho Sheet 1 in Appendix C). The line then crosses Coventry Back Road (mile 1.1; see Ortho Sheet 1 in Appendix C). At mile 1.3, the line then leaves open landscape and enters second-growth vegetation and pasture west and north of Heermanville Road (again, see Ortho Sheet 1 in Appendix C). The line then enters a wooded section at mile 1.7, crossing Linton Road (gravel) at mile 1.8. After the Linton hillside, the line continues northerly on the wooded hillside and crosses the so-called "A & P Marsh Farm" (shown on Ortho Sheet 2 in Appendix C). At approximately mile 3.8, the line crosses Route 14 and stays parallel with Route 14 on the east side at a distance varying from 50 to 100 feet. The line then continues north across Nadeau Park Road (mile 4.1 to mile 4.3) before entering a dense wooded area through Pike Industries land and breaking into the open at mile 4.9 on the Parry Parcel, 400 ft. to the east of Alderbrook Road (Ortho Sheet 3 Appendix C).

The distribution "under-build," again a segment where the transmission line would have distribution line attached below the transmission conductors on the same poles (see Figure 2-1), begins along Alderbrook Road in Coventry at the Knight Parcel and continues to the W. & G. Lawson Parcel, providing service to both sides of Alderbrook Road for the next 1.2 miles.

Figure 2-1

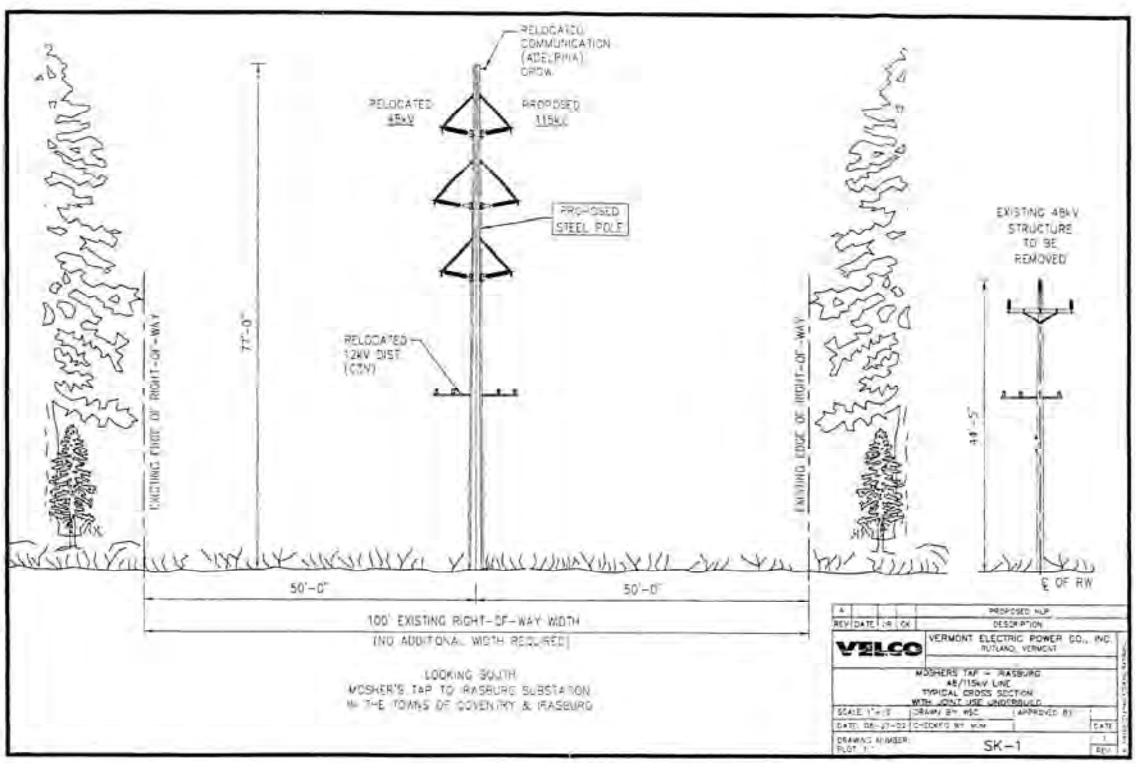


Figure 2-1

At the Mishou rental parcel, the line angles to the west and joins Alderbrook Road (at mile 6.2), where it continues along the Alderbrook Road ROW as a double circuit for 700 ft. or two spans. At this point, the distribution line departs to a pole on the north side of Alderbrook Road, and the 48-kV (and the proposed double) circuit continues the remaining 900 ft. to the Mosher's Tap.

The combined circuits would tie into the 48-kV and 115-kV circuits in an open area north of the Mosher pines.

The existing under-built 12.5-kV distribution line, as mentioned above, starts at the Knight Parcel on Alderbrook Road in Coventry and, along with the 48-kV line, is set back behind the houses (Matheiu, Durocher & Maclure, as shown on Ortho Sheet 3 of Appendix C).

2.1.2 Line Design Specifications and Support Structure

Irasburg to Mosher’s Tap

A new 115-kV line would be required to tie Irasburg Substation to Highgate Substation. As part of the Northern Loop Project, VELCO purchased from Citizens its former 120/48-kV, double-circuit, line constructed between Derby Center and Richford substations, labeled as “L3” and “L5,” and its former 120-kV line between Richford and Highgate Substations, labeled “L6" on Figure 1–1, shown previously.

VELCO has also purchased its single-circuit Mosher's Tap-Irasburg, 48-kV, transmission line and proposes to rebuild it as a 115/48-kV, double-circuit, line within the existing 100-foot ROW as mentioned earlier. The proposed 115/48-kV, double-circuit, Mosher's Tap-Irasburg line route is labeled as “L4” on Figure 1-1. The new 115-kV line would be tapped into the existing Derby Center-Richford 120-kV line at the same location as the 48-kV tap, near Alder Brook Road and Vermont Route 105 in Newport City, Vermont. ("Mosher's Tap" is labeled “S3” on Figure 1-1. See drawings in Appendix C for the existing and proposed Mosher’s Tap configuration.)

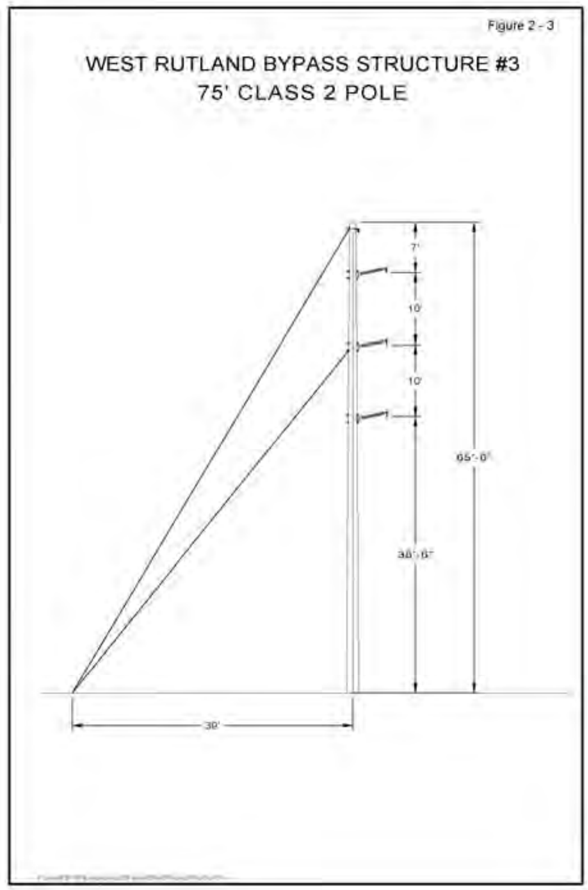
The existing Mosher's Tap-Irasburg 48-kV line utilizes single-bundled, 556-ACSR conductor supported on single wood poles within the 100-foot ROW. The length of the 48-kV line between Mosher's Tap and Irasburg Substation is 5.97 miles. Two short (approximately 1.5-mile) sections of the line carry a 12.5-kV distribution line that is owned and operated by VEC. A fiber-optic cable, owned by Adelphia, runs the entire length of the existing transmission line.

The new line would parallel the existing Mosher's Tap-Irasburg 48-kV line for 5.97 miles to what is now VEC's Irasburg Substation and then continue another 0.5 miles to VELCO's Irasburg Substation. VELCO would reconstruct the single-circuit, Mosher's Tap-Irasburg 48-kV section of line as a double-circuit 115/48-kV transmission line. The current construction, which uses horizontal phasing on single wood poles, would be replaced with vertically-stacked, double-circuit phasing on single poles (see previous Figure 1-6).

The proposed line would be rebuilt approximately pole-for-pole along the alignment of the existing 48-kV line, with the exception, as previously noted, that VELCO will relocate poles to avoid identified sensitive areas. Both lines would be insulated with 115-kV, braced-post, insulators. Matching the insulation of the two circuits is done for aesthetic purposes and to allow the 48-kV circuit to operate at 115 kV if that should become necessary sometime in the future. This would also make the new line look similar to the existing double-circuit line that is currently at Mosher's Tap.

Because of the aesthetic impacts of creating a new ROW, VELCO determined that the better course of action would be to re-attach the distribution wires on the new poles. Therefore, the new line would utilize a combination of guyed and self-supporting wood, laminated-wood or Corten™ steel poles. (Figure 2-2 provides a photographic example of Corten poles, showing their ability to blend in with the natural environment, and Figure 2-3 provides an illustration of a guyed pole); the appearance of wood poles will be similar.

Figure 2-2 **Figure 2-3**



The new 115/48-kV line would be constructed within the existing 100-foot ROW without the need to acquire an additional ROW. However, where the existing ROW has not been maintained to meet VELCO standards, VELCO proposes to use the full width of the existing ROW by "selective" clearing (i.e., clearing that keeps any vegetation that is slow growing and beneficial to wildlife such as cedars and apple trees) of the ROW’s full, 100-foot width. Figures 1-6 and 2-1 above show both existing and proposed configurations.

Even though VELCO purchased the existing ROW easements from Citizens, VELCO is in the process of obtaining all new easements from the land owners along the corridor. The existing easements date back to the 1920s, and VELCO states that it wants easements in place that are in keeping with VELCO’s current easement language in order to avoid any claim that the new line would “overburden” the easement (require more property rights than the original easement grants).

Highgate Line

Nearly all of the overhead transmission lines at the two Highgate substations would be rerouted to accommodate the revised termination points that VELCO has proposed. In addition, two new 115-kV sources would be provided; these lines are labeled as "L8" on Figure 1-1. The existing and proposed line work that is associated with the proposed upgrades to Highgate are shown on the Highgate Substation drawings in Appendix C.

A single, 115-kV transmission line presently ties VELCO's Highgate Substation to its 115-kV system from the southwest. This line is tapped off a 115-kV transmission line constructed between the nearby Highgate Converter Station, located approximately 0.4 miles to the southwest, and VELCO’s St. Albans Tap, which is located approximately 10 miles to the south.

The existing tap to Highgate is approximately 0.2 miles long and is constructed on wood H-frame structures.

An existing 120-kV line just west of the site would be tapped to provide an additional source for the proposed combined Highgate Substation. This existing line ties TransEnergie's Bedford Substation in Canada to the Highgate Converter Station to the southwest of the site and is referenced as the "North Line"; it is labeled as “L7” on Figure 1-1 above. A new disconnect switch would be cut into the North Line just west of the Highgate Substation. A single-span tap line would be constructed from the Highgate Substation to the North Line. It would tap into the North Line at a location between the new switch and the Highgate Converter Station.

The proposed tap line would be constructed utilizing wood H-frame structures (see Figure 2-4 below) on existing VELCO/VEC Highgate property and the North Line ROW, which is adjacent to it. Again, refer to the Highgate Substation drawings found in Appendix C. Clearing of the isting ROW, as discussed previously, would be required.

A single 120-kV transmission line presently ties VEC’s Highgate Substation to the 120-kV system to the north. This line has been purchased by VELCO and would be converted to the Irasburg-(Richford)-Highgate 115-kV transmission line upon completion of the proposed Mosher's Tap-Irasburg 115/48-kV, double-circuit upgrade. This line is constructed on single-pole, guyed-wood structures as it approaches Highgate Substation. It would be re-routed around the proposed combined Highgate Substation to terminate at the new 115-kV ring bus. Two 48-kV lines would have to be rerouted to new termination points, as well. The re-routes would be

Figure 2-4

constructed utilizing single-pole, guyed-wood structures placed just outside the substation fence on VELCO/VEC property. No additional ROW acquisition is anticipated. However, as discussed above, some tree clearing within the existing ROW would be necessary.

Substation Design

Irasburg and St. Johnsbury

Irasburg.

Irasburg Substation is located on Vermont Route 14 in Irasburg, Vermont. It is labeled as "S2" on Figure 1-1; a photograph of the existing substation and drawings of the existing substation layout are included in the Irasburg Substation drawings found in Appendix C.

The substation contains a single-story control building, one lattice-steel 115-kV box structure, one 115-48 kV transformer, 46-kV bus work installed on a steel-box structure and four 46-kV circuit breakers. One 115-kV line going to the St. Johnsbury Substation currently terminates on the existing 115-kV box structure. The purpose of the substation is to serve Central Vermont Public Service Corporation ("CVPS")'s 46-kV loads via a line to Lowell plus VEC's 48-kV loads via lines to Barton and Irasburg and eventually Mosher's Tap. (Note: VEC operates its sub-transmission equipment at 48 kV, while CVPS operates its equipment at 46 kV.)

A drawing showing the proposed Irasburg Substation upgrades are also included in Appendix C. Modifications to the electrical equipment would include the removal of the 115-kV circuit switcher on the St Johnsbury line and the installation of two 115-kV circuit breakers and associated disconnect switches. The new breakers are required to protect the line from St. Johnsbury and the proposed line to Mosher's Tap. Five new, 115-kV potential, transformers would be installed and connected to the 115-kV bus and 115-kV lines for protective relaying and control purposes.

The existing control building would be expanded approximately 10 feet in length (from 30.5 ft. to 40 ft.). The building expansion would be constructed using the same material and color as at present. The control system would be completely upgraded to include redundant control panels and cabling. All new steel structures, including building additions and equipment supports, would be connected to the existing station's ground grid.

St. Johnsbury

St. Johnsbury Substation is located on Higgins Hill Road in St. Johnsbury, Vermont. It is labeled as "S1" on Figure 1-1; a photograph of the existing substation and drawings of the existing substation layout are included in the St. Johnsbury drawings in Appendix C. The substation contains a single-story control building, two tubular-steel, 115-kV-line dead-end structures, one 115-34.5-kV transformer, 34.5-kV bus work and two 34.5-kV circuit breakers. The 115-kV line between Irasburg Substation and Littleton Substation (Public Service of New Hampshire) loops in and out of the substation. The purpose of the substation is to serve CVPS 34.5-kV wholesale and retail loads via lines to Bay Street Substation and Lyndonville Electric Department.

A drawing showing the proposed St. Johnsbury Substation upgrades can be found, again, in Appendix C. Modifications to the electrical equipment would include replacement of the existing 115-kV circuit switchers with 115-kV circuit breakers and two disconnect switches. A third, 115-kV disconnect switch would be installed to isolate one new, 115-kV potential transformer and existing surge arresters connected to the Irasburg line. Three new 115-kV potential transformers would be installed and connected to the 115-kV bus for protective relaying purposes.

Here too, the existing control building would be expanded approximately 10 feet in length (from 30.5 ft. to 40 ft.) to accommodate the new protective equipment. The building expansion would use the same material and color as used at present. The control system would be completely upgraded to include redundant control panels and cabling. All new steel structures, including building additions and equipment supports, would be connected to the existing station's ground grid.

Highgate

The two Highgate substations are located on State Route 78 in Highgate, Vermont. They are labeled "S4" on Figure 1-1; a photograph showing both of the existing substations and drawings of the existing substation layouts are included in the Highgate drawings in Appendix C. As part of the project, VELCO has purchased Citizens' former Highgate Substation and would combine the two yards as one. The South Yard contains a single-story control building, one lattice-steel, 115-kV-line dead-end structure, one 115-48-kV transformer, 48-kV bus work installed on a steel-box structure, four 48-kV circuit breakers and one 48-kV/6.14-MVAR capacitor bank. The South Yard currently ties the VELCO 115-kV and 48-kV systems together with 115-kV connections to the Highgate Converter Station, to St. Albans Tap located to the south, and to 48-kV connections to Village of Swanton Electric Department, the Sheldon Springs hydroelectric station and the former Citizens' Highgate Substation located directly to the north.

The North Yard contains a single-story control building, one A-frame-steel structure, 120-kV-line dead-end structure, one 120-kV circuit breaker, one 120/48-kV transformer, 48-kV bus work installed using low-profile steel structures and five 48-kV circuit breakers. The purpose of the existing North Yard is to serve 48-kV electrical loads with line connections to South Alburg, Richford, and Sheldon Springs and to the South Yard.

As mentioned previously, the North and South Yards would be combined into one yard; drawings showing the proposed upgrades are also found in Appendix C. Modifications to the electrical equipment would include the installation of eight 115-kV circuit breakers, one 115-kV, six-position ring bus, two 115-kV/15-MVAR capacitor banks, one 48-kV/5.4-MVAR capacitor bank, one 115-13.2-kV transformer and two 13.2-kV circuit breakers and may include two 13.2-kV/15-MVAR synchronous condensers.

VELCO, however, is not installing the synchronous condensers at this time. They were needed for voltage support if VELCO were to increase the carrying capacity of the Bedford-to-Highgate line. Because of the cost, VELCO has reevaluated the installation of synchronous condensers and intends to move enough power from contracts over to another interconnection so that it does not have to increase the capacity of the Highgate line.

The existing 48-kV bus and circuit breakers currently located in the South Yard would be removed from the site. The existing 48-KV/6.14-MVAR capacitor bank currently located in the south yard would be moved to the northeast corner of the newly-combined yard. The 115-kV ring bus would be installed initially as a five-breaker, six-position, ring bus with future expansion possible to a six-breaker, six-position, ring bus. The ring bus would be constructed using four bays of lattice-steel structure with strain bus and two sections of tubular aluminum bus to complete the ring.

Three 115-kV transmission lines would terminate on the ring bus, and one 115/48-kV transformer would connect to the fourth position. The fifth position would feed 115-kV station service and also eliminate the crossing of two 115-kV lines which would increase reliability. Transmission lines connecting to the 115-kV ring bus would include a line to VELCO’s Georgia Substation via St. Albans Tap, and may include a line to the synchronous condenser, and would include a 120-kV feed from TransEnergie (operated normally open) and a line to Newport Substation. The two 115-kV capacitor banks and synchronous-condenser-related equipment, if installed, would be located in the northwest corner of the substation. The new 48-kV capacitor bank would tap off the existing Alburg 48-kV line position and would be located centrally in the yard.

The existing control building located in the North Yard would be expanded approximately 19 feet in length (from 25 ft. x 35 ft. to 25 ft. x 54 ft). The building expansion would be constructed using the same material and color as used at present. The building expansion is necessary to house DC–station power batteries, AC-station auxiliary-power equipment and system-protection and control systems. The existing control building located in the South Yard would be removed from the site. The control system would be completely upgraded to include redundant control panels and cabling. The ground grid would be expanded to encompass the entire combined station. All steel structures, including buildings and steel-equipment supports, would be connected to the ground grid. The perimeter fence would also be connected to the station’s ground grid.

St. Albans

St. Albans Substation is located on Nason Street in St. Albans, Vermont; it is labeled as "S5" on Figure 1-1. The substation is presently tied to VELCO's 115-kV system by a single line, which is tapped off the Highgate-St. Albans-Georgia line mentioned previously.

The line tap is located approximately 5,560 ft west of the substation at a location referred to as "St. Albans Tap"; a photograph of the existing tap site and drawings of the existing tap-structure layout are included in the St. Albans Tap drawings in Appendix C. The St. Albans Tap site currently consists of a 115 kV steel-transmission-line tap structure but is otherwise undeveloped.

Modifications to the St. Albans' Tap site include removing the existing steel-transmission tap structure and installing a small switching station; drawings showing the proposed upgrades are also included in Appendix C. Electrical equipment installed in the station would include two 115-kV load-break disconnect switches, surge arresters, grounding switches and a 115-kV station-power transformer. A small control hut, approximately 10 feet wide by 10 feet long, would be installed at the base of the tap point to house control devices and auxiliary AC and DC power equipment for the new equipment. The control hut would be a pre-engineered building of pre-fabricated steel and would be similar in appearance and color to the existing St. Johnsbury Substation and Irasburg Substation control buildings. A ground grid would be installed below grade over the developed site. All new steel structures, including the control hut and steel equipment supports, would be connected to the station's ground grid. A chain-link fence would enclose the station, and the surface of the yard would be crushed stone. Access to the new switching equipment would utilize the existing transmission-line maintenance road, which may require a minimal amount of grading and the addition of crushed rock surfacing material.

2.2 Alternate Routes for the Double-Circuit Line from Mosher’s Tap to Irasburg

2.2.1 Alternative Route Options

VELCO determined that the most feasible possible corridor for this project is the proposed route, which benefits from the use of an existing right-of-way. However, other corridors were considered, of which one was immediately eliminated due to environmental impacts. The other two alternative corridors, referenced in this EA as the “New Corridor Alternative” and the “Partially New Corridor Alternative” (being a combination of the proposed corridor and a part of an alternative corridor), would have required acquiring all new easements and clearing of at least 100 feet of ROW for the 6.47-mile distance.

With either of the alternatives, the existing 48-kV ROW would remain where it is today; that is to say that both alternatives would result in two power line corridors: a new, single-circuit, 115-kV line and the existing 48-kV line. As the existing line must still serve VEC’s Irasburg Substation and residential customers who live along one mile of the existing line, and as the cost of the 48-kV line would not be supported by the New England Power Pool as “Pool Transmission Facilities,” VELCO determined that it could not relocate the existing 48-kV line if either alternative were chosen.

The two alternative corridors are described below. Deciding to stay within the existing corridor, however, is consistent with the State of Vermont's policies and the planning guidelines of the towns and regional planning commissions through which the line passes and in which the substations are located.[11]

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[11] In 1988, the Vermont General Assembly passed Act 200, entitled "An Act Relating to Encourage Consistent Local, Regional and State Agency Planning." Act 200 provided, among other things, that "development and expansion of governmental and public utility facilities and services should occur, where appropriate, within highway or public utility right-of-way corridors in order to reduce adverse physical and visual impact on the landscape and achieve greater efficiency in the expenditure of public funds." In an effort to simplify and streamline the purposes and goals relating to municipal and regional planning and development, this provision was replaced by the legislature in 1990 with more general language. However, the underlying objective of using existing ROWs remains a goal of the legislation, as reflected in the regional plans prepared by the Northeastern Vermont Development Association (NVDA) and the Northwest Regional Planning Commission (NRPC).

NVDA's regional plan (Appendix D) for the Northeast Kingdom (the area within which that the Irasburg-to-Mosher's Tap line resides) states in Section IX, Land Use Plan Paragraph B, that future land use should be concentrated in areas where similar activities already occur. The Northern Loop Project, using the existing corridor as proposed, is consistent with NVDA's plan because the transmission improvements planned for the NVDA region would be constructed within existing utility ROWs and at existing substations.

The plan of the NRPC (Section 2.2.1 -2 in Appendix D), which serves the region in which the Highgate Substation and line improvements and the St. Albans improvements are located, states in Chapter 7, Energy:

> In the evaluation of all energy projects, those with the least adverse environmental, aesthetic, economic and social impacts are preferred.
>
> Generation, transmission and distribution lines or corridors should avoid adverse impacts on significant wetlands, plant and animal habitat, and recognized historic, natural, or cultural resources.
>
> Plans for generation, transmission and distribution lines should incorporate the following design principles: a) rights of ways shall not divide land uses, particularly agricultural lands and large contiguous forest parcels, b) topographical features should be used to minimize the visual impacts of corridors. Corridors, lines and towers should not be placed on prominent geographical features such as ridge lines and hilltops, and c) placement and maintenance of utility lines should minimize the removal of vegetation and disruption of views from public highways, trails, and waters.

Also, in Chapter 8, Land Use, one of the general policies listed is:

> Construct corridors for new energy transmission facilities only when there is a demonstrated need, and then these should be built adjacent to and parallel to existing operational energy transmission corridors. Visual impact of these facilities should be minimized and should avoid sensitive natural features and historic resources.

The Northern Loop Project is consistent with the NRPC Plan because, as stated above, all of the transmission improvements would be constructed within existing utility ROW and at existing substations.

The towns affected by the project, St. Johnsbury, Irasburg, Coventry, Newport, Highgate, and St. Albans, do not provide town plans with specific guidance regarding the siting of transmission facilities.

The two alternatives considered by VELCO are described below:

New Corridor Alternative:

This alternative (Ortho Photos in Appendix E, Sheets 1-10) departs westerly from Irasburg Substation through a mixed woods for 0.1 miles, crosses an open agricultural field for 0.3 miles and then angles northerly on the west edge of a drainage way at 0.5 miles. This angle point is in agricultural land (corn) and is visible from the adjacent farmhouse on Back Coventry Road.

Heading north on the back edge of the field, this alternative corridor crosses Back Coventry Road on a wooded curve at 0.7 miles (Appendix E, Photo 1). The corridor continues north in woods skirting the west side of the above-mentioned drainage way, angling (at 0.9 miles) through regenerating fields ascending the western slopes of the Back Coventry Road valley in a northwesterly direction (Appendix E, Photo 2). It again angles northerly, avoiding, by about $^{1}/_{5}$ of a mile, four or five houses clustered at the end of Chilafoux Road. Through this diversion on

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Use of an existing ROW is also consistent with the Vermont Twenty Year Electric Plan adopted by the Vermont Department of Public Service (pages 5-19):

> Upgrading existing transmission facilities to accommodate higher power transfer levels within existing corridors is clearly the preferred method of increasing the capacity of Vermont's bulk transmission capacity of environmental grounds … Vermont's existing corridors should be upgraded prior to considering new corridors unless it can be demonstrated that the use of such a measure would have a substantial adverse impact on the electric system or societal costs, or the use of such a preferred measure would prevent desirable economic energy transactions with other utilities from occurring.

In the findings issued by the Public Service Board in Docket No. 3481 (See Section 2.2.1–11 in Appendix D) for constructing a 115-kV transmission line from Bennington to East Arlington, the Board complimented VELCO for "planning to meet growth without an appreciable impact on land use. Although this is the first case where VELCO is substituting [a proposed new line] for an existing line, we hope that circumstances would permit more applications of this type."

the hillside above the houses, it travels at the woods' edge (Appendix E, Photo 3), descending the hill and angles to cross over a wooded draw and then Linton Hill Road just south of the fork at Reservoir Road (mile 2.1) (Appendix E, Photo 4). The Linton Residence is $^{1}/_{10}$ of a mile up hill to the west separated by coniferous woods.

The corridor continues northerly on the edge of an open field and enters deciduous woods at 2.7 miles, descending into the Route 14 valley and paralleling the existing 48-kV corridor, offset by $^{1}/_{10}$ of a mile, for a distance of 0.4 miles. Angling (at mile 3.5), it ascends the hillside at the interface of deciduous and coniferous woods before entering a mixed open and wooded landscape (at mile 4.0) crossing Petit Road (at mile 4.1) (Appendix E, Photo 5). This crossing is open, and the structure would be exposed to view on this gravel road serving several farms.

At mile 4.2, the corridor enters deciduous woods (Appendix E, Photo 6), angles and proceeds northeast passing through or on the edge of predominantly coniferous vegetation. It then crosses Route 14 (at mile 5.2) in a valley constriction, skirting the east side of extensive gravel pits. This location is $^{1}/_{5}$ of a mile northeast of Alderbrook Road (Appendix E, Photo 7 and 8).

From Route 14, the line traverses the high ground above and paralleling Alderbrook Road at a distance of $^{1}/_{3}$ of a mile. The line ascends the hillside (to mile 6.0) at the edge of open agricultural land and then descends diagonally through mostly coniferous woods to the Alderbrook valley floor (at mile 6.3). From here north (for 0.8 miles), it travels at the interface of the western slope and valley floor at the edge of patchy woods.

The residences on Lane Road at greater than $^{1}/_{10}$ of a mile's distance may have limited views of the corridor. Suburban houses on the east side of the Alderbrook valley would have views to the corridor for about $^{3}/_{5}$ of a mile, from mile 6.3 to mile 6.9. The views of the line would, however, include the hills on the west side of the valley and the intermittent vegetation in the background and would be at a distance of $^{2}/_{5}$ of a mile from the homes. The corridor traverses a wooded ravine and taps the former Citizens (now VEC) 115-kV corridor at mile 7.0.

The existing corridor for the 48-kV line would remain where it is today.

Partially New Corridor:

This alternative is a sub-corridor of the existing (applicant's preferred) corridor and the New Corridor Alternative. This alternative corridor (see Partially New Corridor Alternative orthophotos in Appendix E) would follow the existing right-of-way from Irasburg Substation, continuing north across Nadeau Park Road (miles 4.1 - 4.3), entering a dense wooded area through Pike Industries' land before breaking into the open at mile 4.9 on the Parry Parcel 400 ft. to the east of Alderbrook Road. At this point, the Partially New Corridor departs from the proposed corridor, moving to the other side of the valley as described next.

From Route 14, the line traverses the high ground above and paralleling Alderbrook Road for a distance of ⅓ of a mile. The line ascends the hillside to mile 6.0 at the edge of open agricultural land and then descends diagonally through mostly coniferous woods to the Alderbrook valley floor at mile 6.3. From here north (for 4/5 of a mile), it travels at the interface of the western slope and the valley floor at the edge of patchy woods.

The residences on Lane Road (at greater than $^{1}/_{10}$ of a mile from the Partially New Corridor Alternative) may have limited views of the corridor. Suburban houses on the east side of Alderbrook Valley would have views to the corridor for about $^{3}/_{5}$ of a mile, from mile 6.3 to mile 6.9. However, the corridor would have the hills on the west side of the valley and the intermittent vegetation in the background and would be at a distance of $^{2}/_{5}$ of a mile from the homes. The corridor traverses a wooded ravine and taps the former Citizens 115-kV corridor at mile 7.0.

2.3 Comparison of the Proposed Route (Preferred Alternative) and Alternative Routes

The New Corridor Alternative would require all-new clearing of vegetation, for a ROW 100 feet wide, in areas where the existing corridor is now not very visible. Both alternatives would affect residents living on Lane Road and still be very visible from Alderbrook Road and the residents who today have an open agricultural view. Additionally, the 48-kV line and the distribution line would remain as it exists today.

As stated at the previous section’s outset, VELCO’s view is that staying in an existing ROW would minimize the proposed project’s impact and is consistent with the policies of the State of Vermont and the regional planning commissions (see previous footnote 11). VELCO stated that it investigated the Partially New Corridor Alternative to the point of contacting affected landowners, several of whom were strongly opposed to this new route. Because of the relocation, VELCO believes, either alternative would result in a second, highly-visible corridor (additional to the existing corridor for the 48-kV that would remain where it is today), so VELCO decided not to pursue either alternative route any further. See table 2.3 in Section 4.22, which provides a comparative analysis of the two corridors.

2.4 Alternative Line and Substation Designs

2.4.1 Alternative Conductor and Pole Size

As described in section 2.1.2, VELCO designed the Mosher's Tap-Irasburg line using 1272 ACSR conductor for the 115-kV circuit and 556 ACSR for the 48-kV circuit. Spans were to be kept as close to the existing line as possible except where it would be environmentally beneficial to change them.

VELCO originally considered using wood poles, then switched to all steel poles and ultimately decided to use a combination of wood and laminated-wood poles except when steel poles are necessary. To prepare a cost estimate for wood-pole-line construction, VELCO originally thought one or more of three previously-identified basic design criteria for this project would have to be changed to reduce the load on the structures; that is, the wire size, pole spacing or framing configuration. Wood poles have lower load-carrying capacity; hence the need for either very large wood poles or shorter spans with more poles. To develop comparable cost estimates, VELCO developed a wood-pole-construction estimate based on reducing the pole spacing while utilizing the same double-circuit framing and wire sizes used to prepare the steel-pole estimate.

To accomplish this, the maximum span for the sections of line supporting 12.5-kV distribution line was reduced to 410 ft. utilizing 74.5 ft.-tall wood poles. Similarly, the maximum spans for sections of line without 12.5-kV under-build was reduced to 485 ft. utilizing 70 ft.-tall wood poles. For comparison, the original pole-for-pole replacement design was based on average spans of 362 ft. with maximum single-pole spans of as much as 525 ft.

One or more of the three basic design criteria could be modified to allow the use of wood-pole construction along the entire route. These include: reducing wire size; reducing the pole spacing; or re-configuring the structure framing, as follows:

Reduced Wire Size

One of the double-circuit wires that the steel pole was originally designed to support is 1272 ACSR, and the other circuit is 556 ACSR. Assuming that the 48-kV-circuit, 556-ACSR wire would not change, VELCO originally analyzed the effect of reducing the size of the 115-kV circuit wire on a tangent structure with 12.5-kV under-build and a maximum span of 475 ft. Reducing the 1272 ACSR to a 556 ACSR reduces the load on the structure to just below 100% of the allowable capacity of an H-6 wood pole at all locations.

Reduced Pole Spacing

VELCO also concluded, originally, that the maximum pole spans would have to be reduced from the desired 475 ft. spacing to 410 ft. for the two-mile sections of line supporting 12.5-kV distribution under-build, and from 525 ft. to 485 ft. for the remaining 4.5 miles.

Re-configured Structure Framing

The double-circuit framing can be modified in a wide variety of ways, which might require using two or more poles at each of the ten tangent-structure locations that require a steel pole. As an example, the new 115-kV line could be built along the existing 48-kV line on a separate, single-circuit, single-pole structure. Two-pole, crossed-braced construction methods could also be used to support the two circuits, either by vertically stacking the circuits side by side on separate poles that are crossed-braced together or by using double-tier H-frame structures by horizontally positioning the 115-kV circuit over the 48-kV circuit.

VELCO Standard Construction

VELCO determined that any new 115-kV construction, including the project's 115-kV line, should utilize 1272 ACRS conductor, for the following reasons:

1. Future electric power-flow requirements are unknown at this time. Typical power flows are on the order of a few MW to over 60 MW, with higher flows common when the Highgate Interconnection Facilities operate. These flows can be changed by numerous factors, including Highgate imports from TransEnergie, load level, PV20 imports from New York, operation of the Comerford and Moore stations at the Connecticut River, internal-to-Vermont hydroelectric-station output, dispatch of the McNeil Station in Burlington (and other Vermont-located thermal station(s)); power transfers within and through New England and VEC's load swaps to the VELCO network at Irasburg and Highgate during daily operations.

Potential changes in the local network affect this flow too. Connecting the Lyndonville load or Barton load to the Irasburg–St. Johnsbury line would change the flow on the Irasburg–Highgate line (and typically increase it when the Highgate Interconnection Facilities are operating). Any generation that comes on-line in the area would change flow patterns also. For all of these reasons, the flow on this newly-built line cannot be predicted with any accuracy.

If, for the sake of argument, a 50-MW flow were assumed on the new line during operation of the Highgate Interconnection Facilities, then the reduction in line losses due to a switch from the lighter 795 to the heavier 1272 ACSR conductor would be about 0.06 MW. Assuming 6000 hours/year of Highgate operation, and a $50/MW-hr energy cost in the Vermont load zone, over the course of a single year the reduction in losses would yield about $18,000. An incremental cost estimate for the cable of utilizing 1272 ACSR instead of 795 ACSR, based on the conductor alone, is about $0.65 per foot or $3432 per mile plus $4000 per mile for installation-hardware changes. Given a new line length of 6.47 miles, the added cost would be about $48,100 to use the heaver 1272 ACSR. Accordingly, the reduction in losses alone on the line would account for the total incremental cost borne by NEPOOL of the 1272 ACSR conductor in less than three years. (About $18,000/year energy cost savings *vs.* a one-time extra cost of $48,100 for installation of the heavier cable.)

2. Since VELCO does not know if, and when, future system changes – e.g., load growth, new local generation, a loss of the Highgate or PV20 ties or the McNeil Power Station for a period of time – would occur, the best choice is deemed by VELCO to be to install a

conductor having sufficient rating to provide flexibility to accommodate uncertainty. Currently, 1272 ACSR conductor is the conductor of choice for potentially thermally-constrained, 115-kV transmission paths in the VELCO network. This conductor, if built to operate at a temperature of 100^{o}C (212^{o}F), should allow roughly a 300-MW flow during summer peak-load conditions.

3. If a smaller conductor were used now and later circumstances were to require installing a larger conductor, the incremental time and cost to reconductor the 6.47 miles of line would be of concern. VELCO estimates five weeks for construction and $88,000 for manpower costs if VELCO line crews were used; the use of non-VELCO line crews would likely be a more expensive option. In addition, re-conductoring this length of line separately at a later date would also unavoidably involve at least some second occurrences of service disruptions or system reconfigurations when compared to simply installing the 1272 ACSR conductor at the time the initial Northern Loop Project construction occurs.

4. VELCO has used essentially the same standard 115-kV line design since its inception. The standard conductor size in the VELCO 115-kV network is 795 ACSR. This conductor is capable of carrying roughly 200 MW of flow during summer peak-load conditions. VELCO's 115-kV network has shown few thermal limitations since its creation in 1956 and construction of the bulk of the 115-kV network in the late 1950s, the 1960s and early 1970s. This means that VELCO's 795 ACSR choice was frequently larger than needed at the time of installation, based on thermal needs, but has resulted in loss benefits over the decades and precluded the need to reconductor or rebuild the bulk of the company’s system for the better

part of a half century. VELCO today views this 795 ACSR conductor choice as thermally limiting on key 115-kV-line sections. Given this fact and the high demands placed on the VELCO system today in terms of loads served and the unpredictable uses of the network in today's utility "landscape," increasing the size of VELCO's standard conductor for newly-built, 115-kV lines to 1272 ACSR is both logical and practical.

2.4.2 Undergrounding the Transmission Line

VELCO also estimated the cost of the alternative of underground-transmission-line construction. The estimated cost per mile for a 115-kV underground construction alternative is about $2.7 million/mile. This cost includes overhead-to-underground transition structures and additional equipment required at each end of the line.

While eliminating visual impacts, underground construction has adverse impacts on the environment in addition to significantly higher costs. Although underground-transmission cables require a narrower ROW when compared to overhead transmission lines, they also involve the excavation of a continuous trench and the installation of underground splice vaults, which must be accessible for maintenance purposes.

Whereas an overhead-transmission line can span steep slopes, rock outcroppings, vegetation, wetlands and watercourses, and agricultural land, underground cable routes typically require excavating through or beneath such resources. Underground construction also requires access along the entire route for trenching equipment and for trucks delivering ductwork, splice vaults, backfill, concrete, cable and other heavy construction materials and equipment.

2.4.3 Alternative Substation Designs

No alternate substation designs were studied with the exception of changes made to the Highgate Substation and the St. Johnsbury Substation as outlined in the Stipulation between VELCO and the Vermont Department of Public Service and the Vermont Agency of Natural Resources (see Appendix B).

The final design for the Highgate Substation included the following alternative features:

1. Install switching equipment that allows for the proposed synchronous condensers to be operated on either the north or the south side of the substation;

2. Remove the proposed transmission line from the existing Highgate Converter Station to the Highgate Substation; and

3. Add a switch at the point where the existing transmission line from the Highgate Converter Station taps into the existing transmission line running south from the Highgate Substation.

The alternative design for St. Johnsbury Substation includes installing two circuit breakers (the original plan had one circuit breaker and a position for a future breaker).

As an alternative to the St. Albans Tap, VELCO briefly considered constructing a parallel, 115-kV, line approximately one mile from the existing tap location to St. Albans Substation. VELCO rejected this proposal without further investigation as the alternative would require VELCO to widen the ROW, create new, visible structures, potentially have other incremental impacts to the environment, and increase the project's cost, which would be compared to the reliability benefit of eliminating one mile of radial feed.

2.4.4 Comparison of the Proposed Design and Alternative Designs

Modifying the line-design criteria in the manners outlined above would entail various undesirable or unacceptable impacts on the project. Steel poles would still be required for ten of the larger tangent spans given the pole-for-pole replacement criteria and possibly for additional spans where self-support angle and dead-end poles are required within wetlands. Reducing the 115-kV-circuit conductor size from 1272 ACSR to 556 ACSR would reduce the current-carrying capacity of the line by over 25%, thereby resulting in a reduction of load-carrying capability of more than 100 MW.

Reducing the pole spacing would, further, require VELCO to place more structures closer together along the corridor, which was not acceptable to adjacent property owners based on conversations between VELCO consultants and ROW agents and the landowners. Furthermore, reduced spans across wetlands and watercourses might not be acceptable or possible. Finally, the increased number of structures would also increase the overall cost of the line as compared to the steel-pole line originally proposed.

Reconfiguring the double-circuit framing by any of the methods considered previously would have negative impacts on the project. Each of the options would increase the visual presence of the line by doubling the number of poles at each tangent location and also require additional ROW and vegetation clearing if used in succession. Additionally, guyed, wood-pole structures within any wetlands would increase the disturbance to these protected areas. Finally, the "over/under" circuit configuration would impose undesirable maintenance restrictions and reduce the lines' reliability.

2.5 Alternatives to the Proposed Project

Section 1508.9(b) of The Council of Environmental Quality regulations for implementing NEPA (40 CFR Parts 1500 – 1508) requires that an EA "Shall include brief discussions…of alternatives as required by §102(2)(E) [of NEPA], of the environmental impacts of the proposed action and alternatives …" The above-cited §102(2)(E) of NEPA requires that the agency "study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

2.5.1 The No Action Alternatives

Under the No Action Alternative, no upgrades or rebuilds to the existing transmission-line system would be constructed in the project area, and only essential maintenance activities would continue to be performed as they have been up until now. Existing structures and hardware would be maintained, repaired or replaced as required during routine maintenance activities or in the event of emergency outages of the transmission lines. However, it is reasonable to anticipate that repairs would be required with increasing frequency in the future as the transmission lines increase in age.

Implementation of the No Action Alternative would preclude the anticipated effects to the environment that would be associated with the Proposed Action. Minor adverse effects, however, would result from the increasingly frequent repairs and maintenance activities.

However, VELCO advises that “No Action” could prevent VELCO from proceeding with certain parts of the project by which electricity flows from the Hydro-Québec to the VELCO system (over the facilities authorized by the two Presidential Permits previously issued by DOE). If VELCO were unable to proceed with the project otherwise, significant electrical loads in northern Vermont would continue to be served by the existing radial transmission lines such that the lines’ loss would, in many intermediate-to-peak conditions on the VELCO system, likely result in the electrical utilities in northern Vermont supplied by VELCO being unable to serve all customer load. Such inadequate capacity situations could result in “brownout” or “blackout” conditions which, in turn, could result in indirect environmental impacts.

For example, non-functioning traffic signals could cause traffic delays, and hence small amounts of increased atmospheric emissions, from vehicle engines in towns and cities such as St. Johnsbury or Newport. Public institutions, such as hospitals, might have to use back-up generators causing increased emissions.

2.5.2 The Generation Alternative

Generation was considered as an alternative to the Northern Loop Project. For a generation option to be a true alternative, it must be in the correct location, sized appropriately and available when needed. Given the size of the load pockets around St. Albans to Fairfax (55 to 60 MW) and St. Johnsbury (30 MW), the minimum size of generation needed to provide a comparable level of reliability to that of the Northern Loop Project would be about 15 to 20 MW in each load pocket.

Prices for used generators of this size were obtained on-line: One power-equipment manufacturer indicated purchase prices in excess of $5,000,000 for each unit. The price typically did not include transport or set-up of the unit, incidental equipment (such as a fuel tank) for the unit and necessary installation costs, like site acquisition, permitting, set-up, and fuel delivery. If the set-up costs were assumed to be double the unit costs, then the generation option would cost on the order of $20,000,000 without accounting for operating costs.

For the generation option to yield the loss savings, maintenance flexibility and reliability improvements, the units would need to run thousands of hours a year. If the running costs for the units were, for example, $60/MW-hr, and the units had to run for 4000 hours a year to begin to achieve an equivalent level of performance, the added cost would be 40 MW x $60/MW-hr x 4000 hours = $9,600,000/year.

This compares to VELCO's total project cost of an estimated $22.65 million and estimated low annual operating costs. VELCO states, however, that the annual operating costs of the generation alternative would still be in the millions of dollars per year.

The generation would have significant environmental impacts. The impacts would include additional site impacts from generation siting that would require either an entirely new substation or a major addition to an existing substation; additional space for fuel storage; and a related, significant, increase in truck or rail traffic to supply the fuel. For reliability purposes VELCO believes that dispatchable[12] fossil-fuel generation would be necessary (an alternative in northwestern Vermont would be to have the existing, natural-gas pipeline enlarged and extended, since at present it does not have the extra capacity to supply a major generator) thus resulting in an increase of air pollutants and other environmental emissions. In addition to these impacts from power generation, some of the proposed transmission upgrades would still be required to provide access to the transmission grid for any generation installed as an alternative means of maintaining reliability (the new power sources would have to be connected to the grid).

Accordingly, due to the high cost to achieve similar performance, and the significant environmental impacts that likely would occur, VELCO determined that this alternative would not satisfy the utility's purpose and need and decided not to consider this option further.

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[12] The meaning of this term depends on the context in which it is used. To dispatch is to control flow and direction. Just as taxi dispatch controls how many cabs are assigned to specific areas of a city, energy dispatch controls how much energy travels through specific transmission stations to end-use service areas. Just as a taxi company requires a dispatcher to communicate with individual cabs, energy dispatch requires a human operator to schedule, monitor and control distribution of energy. Dispatch also denotes the process of coordinating the distribution of energy on a moment-to-moment basis to meet changing load requirements (Ref.: EnergyVortex.com).

2.5.3 The Conservation, Fuel Conversion, Demand-Side Management Alternative

VELCO's analysis of alternative, demand-side-management or "DSM" measures, which would have low impact on the environment as customers would install or use measures typically at their premises potentially reducing the need to construct transmission reinforcements, started with the State of Vermont's load forecast, prepared by the Vermont Department of Public Service in August 2002. Then, utilizing all the research that went into the report, titled "Electric and Economic Impact of Maximum Achievable Statewide Efficiency Savings" published by Optimal Energy (May 29, 2002) and provided in Appendix B, the summer MW deductions from peak demand resulting from DSM measures were used to come up with a dollars-per-kW of reduction for peak demand in summer. Those calculations were then applied to the project. Please refer below to Figure 2-5 for details.

Summary of Results from the DPS May 29, 2002 Study of "ELECTRIC AND ECONOMIC IMPACTS OFMAXIMUM ACHIEVABLE STATEWIDE EFFICIENCY SAVINGS"

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Summer Peak forecast (MW) from DPS August '02 Forecast (1)	1012.0	1039.0	1057.0	1098.0	1124.0	1144.0	1168.0	1191.0	1216.0	1244.0
% growth from previous year		2.7%	1.7%	3.9%	2.4%	1.8%	2.1%	2.0%	2.1%	2.3%
Annual Summer Peak MW Reduction From Energy Efficiency	25.1	33.2	42.6	53.1	59.2	60.9	60.7	57.6	50.6	47.9
Summer Cummulative Peak Reduction	25.1	58.0	99.9	151.9	209.2	266.9	323.4	373.8	414.1	449.3
Annual Peak Reduction as % of Peak	2.5%	3.2%	4.0%	4.8%	5.3%	5.3%	5.2%	4.8%	4.2%	3.9%
Cummulative Reduction as % of Peak (2)	2.5%	5.6%	9.5%	13.8%	18.6%	23.3%	27.7%	31.4%	34.1%	36.1%
Annual Cost ($1,000)	$ 71,026	$ 92,509	$ 120,381	$ 154,077	$ 199,078	$ 234,567	$ 234,187	$ 223,045	$ 200,150	$ 184,454
$/Summer kW Reduction	$ 2,827	$ 2,786	$ 2,826	$ 2,902	$ 3,361	$ 3,854	$ 3,860	$ 3,873	$ 3,952	$ 3,849

Notes:

1) This forecast was not included in the DPS Study. It is from the forecast the DPS provided VELCO in August 2002 and excludes load served in Conn Valley.

2) This percentage is calculated from the summer MW reductions in the DPS Study divided by the summer peak forecast

Apply Same Assumption of the DPS Study to VELCO Northern Loop

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Peak Load Forecast for Northern Loop (1)	150	154	157	163	167	170	173	177	180	184
Cummulative Reduction as % of Peak from Energy Efficiency (2)	2.5%	5.6%	9.5%	13.8%	18.6%	23.3%	27.7%	31.4%	34.1%	36.1%
Cummulative Summer Peak Reduction Achieveable from Energy Efficiency	4	9	15	23	31	40	48	55	61	67
Peak Reduction Required to Maintain Northern Loop Load at a 95 MW Peak (3)	55	59	62	68	72	75	78	82	85	89
$/Summer kW Reduction (2)	$ 2,827	$ 2,786	$ 2,826	$ 2,902	$ 3,361	$ 3,854	$ 3,860	$ 3,873	$ 3,952	$ 3,849
Cummulative Cost ($1,000)	$ 10,528	$ 24,118	$ 41,673	$ 63,998	$ 92,578	$ 125,537	$ 157,869	$ 186,769	$ 210,378	$ 230,494

Notes:

1) Assume Northern Loop Load (St. Johhsbury, St Albans/Fairfax and CZN Block Load) grows in proportion to state wide load

2) Apply results from DPS Statewide Study to Northern Loop Load

3) Combined St. Johnsbury, St Albans/Fairfax and CZN Block Load can not exceed 95 MW to maintain first contingency capability

Figure 2-5

The Northern Loop Project load was then increased by the State's load-growth percentage for Vermont. Then, the percentage of peak that was forecasted to be maximally achievable by DSM was applied to this forecasted peak. By 2012, seven years after the project is to be completed, VELCO concluded that DSM would have to eliminate almost 90 MW of load in northern Vermont to meet the same level of reliability that would be achieved by the Northern Loop Project. Using the above calculations, DSM measures, including increased fuel conversion, would achieve a reduction of only 67 MW at a cost of $230,000,000.

VELCO accordingly concluded that DSM would not provide an adequate or cost-effective alternative to the Northern Loop Project and hence would not meet VELCO's purpose and need.

2.6 Construction Activities

Whether located in an existing or new corridor or location, the construction of a power line or substation has the potential to cause certain impacts, which are analyzed in this section.

2.6.1 Transmission Lines

The construction of a transmission line requires surveying, clearing, access-road construction, pole placements and framing and stringing of line. These activities would occur whether the line is built in a new or existing corridor although the intensity of possible environmental impacts may vary (*e.g.*, construction of a new access road would likely have a greater impact than the repair of an existing access road).

2.6.1(a) Surveying Activities

Preliminary design surveys require access to the lands to be crossed by the line. The surveys show route location, physical features and property data as well as wetlands and sensitive archaeological areas. Final pole placement is determined prior to construction.

2.6.1(b) Right-of-way Clearing and Maintenance Practices

VELCO proposes to clear the full 100-foot existing ROW utilizing a selective-clearing and ROW-management approach to limit the impacts of tree clearing where possible. VELCO determines whether to eliminate, control by trimming or topping, or save a tree by such criteria as location, age, health, and present line clearance. Other factors include ownership, aesthetic and environmental values such as wildlife habitat, water-resource areas, etc.

On a typical stretch of ROW, all fast-growing tree species are cleared. These include softwoods such as white pine, spruce, balsam fir and larch and hardwoods like aspen, maples, birches, cherry, locust, elm, ash, and oak. At road crossings or at special scenic locations, the trees may be topped, thinned out (removal of older, taller trees), or removed and replaced by another low-growing species. Trees and shrub species that may be saved where possible are cedar, apple, pear, hazelnut, dogwood, sumac and shadbush. Some softwoods, such as white pine, balsam, and spruce, may be left on the ROW for more than one clearing cycle for visually aesthetic reasons to break up the whiteness in the winter where possible. These general guidelines are discussed in Appendix D on page 3 of the ROW Plan.

The general procedures for clearing methods or for wildlife areas, wetland areas or areas near streams are described on page 11 of the ROW Plan. Any herbicide use is subject to obtaining a permit from the Vermont Agency of Agriculture, which typically contains specific instructions related to protecting the waters of the state, including required buffer zones near standing water, streams, ponds and lakes. (See Section 3.3.4 below for a description of wetland classification.)

Wildlife travel lanes are maintained in VELCO ROWs in appropriate locations in order to promote movements of white-tailed deer and other wildlife across the corridor. In general, the ROW-management objectives are to favor vegetation that can support snow (softwoods) and thereby keep the snow depth on the ground shallow enough for deer to move about and to conceal wildlife that cross wildlife-travel lanes.

VELCO disposes of the vegetation that is cleared by windrowing all trees at the edge of the ROW for the landowners' use. Stumps would be pulled in locations where structures or anchors would be installed. Limbs and brush would be chipped and spread on-site to help ground stabilization.

2.6.1(c) Access-Road Construction

Existing roads will be used as access to the line for men and equipment and for line-material delivery where possible. VELCO anticipates that some existing access roads may need minor upgrading, *e.g.*, grading and some crushed-rock reinforcing. New access roads require clearing, grading and may also require excavation or filling and the deposit of crushed rock on the surface.

Construction-staging areas along the route would be selected, to the extent possible, at existing cleared areas when the project is close to starting construction. Good examples of “ideal” construction-staging areas would be already paved or graveled sites, *e.g.*, utilizing a portion of the Pike Industrial area (see Sheet 2 of the Orthophotos (Appendix C)).

To control erosion at these areas, VELCO will require the contractor to develop an erosion-control plan that complies with the Vermont Handbook for Soil Erosion and Sediment Control of Construction Sites and to install and maintain control measures as specified in VELCO’s erosion-control plan, the text of which may be found in Appendix D.

2.6.1(d) Pole Installation

The proposed line from Irasburg Substation to Mosher’s Tap will require the excavation of holes for pole placement. The preferred corridor would be rebuilt approximately pole-for-pole along the alignment of the existing 48-kV line, except where impacts on wetlands would be minimized with selective placement of new poles. In alternative corridors, each pole placement would be new. The line will use a combination of guyed[13] and self-supporting wood, laminated-wood or Corten™ steel poles. (Refer to Figures 2-2 and 2-3 above.)

At Highgate, the new single-span tap line, from the 120kV line to Highgate Substation, would be constructed using wood H-frame structures (see Figure 2-4, referenced above). All re-routing of

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13 A “guy” is a cable used to support a pole or tower. This term is not specific to utility poles and transmission towers. Poles used in circus and picnic tents and towers that support weather stations and satellite transmitters might also use guy wires for support (Ref.: EnergyVortex.com).

lines required at Highgate Substation would be constructed utilizing single-pole, guyed-wood structures placed just outside the substation fence.

The installation of poles varies with the local surface geology. For areas overlain with soil and glacial deposits, excavation may require earth augers or backhoes. Areas with very dense glacial till and bedrock would most likely be excavated by means of drilling and blasting. The poles would be placed in the excavated holes and backfilled with excavated material or crushed stone that is tamped in place. Excess excavated material would be disposed on-site with regard for drainage and erosion considerations. No fill would be placed in wetlands.

For each tangent structure, it is anticipated that holes 3 to 4 feet in diameter would be excavated to a depth of 10 to 12 feet. The average spacing between poles would be approximately 400 feet except in the two sections where the 12.5-kV, distribution under-build has to be re-attached. In those two sections, spans would be approximately 330 feet.

2.6.1(e) Framing and Stringing

The pole would be framed on the ground with insulators, hardware, and running blocks, i.e., all of the attachments required would be attached to the pole on the ground while still horizontal. The poles would then be set as described in the previous section. Ropes long enough to be reached from the ground would be hung in each running block and hung up on the pole.

Once all poles are set, a pull ("p") line would be strung between splice/terminal locations. The rope in each running block would be used to pull the p-line up through the running block. This work would be performed by a six-wheeler truck, pickup, or a small track vehicle. The p-line would then be used to pull the conductor in between splice/terminal locations.

Once the conductor is in, it would be sagged (tension adjusted) according to the day's weather conditions. Pickups or six-wheeled trucks would then be used to return to the structure to remove the running block and transfer the conductor to a clamp that attaches to the insulator.

Once the transmission lines are installed, the electric-power distribution and phone lines would be transferred to the pole using new hardware. The existing lines would be reused, and aerial bucket trucks would be used for access to the lines.

Impacts on sensitive wetlands would be minimized either by working in the winter or working off commercial-construction "mats," a thick cover that is placed over the wetlands for a short period of time so that construction activity occurs on the mats and therefore does not come into contact with the underlying wet area. Silt fencing, stone-check dams, and other standard erosion-control methods would be used when necessary to minimize erosion.

2.6.2 Substations

VELCO will not be constructing new substations related to this project because of the cost and also because improving or consolidating existing substations minimizes impacts by locating facilities in already-disturbed, already-fenced sites that have access roads in place. Using an existing facility has the benefit of not causing any change to an already-established use of the land.

2.6.2(a) Irasburg and St. Johnsbury

No expansion of the fence yard or additional site grading and drainage at the existing St. Johnsbury and Irasburg Substations would be required. However, both sites would have expanded control buildings, and they would house sink and toilet facilities connected to new on-site septic facilities.

2.6.2(b) Highgate

As discussed previously, VELCO's Highgate Substation and VEC's Highgate Substation would be combined. Currently, the two substations are separated by approximately 120 feet and have separate ground grids and fences. To make room for the new 115-kV ring bus, the area between the two substations is needed. Therefore, one yard would be developed, with one ground grid, one control house, and one perimeter fence. This approach would eliminate one control house and the existing gate and driveway access to the existing VELCO substation. The former VEC Substation gate and access road would be used for the expanded and combined substation.

Additionally, VELCO will expand the substation to the west to make room for the associated capacitor banks and the future installation of synchronous condensers if VELCO determines they are necessary. The existing fenced area is 57,708 square feet (1.32 acres), and the new area would be 143,812 square feet (3.30 acres). The expanded area would have the organic material (typically up to the first 2 feet) removed. The area would then be cut or filled to rough grade. Fill would consist of a processed, well-draining, granular material. When ground work is complete, crushed stone would be used to get the yard up to finish grade. Final surveys would need to be complete before the amount of fill and grading could be determined.

2.6.2(c) St. Albans

The St. Albans Substation area would need to be surveyed before final construction requirements will be known. Based on an evaluation of the existing 115-kV transmission line's profile, cuts and fills will be necessary.

The existing surface slopes slightly downward heading north. A swale on the north side of the fenced yard would be carved out to route any water around the yard to the west side of the right-of-way. The site work would include cutting the off the area required for the yard and then leveling the yard with either existing subsurface material or additional material trucked in. The finish grade would consist of a permeable crushed stone that would not result in any run-off from the yard.

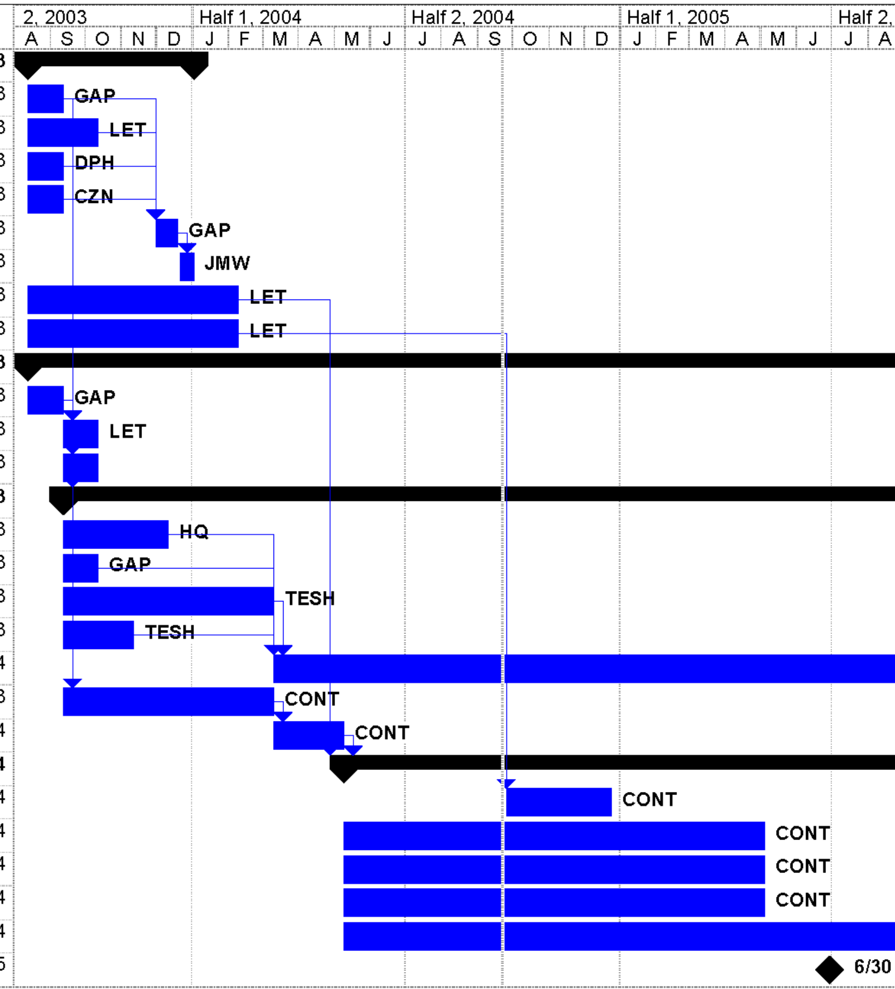
2.6.3 Schedule

The original schedule for the construction of the Northern Loop Project is shown in Figure 2-6 below but has slipped. Construction is now planned to start in the fall of 2004 with completion by the summer power period of 2005.

Northern Loop Project (NLP) Schedule

Tue 12/16/03 2:00 PM

ID	Task Name	Duration	Start
1	**Citizens Asset Purchase**	**102 days?**	**Thu 8/14/03**
2	PSB 109 approval	22 days?	Thu 8/14/03
3	Amend Derby Line PP	60 edays	Thu 8/14/03
4	Highgate Revenue Meter Upgrades	30 edays	Thu 8/14/03
5	Verify CZN easements	30 edays	Thu 8/14/03
6	Closing	15 days?	Mon 12/1/03
7	Secure CZN spare parts	10 days?	Mon 12/22/03
8	NLP PP amendments (Highgate/Derby)	180 edays	Thu 8/14/03
9	Procure remaining 11 Easements	180 edays	Thu 8/14/03
10	**Synchronous Condenser Options**	**552 days**	**Thu 8/14/03**
11	Decide Option A/C A= install, C= eliminate	30 edays	Thu 8/14/03
12	If Option C amend 248, delete tasks 14 - 19	30 edays	Sat 9/13/03
13	VDU transfer contract from Highgate to P1/2	30 edays	Sat 9/13/03
14	**If option A**	**530 days**	**Sat 9/13/03**
15	HQ facility study	90 edays	Sat 9/13/03
16	Formalize HQ/VELCO TTC MOU	30 edays	Sat 9/13/03
17	Design/procure SC equipment	180 edays	Sat 9/13/03
18	Converter/SC interaction evaluation	60 edays	Sat 9/13/03
19	Install/Commission SC	563 edays	Thu 3/11/04
20	NLP Engineering & Procurement specs/RFP	180 edays	Fri 9/12/03
21	Solicit/evaluate procurement/construction bids	60 edays	Wed 3/10/04
22	**NLP Construction/Commissioning**	**408 days**	**Sun 5/9/04**
23	M.Tap/Irasburg 115 line	90 edays	Sun 9/26/04
24	St. Johnsbury sub	360 edays	Sun 5/9/04
25	Irasburg Sub	360 edays	Sun 5/9/04
26	St. Albans Tap	360 edays	Sun 5/9/04
27	Highgate Substation	570 edays	Sun 5/9/04
28	Project Complete	0 days	Thu 6/30/05



Project: NLP construction schedule fig
Date: Tue 12/16/03

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary			

Figure 2-6

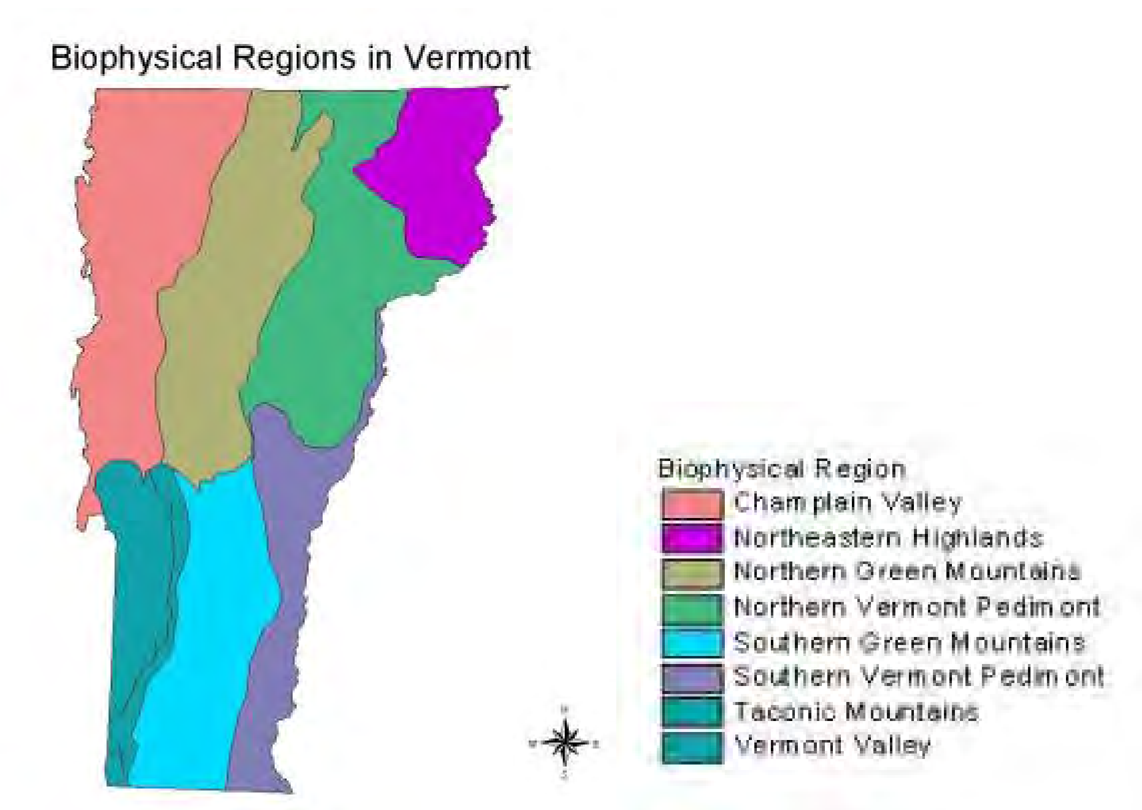
Contents

Chapter 3. AFFECTED ENVIRONMENT

3.1 Climate, Meteorology, and Air Quality

3.1.1 Climate

The climate of northern Vermont is characterized by cool summers and cold winters. The Northern Loop Project is located in two different biophysical regions of Vermont (VForE, 1997; see map below and description at http://vmc.snr.uvm.edu/summary/biophysicalregions.htm); the "Northern Vermont Piedmont" region, which includes St. Johnsbury Substation, Irasburg Substation and Mosher's Tap; and the "Champlain Valley," where Highgate Substation and St. Albans Tap are located.



The moderating influence of Lake Champlain ameliorates climatic conditions in northwestern Vermont versus areas east of the Green Mountains, so the Champlain Valley region experiences a longer frost-free period during late Spring, Summer, and early Fall.

St. Albans has a frost-free growing season of 154 days, while the Newport area (Mosher's Tap) experiences a frost-free growing season of only 130 days and St. Johnsbury has only a 123-day growing season (NOAA, 2003). In the Champlain Valley, mean January temperatures are 18°-20°F, and mean July temperatures are higher than 70°F. In the Northern Vermont Piedmont, mean January temperatures are in the range of 14°-16°F in the Newport area and 16°-18°F at St. Johnsbury. Mean July temperatures are 66°-68°F in the Newport area and 68°-70°F at St. Johnsbury (Wheaton, 1972).

3.1.2 Meteorology

The long-term (1961-1990) precipitation average was below 36 inches per year at St. Albans Bay and Highgate, 36 to 40 inches per year at St. Johnsbury, and 40 to 44 inches per year in the Newport area. (NOAA, 2003). Winter precipitation is normally in the form of snow, with occasional severe ice-storm conditions at both low and high elevations.

The ice storm of January 1998 was particularly noteworthy in its effects, especially at low elevations (below 200 feet) in the Champlain Valley and at high elevations (1900–2800 feet) in the Green Mountains. During that storm, severe icing conditions occurred at St. Albans and at Highgate but not in the Irasburg-Coventry-Newport region or at St. Johnsbury. In some areas, more than 3 inches of ice accumulated on all surfaces, especially tree branches (every twig was encased in ice) and power lines.

Approximately 15 to 18% of Vermont forests were damaged by that storm, with over 700,000 acres affected in Vermont and about 17,000,000 acres affected regionally (VforE, 1998; FPR, 2003; USFS, 2003; DeGaetano, 2000). Many trees were severely damaged, losing 50% or more of their crowns.

Power transmission and distribution in the region, including much of northern New England, New York, and adjacent areas of Québec, were massively interrupted, and social services were strained to their utmost. Some areas in adjacent Québec did not regain power for up to six weeks. This storm has been considered the major natural ecological disturbance of the past century in northern New England.

3.1.3 Air Quality

Air-quality issues in northern Vermont relate primarily to long-distance transport of pollution from industrial facilities, particularly from coal-fired power plants in the Midwest. Northern Vermont typically receives airborne pollutants from the Ohio Valley and the southern Great Lakes region (Schictel & Husar, 1998). Such imported emissions result in significant acid-rain conditions in portions of the state, with effects notably greater at higher elevations than the proposed project facilities (Pembrook, 2001).

Some pollutants, however, derive from in-state sources. According to the 1998 Air Toxics Report (VTAC, 1998), "[L]ocal emissions exceeding the proposed revised standards are benzene, 1,3-butadiene, formaldehyde, methylene chloride, and acrolein. Sources of emissions for these compounds are automobiles, gas stations, industry including incinerators and wood-processing plants, wood stoves, furniture strippers, and garages." Other toxicants either do not exceed standards or do so by a combination of local and imported sources.

St. Johnsbury: There are no identified air-quality problems at this site. Being on the outskirts of the large village of St. Johnsbury, and near Interstate 93, it is likely that standards are occasionally exceeded.

Moshers Tap – Irasburg line: There are no identified air-quality problems on this corridor, although dust from local gravel and sand-extraction facilities may occasionally cause short-term localized problems.

Highgate: No air-quality problems have been identified at this site. Air pollution has been at issue recently in regard to some agricultural operations (specifically, a large egg farm) in the Highgate area, but the operations are not near the substation site.

St. Albans: No air-quality problems have been identified at this site.

3.2 Land Features and Use

3.2.1 Topography, Seismicity, Bedrock Geology and Soils

Topography

The project areas are located in different regions of the state. St. Johnsbury is in the eastern Vermont piedmont, characterized by rolling hills. This area is in the Connecticut River watershed.

The Newport area is in the Lake Memphremagog basin, also characterized by rolling hills but of somewhat less relief. Lake Memphremagog is a large international body of water extending across the Canadian border; it drains north to the St. Lawrence River.

Both of these areas are east of the Green Mountains (maximum elevation: 4295 feet at Mt. Mansfield), which is the major topographical feature of the state.

The Highgate and St. Albans sites are in the Lake Champlain Valley, which is characterized by low ridges and hills with broad areas of intervening, nearly level, terrain. Lake Champlain is the dominant topographic feature of the region, at a normal level of about 95 feet. It is also an international waterbody and flows north to the St. Lawrence River.

St. Johnsbury: This site is located on rolling topography on the north slope of Fairbanks Hill (elevation 1778 feet), at an elevation of about 840 feet. The site has a north-facing aspect and slopes gradually down to the Moose River.

Mosher's Tap – Irasburg Corridor: This corridor is characterized by the relatively narrow, north-south trending valley of Stony Brook and bordered by low rolling hills. Some of the knolls and low hills along the valley walls are formed primarily from large, post-glacial sand deposits, while more elevated and steeper terrain, especially to the east and west of the valley, are more typically-formed hills. Cleveland Hill is the highest hill in the vicinity at about 1400 feet. Most of the project is located between 700 and 900 feet elevation; Irasburg Substation is at about 765 feet elevation. The corridor generally follows the side-slopes of the valley, with some segments along the valley floor.

Highgate: This site is on a plateau more than 100 feet above, and remote from, the Missisquoi River, which cuts a deep gorge through the plateau south of the project area. It is characterized by relatively level terrain at an elevation of about 290 feet. A steep-sided, narrow ravine is incised into the landscape south of the project site towards the Missisquoi River. The land falls gently to the north and west, and there is a small knoll near the northeast corner of the site.

St. Albans: The project site here is located on a low, west-facing hillside at an elevation of 320 feet. There is a ledge outcrop at the eastern edge of the corridor, and the land slopes from that point west toward Lake Champlain.

Seismicity

In general, northern Vermont experiences few earthquakes. None greater than 4.5 (on the Richter scale) have been recorded within 35 miles of the project during the period of observation (1924-

1989). An earthquake in 1934 at Dannemora, New York, about 35 miles west of St. Albans, registered 4.8; another, in 1973 at Beecher's Falls, Vermont, about 35 miles east of Newport, registered 4.0. (NESEC, 1989).

The earthquakes that were closest to the project were one in 1943 at 44° 54' N, 73° 6' W, near the Mississquoi River in Swanton and approximately 3.4 miles southwest of the Highgate Substation site, and one in 1905 at 44° 54' N, 72° 12W', at South Bay of Lake Memphremagog in Newport, approximately 2.9 miles from the northern end of the Moshers Tap-Irasburg corridor (Stover *et al.*, 1980). Both were Class IV on the Modified Mercalli scale[14] (Stover *et al.*, 1980).

Bedrock Geology and Soils

St. Johnsbury: The bedrock in the substation area is the Gile Mountain formation, described (Doll, 1961) as a "gray quartz-muscovite phyllite or schist" of Lower Devonian age. There are no exposures in the project area.

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14 In seismology a scale of seismic **intensity** is a way of measuring or rating the *effects* of an earthquake at different sites. The Modified Mercalli Intensity Scale is commonly used in the United States by seismologists seeking information on the severity of earthquake effects. Intensity ratings are expressed as Roman numerals between I at the low end and XII at the high end.

The Intensity Scale differs from the Richter Magnitude Scale in that the effects of any one earthquake vary greatly from place to place, so there may be many Intensity values (e.g.: IV, VII) measured from one earthquake. Each earthquake, on the other hand, should have just one Magnitude, although the several methods of estimating it will yield slightly different values (e.g.: 6.1, 6.3).

Mosher's Tap – Irasburg Corridor: Bedrock along the project corridor consists of two mapped types (Doll, 1961). Most of the project occurs on the Waitsfield Formation, Ayers Cliff limestone member of middle and upper Silurian age. This is described as siliceous crystalline limestone containing thin bands of slate and phyllite. There are minor exposures near the northern end of the corridor.

In the westernmost segment of this corridor (i.e., on the western slope of the valley of Stony Brook), the project crosses the Northfield Formation of middle and upper Silurian age. This formation consists of dark gray to black quartzite-sericite slate or phyllite with fairly widely-spaced interbeds a few inches thick of siltstone and silty crystalline limestone like that of the Waitsfield Formation (Doll, 1961). No outcrops were observed.

The bedrock is overlain with glacial till and alluvium, with a minor glacial feature near and north of Irasburg Substation. This is an esker along the Barton River; it has been extensively quarried for sand and gravel.

Table 1.

Soils in the Mosher's Tap - Irasburg corridor.

(Data from NRCS ; 1997).

Primary agricultural soils	
Nicholville silt loam	3 - 8 % slope
Roundabout silt loam	0 - 5%
Buckland very fine sandy loam	8 - 15%
Adams loamy fine sand	3 - 8%
Sheepscot gravelly fine sandy loam	0 - 3%
Moosilauke very fine sand loam	0 - 5%
Other soils	
Irasburg loamy fine sand	15 - 25% slope
Buckland very fine sandy loam	8 - 15%
Buckland very fine sandy loam	35 - 60%
Adams loamy fine sand	8 - 15%
Adams loamy fine sand	15 - 25%
Adams loamy fine sand	25 - 60%
Colton-Duxbury complex	8 - 15%
Colton-Duxbury complex	15 - 25%
Salmon very fine sandy loam	25 - 50%

Soils are varied along the preferred route (Table 1), but are mostly fine sand, sandy loam, and silt. Many of the soils are considered primary agricultural soils, as defined in Vermont (SCS, 1985; NRCS, 1997). Approximately 35% of the corridor occupies lands with soils that are considered to have good agricultural potential, and about 52% of that amount (18%) is actually used for agricultural at present (Countryman Environmental, 2002, appended).

Highgate: The bedrock at this site is mapped (Doll, 1961) as the Highgate Formation of lower Ordovician age. The formation is described as banded blue limestone and calcareous slate with local lenses of limestone conglomerate. It is on the western limb of St. Albans synclinorium. There are no exposures at the site.

The soil at this site is mapped by the SCS (1979) as Raynham silt loam (3% to 8% slopes), a hydric soil. It has a productivity rating of 3W, i.e., of moderate productivity but with limitations due to a seasonal high water table.

St. Albans: Bedrock at this site is the Rugg Brook Formation of middle Cambrian age. This consists of sandy gray dolomite, dolomite conglomerate, and interbeds of gray-weathered sandstone in the St. Albans synclinorium. It is exposed in the woodland along the eastern edge of the field, adjacent to the project area.

The soil at this site is mapped by the SCS (1979) as Georgia extremely stony loam, 0 to 8 % slopes. This soil has limited uses due to stoniness, is not listed as a primary or secondary agricultural soil in Vermont (SCS, 1985), but, as noted, is currently farmed with a hay crop.

3.2.2 Agriculture

Agriculture in Vermont is predominantly dairy, with lands devoted primarily to growing feed crops (corn) and hay or in pasture. Horse farming is increasingly important. Other major crops in the state include maple sugar, apples, berry crops, and nursery crops.

St. Johnsbury: This site has no active agricultural use nearby, and nearby fields have been abandoned. There is a large dairy farm to the east of this site on Higgins Hill Road.

Mosher's Tap – Irasburg Corridor: A portion of this project crosses over areas that are currently farmed. Agriculture in this area is predominantly dairy, and the fields are cropped in hay or field corn or used as pasture. Most areas in current use are along the valley floor, not the sloping valley sides. Approximately three-eighths of a mile of corridor passes over active farmland, in three areas: these areas are predominantly in hay, with some corn and a minor area of pasture (and also immediately adjacent to active fields for approximately another three eights of a mile).

Many of the soils along this corridor are considered primary agricultural soils, as defined in Vermont (SCS, 1985; NRCS, 1997; Countryman Environmental, 2002; and see Table 1). As noted above, about 35% of the corridor has soils considered of good agricultural potential of which about half is in current use. Approximately 13 poles are located in areas now used for agriculture with another 27 located on soils of good agricultural potential but where agriculture has been abandoned or other uses are in place such as lawns. Most areas where agricultural uses have been abandoned are on sloping terrain, where previous use was pasture. These fields, outside of the maintained corridor, are now reverting to shrubs and forest.

Another agricultural use noted along this corridor is maple-syrup production (see below, Section 3.2.3, Forest Resources). At least two sugar operations are on lands adjacent to this corridor. In these areas, a sugarbush, i.e., a grove or forest of sugar maple (*Acer saccharum*), is tapped yearly for production of maple syrup. Sap pipelines (2" black plastic pipe to transport liquid maple sap from the forest to the sugarhouses) cross the corridor in two locations.

Highgate: There is no agricultural use in the immediate project area. Just to the north of the site, i.e., north of the old railroad bed, is a pastured area and a dairy farm. VELCO's power lines pass over this pasture. The soil at this site would have agricultural potential if drained, but the site is probably too small to be farmed profitably.

St. Albans: The site of the St. Albans Tap is in the middle of a small field that is currently cropped with hay. Although the soil is not considered a primary or secondary agricultural soil due to stoniness, the soil is fertile and the hay crop appears to be valuable. The general landscape is agricultural, with woodlands on adjacent areas that are not tillable due to ledge outcrops.

3.2.3 Forest Resources

St. Johnsbury: This site is located in an old field area with no significant forest resources but is beginning to grow up to become a young forest. Small stands of white pine (*Pinus strobus*) occupy drier sites but, being open-grown, do not constitute a manageable resource. Northern white cedar (*Thuja occidentalis*) is colonizing the damp slope to the south of the substation, and the remaining forest cover is dominated by aspen (*Populus tremuloides*, *P. balsamifera*). No marketable timber occurs on the site.

Moshers Tap-Irasburg Corridor: The forest-products industry is an important one in the region. Forest trees in the project area are generally conifers, including fir (*Abies balsamea*), red spruce (*Picea rubens*), white spruce (*Picea glauca*), hemlock (*Tsuga canadensis*), and northern white cedar (*Thuja occidentalis*). Northern deciduous hardwoods are also important components of the forest, including sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), paper birch (*Betula papyrifera*) and white ash (*Fraxinus americana*).

However, much of this corridor is across farmland or abandoned farmland with little forest use, and other areas are occupied by alder swamps. Minor areas near the southern and northern ends have adjacent forest lands; as noted, the existing corridor is maintained in a cleared condition. There are small areas of plantations of white pine (*Pinus strobus*) and red pine (*Pinus resinosa*) at two locations adjacent to the cleared corridor.

Of note is the use of large stands of sugar maple for production of maple syrup; two such operations were noted near the proposed corridor, but the corridor does not bisect any operation. Most of the soils in the area are considered to be of moderate or moderately high productivity for forest trees; they have various limitations due to wetness, steep slopes, rockiness, or sandy texture (Table 2).

3.2.4 Earth Extraction

VELCO determined the existence of earth-extraction facilities by inspection of the project areas and conversations with land owners by VELCO representatives.

St. Johnsbury: There are no significant earth resources in the vicinity of the St. Johnsbury substation.

Mosher's Tap – Irasburg Corridor: For the most part, there are no significant earth resources in the vicinity of Irasburg Substation or the Mosher's Tap. However, just north of Irasburg Substation, the corridor passes across an area of glacially-deposited sand and gravel that has been extensively exploited in the past and that is being extracted in areas outside of the existing corridor. There are at present 8 poles located within the gravel "pit" area; a VEC substation is also located in this "pit" area.

Highgate: There are no significant earth resources in the vicinity of Highgate Substation.

St. Albans: There are no significant earth resources in the vicinity of St. Albans Tap. The bedrock at this site is dolomite, a rock that is occasionally quarried in western Vermont. It outcrops at the eastern edge of the corridor at this site. There are quarries at Fonda, a village in St. Albans approximately 4.5 miles north of the project location, but none in the project's immediate area.

3.2.5 Recreation

VELCO evaluated potential impacts on recreational sites by inspection of the project sites and adjacent lands.

St. Johnsbury: There are no recreational facilities or likelihood of recreational use at the St. Johnsbury facility. The area is on the outskirts of the village of St. Johnsbury, there may be some potential for hunting upland game or deer, but this is limited by proximity to Interstate 93 and other land uses.

Mosher's Tap – Irasburg Corridor: Regionally, recreation is very much related to boating and fishing on Lake Memphremagog and along the Black River. Because of the importance of the South Bay area of Lake Memphremagog for migratory waterfowl, duck hunting is also important. Upland game hunting, especially for tailed deer, is regionally important and locally popular. Winter recreation is popular, and snowmobiling is a regionally important use.

The main recreational opportunities along this corridor are fishing in Stony Brook and snowmobiling. Fishing is likely restricted to local use by fishermen on foot (the stream is too small to canoe), and the cold-water fishery in the stream is considered significant (L. Gerardi, Vermont Department of Fish and Wildlife, personal communication to Countryman Environmental). There are snowmobile trails maintained by the Vermont Association of Snowmobile Travelers (VAST) in the vicinity of the corridor, which may cross it in certain locations, but they are not along the corridor itself, being mostly across farm fields.

Highgate: Regional recreational opportunities are primarily associated with Lake Champlain, west of the project facility, and the Mississquoi River south of the project. There are no recreational facilities or likelihood of significant recreational use at the Highgate facility. The nearby railroad bed is likely used for snowmobiling, however, and all-terrain-vehicle (ATV) users can access areas to the north by crossing near the two existing substations.

St. Albans: Regional recreation is strongly associated with Lake Champlain, where swimming, fishing, boating, and camping facilities are all located at St. Albans Bay. There are no recreational facilities or likelihood of recreational use at the St. Albans facility. It is remote enough from residences that there may be some hunting in the area. It cannot be seen from Lake Champlain, 9/10^{ths} of a mile distant.

3.2.6 Residential, Commercial and Industrial Impacts

VELCO evaluated potential impacts on residential, commercial and industrial uses by inspection of the project sites and by reviewing local plans.

St. Johnsbury: There are no such facilities within the immediate area of St. Johnsbury Substation, except Central Vermont Public Service Corporation's substation located on adjoining property. The closest residences to this site are single-family dwellings located approximately 1200 feet to the west, on Higgins Hill Road, and approximately 1200 feet to the east, also on Higgins Hill Road. The village of St. Johnsbury lies to the northwest of the site. The substation is already screened from these residences, and the project involves no change outside the existing fence (only within the already existing substation footprint) so there will be no additional impact to any neighbor.

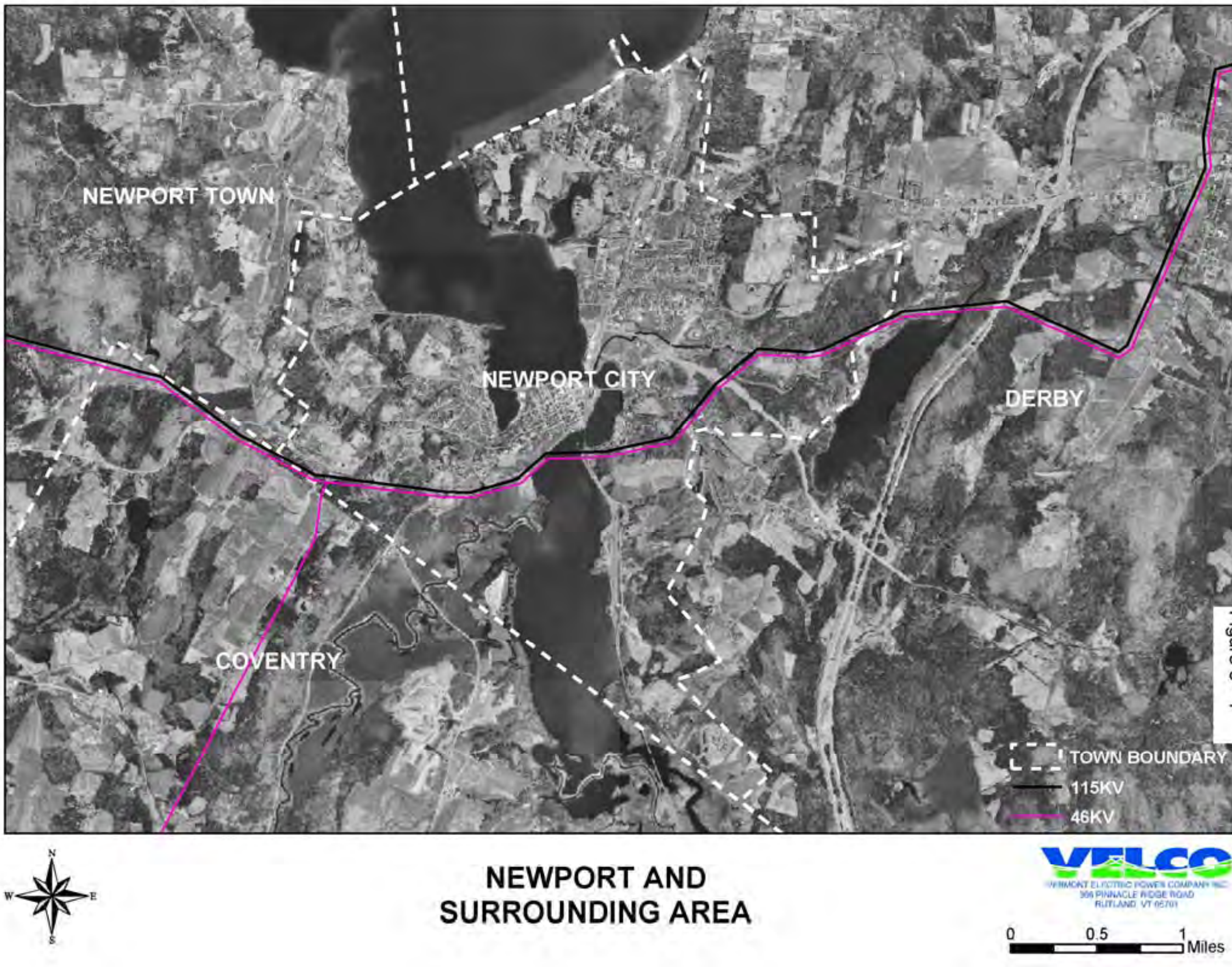
The closest commercial or industrial facilities are the Fairbanks Scale Company, approximately 3800 feet to the northeast, and the Maple Grove food-products facility, approximately 3200 feet to the northwest.

Mosher's Tap – Irasburg Corridor: The region of this project is mostly in an agricultural and forested area, with a rural residential area along Alder Brook Road. There are approximately 39 residences located within 500 feet of the corridor.

Most of these are along Alder Brook Road, Nadeau Road, and Mt. View Drive (north of the actual tap location). More distant residential areas include a rural residential area on Maple Ridge Road, the village of Coventry, and the City of Newport. Figure 3-1 is an aerial map of the Newport region.

Commercial land uses include sand and gravel extraction on lands owned by the State of Vermont (Agency of Transportation) and by Calkins Sand and Gravel Company near State Route 14 in Irasburg and the Citizens substation located in the aforementioned gravel-pit area. A "bed and breakfast" with a restaurant is located on Heermanville Road in Coventry, approximately 800 feet east of the project corridor. A church is located just north of the tap location at the intersection of Alder Brook Road and Route 105. Representatives of VELCO have had discussions with both the bed and breakfast owners and the Church, with regard to both explaining the project and obtaining VELCO easements. The Church has not signed an easement at this time as one issue remains unresolved. The owner of the bed and breakfast has not signed VELCO easement to date.

Figure 3-1.



Highgate: One residence is located 300 feet distant on the adjacent parcel to the east of the substation site. The substation is already screened from the one residence, and the area of enlargement is on the opposite side of the substation from the residence so it will not be any more visible to them.

Commercial property is located on the adjacent parcel west of the substation but is screened from the project area by a large patch of trees. The site is on the outskirts of the village of Highgate Center.

St. Albans: Only one residence is located within 1000 feet of this facility, a private residence about 400 feet to the northeast. The switching station will not be visible from the one residence.

There are no commercial or industrial uses in the project vicinity. The village of St. Albans Bay lies slightly less than a mile to the west, and the City of St. Albans lies approximately one mile to the east.

3.2.7 Airports, Navigation, Training Areas, Public Facilities and Other Land Uses

St. Johnsbury: A municipal water tower, supplying water to the village of St. Johnsbury, is located across Higgins Hill Road from the substation. A substation owned by Central Vermont Public Service Corporation is on adjacent property to the northwest. Also, the project is located near Interstate 93, upslope to the south.

Mosher's Tap – Irasburg Corridor: The Newport Airport in Coventry is approximately 1.3 miles from the project corridor. In line with the NW-SE runway, the project is approximately 1.8 miles northwest of the runway; in line with the NE-SW runway, the project is approximately 3.8 miles southwest of the runway. VELCO consulted a Federal Aviation Administration Advisory Circular and a local pilot who has knowledge of the airport, and both sources indicate that the alignment of the proposed Irasburg-Mosher's Tap line will not interfere with airport operations (see Appendix D). VELCO will seek written confirmation. A water-storage tower for the City of Newport's municipal water system is located approximately 1900 feet to the northwest of the existing Mosher's Tap structure.

Highgate: The Franklin County State Airport lies 2.3 miles to the west of the substation. This facility has a N-S runway, parallel to the project power lines and not in line with the substation.

The project is adjacent to State Route 78; south of that road is the Highgate Converter Station, owned by the Highgate Joint Owners, operated by VELCO. The project is approximately 2300 feet from the Highgate Falls hydroelectric station (owned by Swanton Village, Inc.) on the Missisquoi River. In the village of Highgate Center are the Highgate schools and sports arena.

St. Albans: There are no facilities in the project vicinity.

3.3 Hydrology, Water Quality and Water Use

3.3.1 Surface Waters

St. Johnsbury: There are no surface waters near the St. Johnsbury facility. Site work for the facility intersects the local water table at about 5 feet below the original soil surface on the slope located on the south side of the substation; VELCO notes that this is a common occurrence with earthworks in Vermont's hilly terrain. As a result, there is groundwater discharge near the southeast corner of the facility, but the discharge is captured by a ditch and eventually infiltrates back into the ground; that is, the lowest part of the 'cut bank' is seep but also vegetated, and while the volume of water is not great it is sufficient to maintain wetland vegetation along the toe of the bank and in the ditch. As this wet area is outside the substation fence and at the edge of the gravel pad, the potential for contamination is not significant.

Approximately 1900 feet west of the facility is a small permanent stream that is a tributary to the Moose River. A small seasonal stream, tributary to the above-named permanent stream and near the access road, flows approximately 800 feet north to its confluence with the permanent stream.

Stiles Pond (146 acres), which is the municipal water supply for St. Johnsbury, is located 2.5 miles east of the project site. It drains to the Moose River via Stiles Brook, east of the project site.

Mosher’s Tap – Irasburg Corridor: Streams along this route are Ware Brook, an unnamed tributary to the Black River, several seasonal and permanent tributaries to Stony Brook and Alder Brook, and Stony Brook itself. The tap itself is located approximately 150 feet from Alder Brook. The corridor crosses over approximately six seasonal or small permanent streams that are tributaries to the above-named brooks. During construction, VELCO will use existing roads to access the corridor. As these roads have bridges where they cross some of the streams, there will be no impact on the streams themselves as construction vehicles and equipment will cross the streams using these bridges. These streams will not be impacted by this project (see memorandum from Art Gilman, Appendix F, and Vermont’s Agency of Natural Resource CUD permits item 5 (Appendix B), where it states that crossing will be only by existing bridges and farm roads).

The corridor more or less parallels the course of the Black River which flows north into Lake Memphremagog, an international waterbody. At its closest, near the south end of the corridor, the Black River is approximately 500 feet distant to the east. Much of the corridor is approximately 5000 feet distant from the Black River, which is beyond an intervening series of hills. At the north end of the corridor, the mouth of the Black River into Lake Memphremagog is approximately 1.1 miles east of the corridor.

Lake Memphremagog, the location of which is shown in Figure 1-1, is the major body of water in the region, covering some 6317 acres in the United States (VT AEC, 1981). It drains north to the St. Lawrence River. Ponds within 1.5 miles of the project area are Walker Pond, Sargent Pond, Smith Pond, and Kidder Pond, all less than 20 acres (VT AEC, 1981), and two small ponds on an unnamed tributary to Stony Brook; all lie west of the corridor. There are also farm ponds in the vicinity of Alder Brook Road, and three small dug ponds (i.e., two near Nadeau Road and one near Alder Brook Road) lie partially within the project corridor.

Highgate: Other than dug ditches, the only surface water on the site is a small pond, apparently a dug stormwater pond, near State Route 78. The project area drains to this pond and subsequently off-site via a culvert under Route 78. This culvert is the head of a seasonal stream that is a tributary to the Mississquoi River, approximately 4850 feet southwest of the substation area. Missisquoi Bay of Lake Champlain lies approximately 4 miles' distance to the northwest.

St. Albans: There are no surface waters in proximity to the St. Albans Tap site. The nearest surface water, an unnamed tributary to Lake Champlain, is approximately 1750 feet to the north. Lake Champlain itself is approximately 4800 feet west of the site.

3.3.2 Flood Waters

Approximately 3.5% of the state of Vermont is subject to flooding, with “2000 miles of major streams, and more than twice that number of smaller streams which periodically experience flooding” (Wernecke and Mueller, 1972). Lands along the shore of Lake Champlain are subject to annual inundation following spring snowmelt. Major rivers are sometimes subject to spring flooding, with problems developing especially from the formation of ice jams. Rivers also flood on occasion following prolonged heavy rains; this can occur in any season. A particular problem in Vermont is summertime flash-flooding, often following severe thunderstorms. This problem is especially noted in towns with hilly or mountainous terrain and narrow, steep-sided valleys.

St. Johnsbury: The project is not subject to floodwaters, being on elevated, sloping terrain.

Mosher’s Tap – Irasburg Corridor: Following along the valley floor, a portion of this corridor at Ware Brook and segments along Stony Brook will be within the 100-year floodplain (FEMA, 1976). Pole placements will be designed to withstand flooding. Wood poles will be treated with pentachlorophenol, a treatment used by VELCO on all of its poles that has been approved by the EPA and the State of Vermont to withstand the impact of any flooding. The approximately 11 poles that may be constructed with Corten steel will not need any additional treatment or coating.

Highgate: The project area is not subject to floodwaters, being on elevated terrain more than 100' above the elevation of the Missisquoi River.

St. Albans: The project is not subject to floodwaters, being on elevated, sloping terrain more than 100' above the elevation of the nearest stream.

3.3.3 Ground Water and Water Supply

St. Johnsbury: Groundwater favorability is rated low in this region (SPO, 1972). The location is outside of the local water-supply-protection area.

Mosher's Tap – Irasburg corridor: Portions of the corridor are within areas of potential aquifer recharge with sandy or gravelly soils (SPO, 1972), including the Irasburg Substation site. There are no public water supplies within the corridor; a wellhead-protection area lies east of the corridor near Heermanville Road in Coventry.

Highgate: The Highgate Substation site is located in a potential aquifer-recharge area due to gravel underlayment (SPO, 1972). It is not within a public water-supply area. The closest public-water supplies are for Highgate Manor (3000' distant) and Highgate Center School (1600' distant).

St. Albans: The St. Albans Substation site is located within a potential bedrock aquifer-recharge area (SPO, 1972). It is not located within a public water-supply area.

3.3.4. Wetlands

In Vermont, wetlands are classified according to functions and values. As defined by the Vermont Water Resources Board, Class One wetlands are wetlands that are deemed as significant by the Board so "that they merit the highest level of protection." (Vermont Wetland Rules, 2001). There are no Class One wetlands affected by this project.

A Class Two wetland is one that appears on a National Wetland Inventory Map (1978) or is a wetland contiguous to a mapped wetland. Except for certain allowed uses, any development in a Class Two wetland, or its associated 50-foot buffer zone, requires a Conditional Use Determination ("CUD"). All other wetlands are Class Three wetlands not requiring a CUD for development.

St. Johnsbury: There are small areas, a few hundred square feet to approximately one acre, of wetland swales near St. Johnsbury Substation, notably, upslope to the south and in a small valley to the east. These were not delineated but were determined by inspection. These are classified (Cowardin et al., 1979) as palustrine forested (PFO) and palustrine emergent (PEM) wetland, respectively. There is also a small palustrine forested wetland, a few thousand square feet in size, in a small valley along a seasonal stream to the west, approaching the project area near the access road. These all drain northward to the Moose River. These wetlands are all outside the area of the proposed work, which will be within the existing substation's fence.

Mosher's Tap – Irasburg corridor: Wetlands along this corridor were delineated and are shown on the project site plans. See, in Appendix F, a memorandum (Countryman Environmental

2002b) detailing the delineations and functional evaluations of the wetlands on this corridor. Most of the wetlands on the project corridor are classed as palustrine scrub/shrub (PSS) or emergent wetlands (Cowardin et al., 1979). The scrub/shrub wetlands are predominantly alder swamps, and the emergent wetlands are mostly "wet meadows" in pasture or abandoned pasture. The corridor bisects some forested wetlands.

Highgate: A wetland at this site was delineated and is shown on the project site plans. This wetland is primarily palustrine scrub/shrub in nature, with some subordinate emergent and forested vegetation. This wetland is approximately 2 -3 acres in total size. Of this, 33,883 square feet (less than one acre) will be filled for the substation expansion as permitted by the Army Corps of Engineers under a General Permit (see Appendix B). The General Permit stated that "the work...will have minor individual and cumulative impacts on the waters and wetlands of the U.S." and made the project subject to the Corps' standard permit conditions for "Minimization of Environmental Impacts" that are part of the Vermont General Permit No. 58, i.e., Conditions 13-22 which among other provisions include requirements for avoidance or minimization of impact, stabilization of temporary fill, and erosion control (see Appendix B). Under the General Permit process, the Vermont Agency of Natural Resources commented on VELCO's application, raising no concerns in regard to wetlands functions and values, and the Corps imposed no special conditions.

St. Albans: There are no wetlands in the project vicinity, which is located in an upland field.

3.3.5 Water Quality

Water-quality issues in Vermont are related, as elsewhere, to wastewater, industrial pollution, stormwater runoff, land development, and agricultural operations. Waterbodies that do not meet Vermont Water Quality Standards (see Appendix F) were recently listed (VT DEC, 2000) as "impaired waters."

St. Johnsbury: There are no identified water-quality problems at this site, and it is not in the watershed of any impaired water.

Mosher's Tap – Irasburg Corridor: There are no identified water-quality problems along this corridor. It is likely that there is non-point-source runoff from agricultural operations that may affect water quality in Water Brook, Stony Brook, and receiving waters. Gravel-extraction operations near and along the project corridor have settling ponds that capture fine sediments.

The entire corridor is in the watershed of Lake Memphremagog (including South Bay), which is impaired due to excessive algal growth and nutrient enrichment.

Highgate: There are no identified water-quality problems at this site. It is in the watershed of the Missisquoi Bay of Lake Champlain, which is considered an impaired water due to elevated levels of mercury in walleye fish and phosphorous enrichment. In August 2003, Missisquoi Bay experienced a major algal bloom that resulted in beach closures and health warnings (Crawford, 2003).

St. Albans: There are no identified water-quality problems at this site. It is the watershed of St. Albans Bay of Lake Champlain that is considered impaired water due to elevated levels of mercury in walleye, elevated levels of polychlorinated biphenyl ("PCBs") in lake trout, and phosphorous enrichment.

3.4 Ecology

3.4.1 Vegetation/ Flora

Flora - Terrestrial/Uplands

The project is primarily located in the "northern hardwood forest" region of Vermont (Johnson, 1980), characterized by deciduous trees especially sugar maple (Acer saccahrum), beech (Fagus grandifolia), paper birch (Betula papyrifera) and yellow brich (Betula alleghaniensis). In this region there is also a significant component of conifers, especially balsam fir (Abies balsamea), hemlock (Tsuga canadensis) and red spruce (Picea rubens).

The St. Albans site and the Highgate sub site are located in the "northern hardwood - oak-hickory region" (Johnson, 1980), characterized by the presence of those two additional genera (*Quercus, Carya*).

The entirety of northern Vermont is located within the "conifer-deciduous association" of the eastern deciduous forest (Greller, 1988). The region is near the southern boundary of the boreal forest region, and portions of the region are mapped as "high elevation Appalachians" (Barbour and Christensen, 1993).

The terrestrial flora of the region is well-known (Fernald, 1950; Seymour, 1969) and is described below from field inspection by personnel of Countryman Environmental. The flora of Caledonia County (St. Johnsbury) was recently enumerated by Gilman (1999).

The natural communities of Vermont, including the common, matrix communities such as occur in the several project areas, are described by Thompson and Sorenson (2000).

St. Johnsbury: This area is on a hillside formerly used as upland pasture. Remnant fields are in hay species, and old field areas are being colonized by white pine (*Pinus strobus*) on drier areas and northern white cedar (*Thuja occidentalis*) on damper soils. Aspen (*Populus tremuloides*, *P. balsamifera*), maples (*Acer saccharum, A. rubrum*), elm (*Ulmus americana*), and birches (*Betula populifolia*, *B. papyrifera*) dominate the woodlot to the south.

Mosher's Tap – Irasburg Corridor: Lying near the Canadian border but at low elevation, the plant communities in this region are controlled by a combination of low winter temperatures, soil fertility and reaction (pH), and moisture. Forest trees in the project area are generally conifers, including fir (*Abies balsamea*), red spruce (*Picea rubens*), white spruce (*Picea glauca*), hemlock (*Tsuga canadensis*), and northern white cedar (*Thuja occidentalis*). Northern deciduous hardwoods are also important components of the forest, including sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*) paper birch (*Betula papyrifera*), and white ash (*Fraxinus americana*).

Non-forest upland communities in the corridor are primarily in early stages of “old field” succession and are at present dominated by pasture grasses, including timothy (*Phleum pratense*), orchard grass (*Dactylis glomerata*), creeping red fescue (*Festuca rubra*) and Kentucky bluegrass (*Poa pratensis*). Brambles (*Rubus spp.*) are prominent. In some areas, especially on gravels and sands, clubmosses (*Lycopodium spp.*), bracken (*Pteridium aquilinum*) and other pteridophytes are common.

Highgate: The area of the Highgate Substation is on apparently-abandoned farmland, now significantly grown up (where vegetation has not been maintained within the power-line corridors) to an upland species of alder (*Alnus viridis* ssp. c*rispa*) and also to poplars (*Populus tremuloides*), willows and other shrubs and trees. A wetland in the vicinity of the substation expansion is dominated by willows and other shrubs. Surrounding lands include a patch of forest with paper birch (*Betula papryifera*) and white pine (*Pinus strobus*) and agricultural lands beyond an abandoned railroad bed.

St. Albans: The area of the St. Albans Tap is in a mowed field, apparently recently renovated and dominated by grasses including Hungarian brome (*Bromus inermis*) and red clover (*Trifolium pratense*). Adjacent forest is of a type adapted to dry, circumneutral soils including sugar maple (*Acer saccharum*), bitternut hickory (*Carya cordiformis*), hophornbeam (*Ostrya caroliniana*), etc.

Flora - Aquatic/Wetlands and Waterbodies

The composition of the aquatic and wetland flora of the project area is influenced by the generally cool summer temperatures of the region, water chemistry (in turn influenced by bedrock and surficial geology), and nutrient input from runoff (Hutchinson, 1975). In general, Lake Memphremagog and Lake Champlain are noted to have high diversity of aquatic species and robust wetland communities (e.g., Muenscher, 1930; Johnson, 1980) although aquatic weed problems, e.g., Eurasian water milfoil (*Myriophyllum spicatum*) are noted, especially in Lake Champlain (see related article in Appendix F). Also, see Section 3.3.5 (regarding water quality) for a description of recent algal blooms exacerbated by phosphorous loading.

Wetlands in this area are classified in accordance with Classification of Wetlands and Deep Water Habitats of the United States (Cowardin et al 1979).

St. Johnsbury: Wetlands in the vicinity are small palustrine forested and emergent. Forest trees include northern white cedar (*Thuja occidentalis*) and red maple (*Acer rubrum*); some quaking aspen (*Populus tremuloides*) also occur in the small wetland patches. Emergent plants include various sedges (*Carex spp*.), e.g., yellow sedge (*Carex flava*) and scabrate or seep sedge (*Carex scabrata*), marsh fern (*Thelypteris palustris*), horsetail (*Equisetum arvense*) and broad-leaved cat-tail (*Typha latifolia*).

Mosher's Tap – Irasburg Corridor: The larger wetlands along this project corridor are dominated by speckled alder (*Alnus rugosa*). Understory thickets are dominated by emergent plants such as bluejoint grass (*Calamagrostis canadensis*), tall meadow rue (*Thalictrum polygamum*) and Joe Pye weed (*Eupatorium maculatum*). Some of the abandoned fields have a "wet meadow" community dominated by reed canary-grass (*Phalaris arundinacea*), red-top grass (*Agrostis gigantea*) and various sedges (*Carex spp.*) and bulrushes (*Scirpus spp.*)

Purely aquatic plants are confined to Alder Brook and include tape-grass (*Vallisneria americana*). Extensive aquatic-bed, emergent, and scrub/shrub wetland communities with many more species occur at South Bay of Lake Memphremagog.

Highgate: The wetland community, as documented by transect data for the required delineation, includes primarily alders, willows, aspen, and red maple with an understory of emergent herbaceous species, prominently sedges, grasses, and ferns. The small open pond, which is in the nature of a stormwater-retention pond, has some floating-leaved aquatic species, including duckweed (*Lemna minor*).

St. Albans: There are no wetland communities in the project vicinity.

3.4.2 Wildlife

The tables in Appendix F list species of mammals, birds, amphibians, and reptiles that are known or are likely to occur in the various project regions. Significant habitat maps, published by the Vermont Department of Fish and Wildlife (DFW, 1997), are also appended in Appendix F.

Wildlife-Terrestrial/Uplands

St. Johnsbury: St. Johnsbury Substation is on a terrace on a north-facing hillside within the curve of a local highway (Higgins Hill Road) and just down slope of Interstate 93. The area is characterized by small fields and woodlots typical of formerly active agricultural land. The nearest contiguous forest cover lies along the south bank of the Moose River, about 1000 feet to the north. Wildlife species in this area are likely limited to small mammals, with seasonal (summer) use by deer. There are no deer-wintering areas mapped by the Vermont Department of Fish and Wildlife near the substation.

Mosher's Tap – Irasburg Corridor: Wildlife within the project areas is typical for the region; no concentrations of wildlife or critical habitat, such as deer-wintering habitat, have been noted. The area includes forest and field at relatively low elevation. Common species include white-tailed deer, moose, snowshoe hare, coyote, fox, raccoon, and skunk as well as small mammals (see Appendix F). One area of deer-wintering habitat has been identified on the southeast edge of Cleveland Hill at the Coventry-Irasburg town line. This habitat is adjacent to the existing cleared corridor, but the corridor does not bisect it; it is the easternmost extension of an extensive deer-wintering area in the hills west of this corridor.

Highgate: The area of the Highgate Substation, constrained between a major road and an abandoned railroad and immediately adjacent to the already-developed substations, is not optimal for wildlife habitat. Some migratory songbirds were observed, notably red-winged blackbird and yellow-rumped warbler. Snipe were observed in a brushy field on the other side of the old railroad track. There may also be some amphibian use of the small stormwater pond in the lower area of the wetland; however, this would be limited to common species.

The Missisquoi River, which flows through a deep valley south of the substation site, likely serves as a wildlife corridor, especially for waterfowl and wading birds. However, the substation site is separated from the river by a state highway, a 1500'-wide terrace and steep slopes.

St. Albans: The area of the St. Albans Tap, being in the middle of a small field, likely has little wildlife use. A forested ridge running north-south parallels the power-line corridor to the west, representing the only sizeable woodland habitat in the area. Even so, area wildlife is likely to comprise only species common to field and forest habitats such as deer, small mammals, rodents, and insectivores along with common bird species.

Wildlife - Aquatic/Wetlands and Waterbodies

St. Johnsbury: There is no aquatic or wetland habitat in the vicinity of the St. Johnsbury Substation.

Mosher's Tap – Irasburg Corridor: Wetland-dependent wildlife, including beaver, mink, and muskrat, occur along Stony Brook. For migratory birds, the northern end of the power-line corridor is located approximately 0.43 miles west of the South Bay State Wildlife Management Area, on South Bay of Lake Memphremagog. South Bay is an attractant to, and sustains, large populations of migratory waterfowl. However, the crest of a ridge separates the project area from South Bay.

Alder swamps along Stony Brook appear to be good habitat for woodcock and certain migratory songbirds.

Fisheries in Stony Brook and Ware Brook are cold-water type, and the streams are considered important breeding habitat for anadromous rainbow and brown trout that access them from Lake Memphremagog. Landlocked salmon may also access these streams, but the streams are not managed for salmon by the Vermont Department of Fish and Wildlife.

Highgate: Some migratory songbirds were observed, notably red-winged blackbird and yellow-rumped warbler. Snipe were observed in a brushy field on the other side of the old railroad track, but the site itself is in too late of a successional state to receive use by snipe. Woodcock may be present. There may also be some amphibian use of the small stormwater pond in the lower area of the wetland; however, this would be limited to common species.

St. Albans: There is no aquatic or wetland habitat in the vicinity of the St. Albans project site.

3.4.3 Rare and Endangered Species

Threatened and Endangered Plants

St. Johnsbury: There are no occurrences of federally-listed threatened or endangered plants (50 CFR 17.11) within the project area. In Vermont, the listed species (see Appendix F) are small whorled pogonia (*Isotria medeoloides*), Jesup's milk-vetch (*Astragalus robbinsii* var. *jesupi*) and barbed-bristle bulrush (*Scirpus ancistrochaetus*); none are likely to occur within the project area. The first small whorled pogonia has historically only occurred only near Burlington (Jones, 1902), and the other two are confined to southeastern Vermont.

Also, no species that is listed as threatened or endangered under Vermont statute (10 Vermont Statutes Annotated, Chapter 123, as amended) exists at the St. Johnsbury Substation site or nearby. The current list of 152 species is appended. There is a historical record for ram's-head lady's-slipper (*Cypripedium arietinum*) approximately 3000 feet distant, but this plant has not recently been observed there (Countryman Environmental, personal observation). No species ranked as rare by the Vermont Department of Fish and Wildlife, Nongame and Natural Heritage Program ("NNHP") is known within the project vicinity.

Mosher's Tap – Irasburg Corridor: There are no occurrences of federally-listed threatened or endangered plants within the project area. One species that is listed as threatened in Vermont was noted at the Irasburg Substation site: Greene's rush (*Juncus greenei*). Plants inventoried in 2001 and in July 2003 by VELCO consultants occurred outside the proposed building envelope and will be avoided during construction. There are three plants immediately outside the existing fence. Another project being filed in the near future, which VELCO is associated with, will bring another 48-kV line into the Irasburg substation and, in doing so, enlarge the footprint. In conjunction with this follow-up project, VELCO will need to acquire an Endangered Species Permit from the Vermont Agency of Natural Resources to transfer those three plants and develop a management program for all the other existing population (not in the area to be disturbed).

No other of the 152 species currently listed as threatened or endangered in Vermont (see Appendix F) or any that are ranked as rare by the NNHP are known to occur within the project area, although several occur at South Bay of Lake Memphremagog. The statutory list is currently undergoing revision, in which it is proposed to delist one species, the many leaved-rush (*Scirpus polyphyllus*), and to add another species, the dwarf water-lily (*Nymphaea leibergii*). Dwarf water-lily occurs in the Lake Memphremagog vicinity but not near or within the project area.

Highgate: There are no federally-endangered or state-listed species of plants known in the project vicinity or any that are ranked as rare by the NNHP. Rare plants in the region are found mostly along Lake Champlain or the Missisquoi River, remote from the project.

St. Albans: There are no federally-listed endangered or state-listed species of plants known in the project vicinity or any that are ranked as rare by the NNHP. Some are known at St. Albans Bay and headlands along Lake Champlain. A population of awned sedge (*Carex atherodes*) occurs in a wet meadow under VELCO power lines east of the tap towards St. Albans. Recently discovered in Vermont (Briggs, personal communication), this is the only station for the species in the state; it is not as yet ranked by the NNHP.

Threatened and Endangered Wildlife

No occurrences of federally-listed threatened or endangered fauna (50 CFR § 17.12) are known within or near the project areas (please refer to Appendix F). In Vermont there are six such species: eastern mountain lion (*Felis concolor couguar*), lynx (*Lynx canadensis*), Indiana bat (*Myostis sodalis*), bald eagle (*Haliaeetus leucocephalus*), Puritan tiger beetle (*Cicindela puritana*) and dwarf wedgemussel (*Alasmidonta heterodon*). These are briefly discussed below:

- Eastern mountain lion has recently been confirmed as a transient in northern Vermont; however, no resident individuals or breeding populations are known.
- Lynx has been historically known in Vermont; current populations occur in forested terrain remote from any of the project areas.
- In personal communication to Arthur Gilman, Susie van Ottingen, endangered-species specialist with the US Fish and Wildlife Agency, stated that the Indiana bat breeds in the southern Champlain valley, and while it is possible that it may also occur in the northern Champlain Valley, the Indiana bat is not known to occur in the Swanton and Highgate areas and is not likely to occur elsewhere in the project area; no records are known for the Indiana bat near the project elements, and no critical habitat (nesting or roosting trees, or hibernacula) for this species occurs on the involved project lands.
- Transient individuals of bald eagles may occur anywhere in northern Vermont. However, the species is not known to nest in Vermont (Crawford, 2003), and no other critical habitat, such as winter-feeding areas, is in the project area. A Bald Eagle Recovery Plan for Vermont is currently being developed (Crawford, 2003b, see Appendix F).

- Puritan tiger beetle is confined to habitats along the Connecticut River, remote from the project area (Leonard and Bell, 1999).
- Dwarf wedgemussel is also confined to the Connecticut River, remote from the project area (Fichetl and Smith, 1993).

There are 42 species of fauna listed as threatened or endangered under Title 10, Chapter 123 of the Vermont Statutes Annotated, as amended (see Appendix F). None of these are specifically known to exist in the project area. As noted, transient individuals of some mammals such as eastern mountain lion, lynx, marten (*Martes americana*), Indiana bat and some birds such as bald eagle, peregrine falcon (*Falco peregrinus*) and upland sandpiper (*Bartramia longicauda*) may also occur, but no critical habitat is known for these species on the project area (Countryman Environmental, 1997).

With these generalities in mind, the following site-specific notes are offered:

St. Johnsbury: This site is approximately 5.5 miles from the Connecticut River, where bald eagles are regularly observed.

Mosher's Tap – Irasburg Corridor: Upland sandpiper has regularly occurred in the project vicinity (Laughlin and Kibbe, 1984) and has been known to nest at the Newport Airport in Coventry; it is likely to occur in farm fields in the project vicinity. Some rare species, e.g., common loon (*Gavia immer*) and common tern (*Sterna hirundo*), occur at South Bay of Lake Memphremagog.

Highgate: Three species of mussels that are listed as endangered in Vermont occur in the Missisquoi River in Highgate (Fichtel and Smith, 1994), which is approximately 2300 feet from the Highgate Substation. These are cylindrical papershell (*Anodontoides ferussacianus*), pocketbook (*Lampsilis ovata*) and black sandshell (*Ligumia recta*), but only black sandshell is known historically from the area.

St. Albans: There is little potential for such species in this area.

3.4.4 Natural Areas

The State of Vermont's Department of Forests, Parks, and Recreation manages 33 designated "natural areas" (see Appendix F). Of these, none are within one mile of any of the project areas, the closest being Highgate Cliffs in Highgate approximately 4 miles distant from the project site in that town. Highgate Cliffs Natural Area is described as a "small headland on Missisquoi Bay" (FPR, 2003b).

Numerous other entities and authors have listed, or discussed, various "natural areas" in Vermont, all using somewhat subjective criteria. For example, the U.S. Environmental Protection Agency (EPA, 1987) listed priority wetlands in New England, including Lake Memphremagog, and VRC (1988) discussed a classification scheme for natural areas in the state. Other publications include Vogelmann (1964, 1969) and Countryman (1972). None of the sites discussed in these publications, with the exception of Lake Memphremagog, are within one mile of any of the project sites.

The New England Natural Resources Center (NENRC, 1970 *et seq*.) listed numerous sites in Vermont. The following are those, exclusive of deer-wintering areas and archaeological sites, that are within one mile of the project areas, with one-line descriptions after NENRC:

St. Johnsbury: None

Mosher's Tap – Irasburg Corridor:

Black River Marsh -Extensive marsh supporting many wildlife species.

Newport Cliffs - Scenic cliffs.

South Bay, Lake Memphremagog - Narrows famous for salmon runs in spring.

Highgate:

Highgate Falls - Waterfalls and cascades of Missisquoi River (also see Jenkins and Zika, 1987, who describe it as "a wide gorge below a small dam and the remnants of a falls").

St. Albans: None.

More recently, Thompson and Sorenson (2000) have broadly evaluated Vermont's ecosystems and described 80 community types across the state. A number of these are ranked as rare. None of the project sites occur on habitats that would be so ranked under the system proposed by them.

3.5 Socioeconomics

All statistical information in this section was retrieved from the following web sites (see also the Reference section):

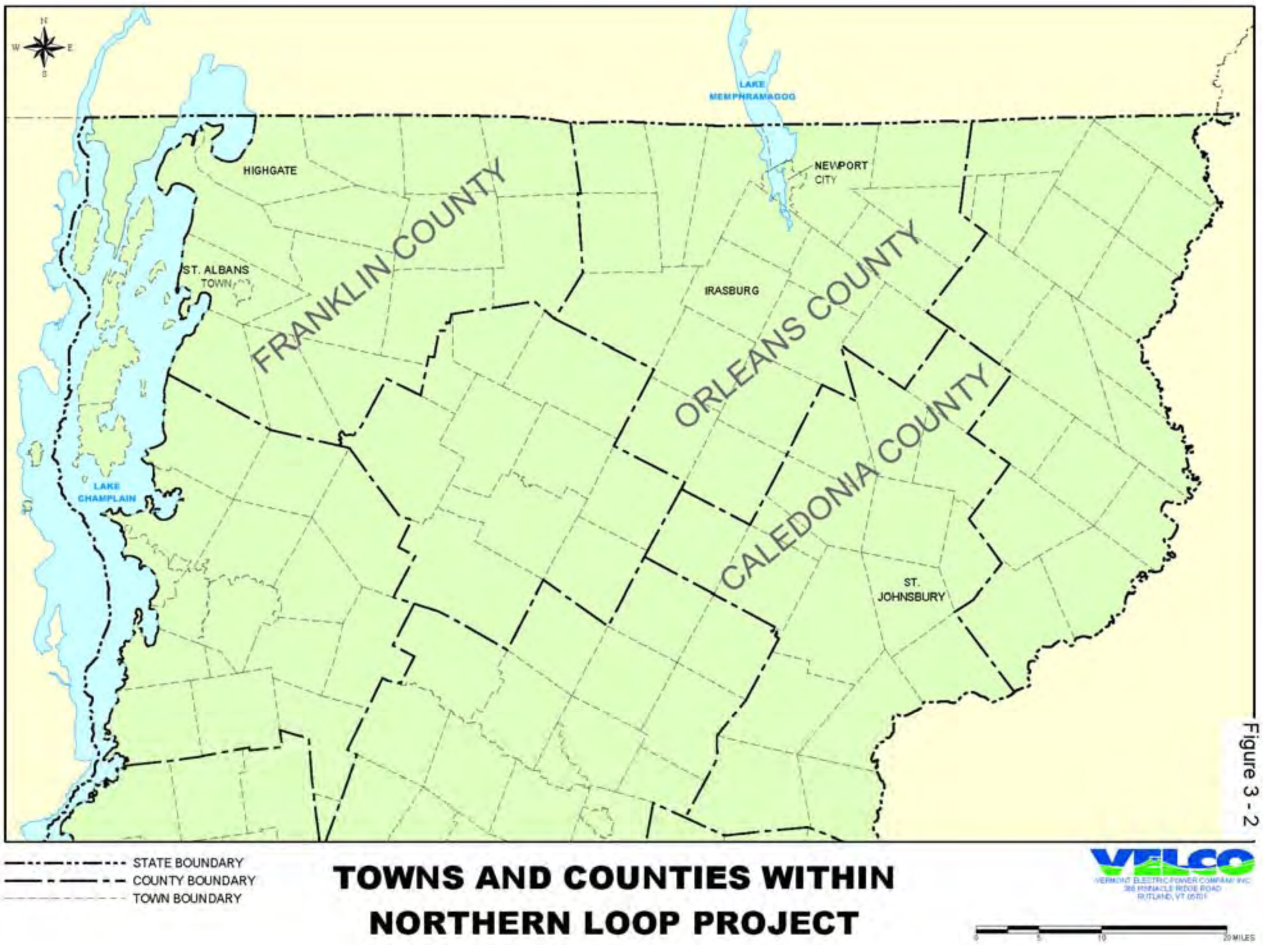
- Vermont Dept. of Employment and Training, at http://www.det.state.vt.us
- U.S. Census Bureau, at http://factfinder.census.gov
- The Vermont League of Cities and Towns, at http://www.vlct.org
- The Northeastern Vermont Development Association, at http://www.nvda.net
- The Northwest Regional Planning Commission, at http://www.nrpcvt.com

3.5.1 Institutional Setting

St. Johnsbury in Caledonia County, Coventry, Irasburg, and Newport City in Orleans County, and Highgate and St. Albans Town in Franklin County are organized towns/cities located in the northern part of Vermont. (See Figure 3-2.)

Organized towns in Vermont hold either town meetings or elections at which selectmen/aldermen are elected. These selectmen/aldermen are an administrative entity with limited jurisdiction. They, in turn, appoint a planning commission, which may prepare and adopt a master plan for the town and review site plans and subdivisions.

Figure 3-2



St. Johnsbury, Coventry, and Newport City are served by both their individual planning commissions as well as by the Northeast Vermont Development Association. The Town of Irasburg has no town planner but is served by the Northeast Vermont Development Association. Highgate and St. Albans Town also have their own planning commissions and are served by the Northwest Regional Planning Commission.

3.5.2 Population

The counties of Caledonia, Essex and Orleans together are called the "Northeast Kingdom." Although the Northeast Kingdom makes up 21 percent of the land area of Vermont, only 10 percent of the state's population reside in this area. In 2000, the Town of St. Johnsbury had a population of 7571, Irasburg had 1077, Newport City had 5025, and Coventry had 1014.

Racial diversity is minimal in the project area. Most of Vermont is about 98 percent White. The Northeast Kingdom is no different. In St. Johnsbury, Blacks comprise 0.5%, Native American Indians around 0.7% and Asians around 0.6%. Irasburg is comprised of 98.9% White, and American Indian 1%. Coventry is 97.6% White, 0.3% Black, 1.5% American Indian and 0.4% Asian.

St. Johnsbury Substation is located over one-half mile southeast of the populated area. At Irasburg, the substation is not visible to any of the residents. The transmission corridor from Irasburg to Newport City (Mosher's Tap) is situated to the west of the small population centers in Irasburg and Coventry, with the exception of the houses along Alderbrook Road in Coventry. At Newport City, the transmission corridor touches only the most westerly corner of the municipality.

Franklin County, where the Highgate substation and St. Alban's Tap are located, is primarily rural. Some of the largest farms in the state are located here. It is also the third fastest-growing county in the state. Growth continues to radiate out from the greater Burlington area, extending towards the Canadian border in Franklin County.

In 2000, Highgate had a population of 3397, and St. Albans Town had 5324. The ethnic composition on this side of the state is somewhat more diverse. Highgate has a white population of 92.9% with American Indian comprising 6.5%, Black and Asian at 0.2%. St. Albans has 97% white, American Indian 1.7%, Black at 0.6% and Asian at 0.5%. Highgate Substation is located to the east of the Highgate population center. The improvements in St. Albans Town lie approximately one mile east of the center of the municipality.

VELCO considered whether the project raises issues of environmental justice. It concluded that the project does not raise environmental-justice concerns, as discussed below.

Every substation and transmission line that will be affected by this project exists today. Anyone impacted by the project is already affected by the location of these substations or the existing line. VELCO selected the preferred corridor for and decided to make related, necessary improvements to substations serving what will become a looped transmission line, because locating the project at existing sites would minimize adverse impacts. VELCO states that it did not choose these locations to avoid non-minority or middle- and high-income populations that might oppose the project or increase easement-acquisition costs.

As stated in the next section, the areas served by the proposed project, especially the areas located in the Northeast Kingdom, lag the remainder of the state economically. One of the primary purposes of the project is to provide these areas with the same level of electric reliability that most of the rest of the state enjoys. Without reliable electric service, VELCO believes these areas will not have a chance to compete for new industries and businesses and could in fact risk losing existing ones.

The Northern Loop Project will provide that same level of reliability, and do so by using existing facilities, thereby minimizing environmental impacts to the degree possible.

3.5.3 Employment and Economics

The Northeast Kingdom’s economy is the most challenged in the state with the highest unemployment levels. The number of jobs in the area has increased, but in spite of the increase there are only jobs for about 7 out of 10 persons in the labor force. This means that many residents pursue employment opportunities outside the region.

St. Johnsbury, in Caledonia County, employs 6047 people, with 58% in some type of service industry and 25% in manufacturing. Almost half the employers and employees for the area-wide labor market are in St. Johnsbury, as it is at the center of one of the two labor markets that serve the Northeast Kingdom. Coventry, Irasburg and Newport City are in Orleans County and employ 172, 190 and 4044 people, respectively.

The economies of Orleans and Caledonia Counties are closely connected to natural resources: logging and wood-products manufacturing have a significant share of the job opportunities. Caledonia County, however, provides a broader array of services and job opportunities.

Orleans County ranks third in the state in agriculture, and dairy farming makes up 85% of the agricultural sales. Orleans Country is also a leader in softwood logging and forestry, having 21.9% of the total state harvest.

Coventry can be categorized as an agriculturally-based bedroom community (in 1990, 77% of the town’s work force were employed out of town). Its economic future is tied to the stability of its farming community as well as the growth of the commercial and industrial bases of its surrounding communities.

Newport City is the center of economic, educational and cultural activity for Orleans County. It depends on diverse economic bases: regional business and retail-shopping centers; industrial; tourism; and governmental. Newport is also economically tied to the bordering areas of the Province of Québec, attracting Canadians to its stores and as tourists to Jay Peak for skiing and Lake Memphremagog for recreation including boating.

Franklin County, the county that includes both Highgate and St. Albans, has the strongest job growth in the state with 2.5%. This growth is due to the close proximity to the major population concentration in the state (Burlington) and has been mostly in the service and retail trades.

Manufacturing has actually declined in the county. Franklin County is also one of the most significant agricultural areas of the state. Here, as with Orleans County, dairy farming makes up over 85% of all agricultural sales.

The Town of Highgate's economy is divided between agriculture and non-agricultural employment located in other communities. It is proximate to the local job markets of Swanton and St. Albans. In 1990, more than 80% of the work force working outside of Highgate, and that trend has continued.

St. Albans Town is in the midst of evolving from an agricultural community to one that supports seasonal, residential, commercial and industrial development. St. Albans is partially located along Lake Champlain, thus benefiting from the Vermont tourism trade. The State of Vermont's total labor force in 2001 was 334,700 with an unemployment rate of 3.6%. The unemployment rate for the towns in the northeastern part of the state is higher than the state-wide rate.

The labor force in St. Johnsbury in 2001 was 3850 with an unemployment rate of 5.7%. Irasburg had 560 in the labor force with unemployment at 6.7%. Coventry had 490 in the labor force and an unemployment rate of 3.9%. Newport City had a labor force of 2060 with unemployment running around 10.3%.

Highgate's total labor force in 2001 was 1610 with an unemployment rate of 5.3%. St. Albans, with strong economic ties to the Burlington metropolitan area, had 3120 in the work force with an unemployment rate of 1.3%.

3.5.4 Housing

In 2000, the Town of St. Johnsbury had a total of 3482 housing units. Of these, 1802 are owner-occupied and 40 are seasonal rentals. The remaining are rentals ranging from senior housing to apartments with anywhere from 2 units to 47 units. St. Johnsbury has actually seen a small decline in housing units: in 1990, there were 3487 housing units available.

Irasburg experienced a 30% jump in housing from 1990 to 2000 with 493 housing units available in 2000. 331 are owner-occupied, 60 are seasonal, and the remainder is rentals.

Coventry also saw an increase in available housing with 283 units in 1990 and 435 available in 2000. 306 units were owner-occupied, 38 were seasonal and the remainder was rentals.

Newport City had an increase of 10% from 1990 to 2000, with housing units growing from 2128 to 2342. 1098 are owner-occupied, 145 are seasonal and the remaining are rental units.

In Highgate, the total number of housing units increased from 1247 in 1990 to 1375 in 2000 with 965 being owner-occupied, 134 seasonal, and the rest rental.

St. Albans experienced growth as well, with 2115 housing units available in 1990 and 2257 available in 2000. Of those, 1529 are owner-occupied, 384 are seasonal, and the remainder is rental units.

Town	**1990 Total**	**2000 Total**	**2000 Owner Occupied**	**2000 Rental**	**2000 Seasonal**
St. Johnsbury	3487	3482	1802	1640	40
Irasburg	380	493	331	102	60
Coventry	283	435	306	91	38
Newport	2128	2342	1098	1099	145
Highgate	1247	1375	965	276	134
St. Albans	2115	2257	1529	344	384

3.5.5 Transportation

Interstates 91 and 93 are the major four-lane highways leading into the northeastern part of the project area. Both of these major highways run north and south. St. Johnsbury is at the junction of these two interstates and is served by four interstate exits (average annual daily traffic counts are 5500 for Interstate 93 and 10,000 for Interstate 91). While this provides economic benefits, it also results in a high amount of truck traffic that winds its way through the town. The most direct route from upstate New York to the cost of Maine, which is U.S. Route 2 to U.S. 302, also goes through St. Johnsbury. St. Johnsbury is also served by rail lines from two directions. A significant number of commercial properties are adjacent to the rail lines. The community is 75 miles away from commercial air traffic located in Burlington and 65 miles from a commuter-airline airport in West Lebanon, New Hampshire. There is a State airport in Lyndon (5 miles away) capable of handling private aircraft.

In Coventry, Interstate 91 runs the length of the town's eastern border but does not offer a town exit. The town center is located just off U.S. Route 5 (the average annual daily traffic count for Route 5 is 2000). Newport State Airport is located in Coventry, is capable of handling private aircraft, and plans to expand. There is no rail service to the town, but service is available in Newport. The Town of Irasburg is located at a junction of State Routes 14 and 58, both small State roads (and average annual daily traffic count of between 1600 – 2200). There is no local airport or any rail service to the town.

On the other side of the state, Interstate 89 passes through both St. Albans and Highgate, which links both communities to the region, to the state and to Canada. U.S. Route 7 is a major State-maintained arterial which parallels I-89 to the west; Route 7 experienced an average annual daily traffic of 1100 vehicles. At Highgate, the other major highway, State Route 78, a two-lane road, runs east-west and connects Interstate 89 with Highgate Center and State Route 207, a smaller, two-lane road (also called Gore Road); Route 78 experiences between 3600 and 4100 vehicles, approximately 40% more average daily traffic than Interstate 89. The Lamoille Valley Railroad and the Franklin County Airport are located in the Highgate area as well. Franklin County Airport is the region's sole public airport facility, serving private aircraft only.

For St. Albans, Interstate 89, U.S. Route 7, and State Routes 36, 104 and 105 all provide easy access to all parts of Franklin County and beyond. The Northwest Vermont Public Transit Network operates a public-transit system in Franklin County. Lake Champlain is a much-valued corridor for recreational boat traffic. The New England Central Railroad is located in St. Albans and provides a means of moving both people (Amtrak) and freight. Please refer to the Vermont Agency of Transportation web site at http://www.aot.state.vt.us for more information.

3.5.6 Public Concerns

Beginning in 2001, VELCO met on numerous occasions with the planning commissions and selectboards of all of the potentially-affected towns. By letters dated May 28, 2002, and June 13, 2002, VELCO contacted the Coventry Planning Commission, the Northwest Vermont Regional Planning Commission, the Town of St. Johnsbury, the City of Newport, and St. Albans Town Planning Commission to provide them with the Northern Loop Project plans (see letters in Appendix D). Representatives of VELCO then met with the Northeastern Vermont Development Association on May 23, 2002, the Town of Highgate on June 3, 2002, the Town of Irasburg on June 10, 2002, the Town of Coventry on July 8, 2002, the Town of St. Johnsbury on July 17, 2002, and the Town of St. Albans on October 8, 2002. Refer to Table 3.3 below for the list of contacts.

On February 20, 2003, public site visits and a public hearing were held by the State of Vermont Public Service Board (see transcripts in Appendix B). No one from the public attended the site visits, but several people, including two landowners affected by the project, attended the public hearing. Their main concerns were the potential aesthetic impact of the new double-circuit line and possible electromagnetic field (EMF) health implications of the new lines.

Table 3-3

Phone Number	Town	Planning Commission Contact Person	Address
(802) 748-4331	St. Johnsbury (Caldonia County)	Priscilla Messier	1187 Main Street, Suite 2 St. Johnsbury, VT 05819
(802) 754-2242	Irasburg (Orleans County)	David Turner	P.O. Box 51 Irasburg, VT 05845
(802) 754-2288	Coventry (Orleans County)	Jeff Vinton	P.O. Box 104 Coventry, VT 05825
(802) 334-2112	Newport City (Orleans County)	Charles Elliott	222 Main Street Newport City, VT 05855
(802) 868-4697	Highgate (Franklin County)	James W. Pockette	468 Fortin Road (Home) Swanton, VT 05488 *or* P.O. Box 67 (Town Clerk) Highgate Center, VT 05459
(802) 524-2415	St. Albans Town (Franklin County)	Rebecca Perron	P.O. Box 37 St. Albans, VT 05481
Regional Planning Commissions			
(802) 748-5181	Northeastern Vermont Development Association (Covers: Caldonia, Essex & Orleans County)		Steve Patterson, Executive Director P.O. Box 630 St. Johnsbury, Vermont 05819
(802) 524-5958	Northwestern Regional Planning Commission (Covers: Franklin & Grand Isle County)		Ms. Catherine Dimitruk, Executive Director 7 Lake Street, Suite #201 St. Albans, Vermont 05478

3.6 Visual Resources

3.6.1 Landscape of the Study Area

Caledonia and Orleans Counties (St. Johnsbury, Coventry, Irasburg and Newport)

This region, known as the Northeast Kingdom, has an area of 2,027 square miles, representing 21% of the state. The land on the region's eastern border rises from the fertile Connecticut River valley up to the forested hills. In Caledonia and Orleans Counties, the land becomes a rural mosaic of farmland and forests with concentrated development in the river valleys. Gentle slopes and good soil sustain the farming.

The region has abundant clean water. Much of the region's western edge drains north and west as part of the Lake Champlain basin. There are more than 130 lakes and ponds concentrated in the region. The Clyde, Black, Barton and Willoughby Rivers, the main tributaries to Lake Memphremagog, run through the region. The topography of this region is discussed in Section 3.2.1.

The St. Johnsbury Substation is remote and not visible from either Interstate 93 or Higgins Hill Road (where it is located). Irasburg Substation is located off State Route 14, set back several hundred feet behind a densely vegetated hill. It is not visible from the roadway.

Franklin County (Highgate and St. Albans)

This area of the project is located wholly within the Champlain drainage basin and spans the 45th parallel. The landscape is either flat or rolling. Most of the countryside is rural agricultural land with a few wooded areas, wetlands, lakes and rivers dotting the landscape. No mountains or hills in the area are over 200 feet. The topography of this area is discussed in Section 3.2.1.

The proposed Highgate Substation, located immediately off of State Route 78, would be a consolidation of the existing VELCO Highgate Substation and the former Citizens (now VELCO-owned) Highgate Substation. There will be a single-fence line and one access road, thus allowing for better screening from Route 78. Currently there is a heavy screen of brush along Route 78, including alders, poplars, ash and dogwood, with an interruption of the screen by the VELCO access drive. The tap modifications planned for St. Albans will not be visible by the public because of its remote location.

3.6.2 Corridor Landscape Description

The proposed (and existing) corridor is described in Section 2.1.1. VELCO plans to co-locate the new 115-kV circuit with the existing 48-kV circuit on single-pole structures and thus will replace the existing 6.47-mile, 48-kV transmission line with a 115-kV/48-kV line using double-circuit construction. The new line will be rebuilt approximately pole-for-pole along the alignment of the existing 48-kV line, except where impacts on sensitive areas (wetlands) can be minimized with selective placements of new poles. This new line is being designed for single wood, laminated-wood or Corten™ steel poles which are rust-inducing poles that blends well with the dark green of conifers and the brown of deciduous trees in winter.

In addition to co-locating its 115-kV circuit with the existing 48-kV circuit, VELCO proposes to use the existing 100-foot, transmission-corridor right-of-way, even though its general practice is to maintain a 150-foot ROW for 115-kV circuits. Co-locating the transmission circuits, while maintaining the same 100-foot ROW width, would minimize the need for additional screening.

3.7 Cultural Resources

3.7.1 Prehistoric Sites

At the time of European American contact, the Abenaki people inhabited the area from Maine to Vermont and much of the southern portions of the Province of Québec. Common patterns of settlement and subsistence, and the lack of identifiable replacement cultures in the archaeological record suggest that the Abenaki people have a long history within this region. Antecedents to the Abenaki are represented throughout the Holocene Period, with representative archaeological sites from the Paleo Indian Period (*ca* 11,000 to 9,000 Years Before Present (YBP)), the Archaic Period (ca 9,000 to 3,000 YBP), and the Woodland Period (3,000 to 250 YBP). Descendants of the pre-European contact Abenaki still live throughout this region, in both organized Native villages (Odanak and Wolinak, First Nations reserves in Québec), and as enclaves within various cities and towns throughout New England (e.g., Swanton and Highgate, Vermont).

Prior to 20,000 years ago, up to three-kilometer-thick glacial ice covered New England. During the next 4,000 to 5,000 years, this glacial mass stagnated and underwent a process of melting, punctuated by relatively brief periods of glacial advancement. As the glaciers melted and the valley ice began to retreat, ice- and till-impounded lakes of meltwater formed.

Meltwater from glaciers around the world flowed into the oceans, resulting in the steady rise of sea levels relative to the land. By about 14,000 calendrical years ago, the rising sea levels filled the Saint Lawrence, Great Lakes and Champlain Basins to form a large estuary know as the Champlain Sea. Four phases of the Champlain Sea have been defined through the identification of relict beach terraces: Champlain Sea Maximum, Pre-Port Ken, Port Kent, and Burlington phases.

Glacial lakes, saltwater estuaries, and freshwater lakes emerged from these conditions. Meltwaters from glacial ice in adjacent valleys carried gravels, sands, silts, and clay sediments, which settled in lake basins and mantled bedrock and tills. Rivers then eroded glacial outwash, ice contact features, and former glacial lake sediments. The rivers transported these eroded sands, silts, and clays to the saltwater estuary and later freshwater bays. As the levels of the glacial lakes and saltwater estuary dropped with the retreating ice, the newly-exposed sediment deposits co-evolved with microbial and vegetative communities into a mosaic of soils.

These emergent landscapes did not present a flat and uniform surface. Numerous small lakes and ponds would have remained separated from the major lakes and estuaries within this undulating landscape, and surrounding soils would have supported vegetative communities appropriate to the climatic regime of the time period and topographic position. In general, the time depth for Native American occupation in northern Vermont runs throughout the Holocene Period, from roughly 11,000 years before present down to the present.

St. Johnsbury and Irasburg to Mosher's Tap Corridor:

This segment of the project falls within the borders of Drainage Basin 17 (Scharoun and Bartone, 2002), which includes Lake Memphremagog and its tributaries. Lake Memphremagog shorelines include bays and associated wetlands. These lake-associated wetlands, along with several existing and former smaller lakes, produce a wider variety and greater abundance of flora and fauna than any other ecological environment. As such, many archaeological sites may be associated with these freshwater marsh communities, given the high density of potential resources available most of the year.

However, no Native American sites have been recorded within the transmission-line corridor from Irasburg to Mosher's Tap. The closest-recorded sites are to the west on the South Bay of Lake Memphremagog (Frink, 2002). Pre-European Native American subsistence strategy consisted of a scheduled, seasonal movement about extended family territories. Within these territories, some high-yield areas, such as South Bay for fish, fowl, and grains, would be reoccupied virtually every year. Lower-yield areas, such as small (less-than-100 acre) deer yards, would have been used in rotation with other similar niches across the territory. As such, they might be occupied once or twice per generation.

There were 20 locations within the project corridor identified by the University of Maine at Farmington (UMF) that could be considered archaeologically sensitive for Native American sites (Appendix F). Paleo-lake-predictive models that Archaeological Resource Assessment (ARA) developed produced good examples of possible site types (See UMF and ARA studies in Appendix F).

Highgate and St. Albans:

Prehistoric man camped along the edge of the Champlain Sea. Rivers running into the sea-formed deltas, and as the Champlain Sea retreated these deltas were probably occupied by prehistoric man. Man could have occupied this area as early as 10,600 years ago. The glacial-outwash deltas of rivers most likely supported small to moderate-sized processing camps and kill spots by Native Americans. The forests that occur in soils that form in riverbank deposits, along primary mature rivers with relatively broad floodplains, would support moderate to large processing sites and long-duration encampments due to the diversity of potential resources. Small kill and resource-gathering sites are also likely to be present.

At Highgate, a widely diverse, low-density concentration of floral and faunal resources would predict early Native American site locations, small to medium-sized seasonal-hunting and gathering and resource-processing sites. The closest known site to the substations is located 1150 feet away. This Native American site, found in 1984, dates back to the Late Archaic to Early Woodland period (between 6000 and 2000 BC). Two other sites have been found within 1.2 miles of the two substations. (See ARA report in Appendix F).

The St. Albans parcel lies on bedrock classified as Parker Slate and Dunham Formation. The Dunham Formation dolostone is known to have been used by early Native Americans for ground stone tool production. The surrounding, oak-ash-hickory, northern-hardwoods-forest communities would have attracted a variety of game, thus encouraging small- to moderate-sized Native American processing camps and kill spots.

Mitigation measures are described in Section 4.3.7.

3.7.2 Historic Sites

St. Johnsbury and the Irasburg-to-Mosher's Tap Corridor:

Three transportation routes existed in this area prior to Euroamerican settlement. One, the Missisquoi River, flowed westward to Lake Champlain and the influential Abenaki settlement in Swanton. Another route was along the Clyde River, and the third route utilized Lake Memphremagog's outlet in Canada, the Magog River.

The Euroamerican settlers starting arriving in the late 1770s. Traders, military and travelers utilized a road that followed the Black River to its outlet at Lake Memphremagog in the present day vicinity of Newport. This area became a trading center, and the Abenakis from the upper Lake Champlain Basin settled along the shores and tributaries. In the late 1700s, the townships of Irasburg and Coventy were established, and in the early 1800s Newport was chartered. In spite of a rich Euroamerican history in this general area, no known European American archaeological sites within the project corridor are recorded in the Vermont Archaeological Inventory (VAI). The closest site is located on Lake Memphremagog's western shore in Newport (UMF, 2002).

Archival maps were studied to determine the probability of encountering additional European American archaeological sites within the project corridor. F.W. Beers, in the late nineteenth century, published county-wide atlas maps of Vermont. Beers' (1878) Orleans County maps provide a useful overview of historic settlement patterns near the project corridor. Some of the properties shown on the Beers maps may no longer stand above ground but do exist as archaeological properties.

Structures that once stood prior to 1859 or were built after 1925, but may not remain today (as archaeological sites), are not individually identified in this preliminary survey of the project corridor. Additionally, significant archaeological information may exist in association with historic properties that retain standing structures.

Two locations within the project corridor were identified by the UMF team. In Coventry, there are the remnants of a small cellar hole on the edge of the right-of-way. Cultural deposits related to the cellar hole may be located within the project corridor.

At another location west of Stony Brook in Coventry, a road and a stone foundation related to a sawmill were found.

Highgate and St. Albans:

Highgate was chartered as a New Hampshire town in 1763. The first settlers were the Dutch and Germans in the 1780s. Although the local population developed a number of industrial enterprises due to waterpower and an agricultural/ manufacturing village evolved, the parcel of land for this project appears to have only been used for agricultural purposes. As an interesting sidenote, the project is located along the historic overland route (Route 78) that was probably used by farmers and others from as far away as the Northeast Kingdom to transport goods to Missisquoi Bay and the Montreal market (UMF, 2002).

In the vicinity of the two Highgate substations, the VAI were reviewed for documented European American sites near or within the proposed substation area. No European American sites were near. Historic Beers and other maps were also reviewed, and again no former or existing European American structures were located with the proposed project's boundary. The closest recorded European American site is located 2420 feet away at Highgate Falls.

No European American sites, former or existing, are known to exist at the St. Albans project site.

With regard to historic structures in the project area, ARA consulted the 2002 updated listing of the The National Register (NR)'s online database (NRIS) on NR-eligible sites. They found only three properties anywhere near proximate to the project area in the Northeast Kingdom. One property was well to the south, one in the next valley to the east, and one over the hill in Newport. None of these NR-eligible properties are within the view shed of the northeast portion of the Northern Loop Project. No NR-eligible properties were found to be within the Highgate or St. Albans area, either (Frink, 2004).

3.7.3 Paleontological Sites

There are no identified paleontological sites in the project area. There is a sedimentary sequence of Ordovician age in the Chaplain lowlands, and this sequence does have some fossil remains.

However, it is not considered a particularly rich environment. (Frink, 2002). No areas identified as geologically unique because of their paleontological qualities have been identified. This suggests that the project area has few, if any, sites of paleontological significance.

← Return

Chapter 4. ENVIRONMENTAL IMPACTS

4.1 Climate, Meteorology, and Air Quality

4.1.1 Air Quality

This project has no components that would adversely affect air quality with the exception of locally-created dust during construction and emissions from construction vehicles and equipment. In particular, VELCO plans to construct the 6.47-mile Irasburg-to-Mosher's Tap line during winter which will minimize the potential for dust emissions.

This section describes the potential for air-quality impacts during the project's construction and operation and below provides calculations of air-quality impacts including the project's conformance with the Clean Air Act (CAA) and State and local requirements.

Any potential air-quality impacts will occur during the construction phase of the project. These would include potential air emissions that could occur during construction from fugitive dust (dust that escapes from a construction site) and equipment exhaust. Mitigation measures to avoid potential nuisance dust conditions and minimize construction-equipment impacts to nearby residents are described next and also in Section 4.3.1.

Fugitive-dust emissions would result from construction along the transmission line right-of-way (ROW) from Mosher's Tap to Irasburg and the associated staging areas and at Highgate, Irasburg, St. Johnsbury, and St. Albans Substations. Construction-equipment traffic, land clearing, drilling, excavation, and earth moving would be the major sources of dust emissions.

Dust emissions would vary substantially from day to day depending on the level of activity, the specific operation, and the prevailing meteorological conditions.

The use of construction equipment would also result in the emission of air pollutants associated with diesel combustion (NOx [oxides of nitrogen], CO [carbon monoxide], SOx [oxides of sulfur], PM10 [particulate matter with an aerodynamic diameter less than or equal to 10 microns] and reactive organic gases [ROG] from the fuel) (DOE, 2004). All construction-vehicle movements would be limited to the ROW or to pre-designated staging areas, the four listed substations, or public roads. Roads and active areas would have requirements either for watering or application of solid chloride pellets appropriate for dust control. Given the limited emissions of the project, it would not be subject to New Source Review (NSR) permitting under the CAA.

Less than about 100 residents in the vicinity of the ROW may be affected by a temporary adverse impact on their local air quality during construction. The average duration for a construction site to be active adjacent to any one residence or business is less than one month; construction of the new line is estimated to be completed in three months, and the Irasburg, St. Johnsbury and St. Albans Substations are estimated to be completed in two months, so any impact on the affected residents near those substations would be within those intervals. Detailed quantitative analysis follows below.

No significant air impacts would occur from ongoing operation and maintenance of the Northern Loop Project. Restoration of the ROW to natural vegetation will mitigate any fugitive dust emissions from the ROW itself. Atmosphere emissions would be produced only by the occasional maintenance vehicle that would be required to perform infrequent maintenance activities.

Historically, Vermont has had a few instances of federal air-quality standards being violated or State Implementation Plan (SIP) requirements being triggered. Since the early 1980s this has not been the case. Because of persistent regional air-quality-standards violations that continue in most of the northeastern states (only Vermont has no current standards violations), however, Vermont is required by the federal CAA to have a SIP for purposes of addressing regional ozone air quality. VELCO has estimated total emissions for each pollutant of concern.

Also, a conformity review of the proposed project (required under Section 176[c] of the CAA), was conducted in accordance with U.S. Environmental Protection Agency (EPA) and DOE guidance. The review shows that construction project emissions of PM_{10} and CO would be below regulatory thresholds and would not constitute a regionally significant action.

Because the project emissions during operation (post-construction) will be limited to those from occasional maintenance vehicles or equipment, the maximum year of project emissions calculated for the conformity review would be a full year of project construction. To be conservative in terms of estimating the maximum emissions that could possibly occur, a one-year period for project construction was assumed to cover all work with scheduled 6-day work-weeks and with no allowance for work-days lost to bad weather, time off, or holidays. The emissions included within the conformity review are as follows: (1) PM_{10} fugitive dust emission from construction and use of project access, staging areas, and tower and substation areas, (2) PM_{10}

and CO vehicle emissions from construction-access vehicles and heavy construction equipment, (3) possible PM_{10} and CO emissions from explosives blasting for tower and substation construction, and (4) emissions from the personal vehicles of construction workers commuting to and from the project-staging sites.

In accordance with 40 CFR 93.153(b), the total emissions estimates were compared to the applicable threshold emissions rates for the pollutants of concern, as listed in Table 4.1.1-1. For both PM_{10} and CO, the applicable threshold emission rate is 100 tons per year (tpy) (91 metric tons, or tonnes, per year [mtpy]). If the total emissions estimates were found to equal to or exceed the threshold emission rates for any pollutant of concern (shown below in Table 4.1.1-1), then a conformity determination would be required.

Table 4.1.1–1 Regulatory Threshold Emission Rates for PM_{10} and CO.

Criteria Pollutant and Air Quality Classification	Threshold Emission Rates (tons/year)
PM_{10} Moderate Non-attainment Area	100
CO Maintenance Area	100

Source: 40 CFR 93.153[b].

The following background assumptions were made for estimating the fugitive-dust emissions and equipment and vehicle emissions. Since precise information is not known, conservative assumptions (potential overestimates) are used (DOE, 2004). The analysis applies cumulatively to all project locations:

- There would be no new unpaved project-access roads for the Mosher's Tap-to-Irasburg Corridor.
- There would be approximately 90 new structures in that corridor.
- Each structure site would require a 100 by 30 ft (30 by 9 m) assembly area.
- All structures would be monopoles.
- There would be only tensioning/pulling sites (each 100 by 100 ft [30 by 30 m]) under active construction or use at any one time.
- Construction would last one full year (for the entire project). There would be two construction crews that would be working a maximum of 6 days a week throughout a year, or 313 days per year. Down time from bad weather, holidays or time off is conservatively assumed to be zero. Twenty-five percent of the segment of the project would be under construction at any one time. It should be noted that these (and the following assumptions are well in excess of the actual levels-of-effort or project task durations expected, so chosen such that the expected actual levels would easily be less than the calculated values.
- Of the 3.3 acres (1.34 ha) of the Highgate Substation, 86 percent (that is, 2.85 acres [1.16 ha]) would be under construction at any one time during the 8-month construction period.
- An additional 5 acres (2 ha) at the staging area adjacent to the line corridor would be engaged in construction activities for 3 months of 6-day work-weeks.
- Each construction crew would utilize the following equipment continuously for 8 hours each day: one planer or bulldozer, one wheeled loader, one excavator, one road truck, one

crane, and one water spray truck (on the conservative assumption that the work could not be done in winter as planned).

- All emissions estimates and assumptions, unless otherwise stated, are based on EPA's "Compilation of Air Pollutant Emission Factors" (AP-42, EPA 1995; also available at http://www.epa.gov/ttn/chief/ap42/)). To calculate the fugitive dust-emissions rate, the AP-42 daily emissions rate of 80 pounds of total suspended particulate matter (TSP) per acre of active construction per day (90 kg/ day) was multiplied by the percentage of PM_{10} in the TSP, which varies with soil type (Wild 1993). The proposed project would cross a range of soil types, from sandy loams (10 to 30 percent PM_{10}) to clay loams (30 to 50 percent PM_{10}). The highest possible percentage of PM_{10} was conservatively assumed to be the 50 percent maximum.
- VELCO would employ dust-control measures on unpaved roads and in work areas. (On the conservative assumption that the work could not be done in winter as planned). A control efficiency of 50 percent was assumed for typical dust control measures, such as watering roads and work areas. This conservative estimate is based on EPA dust-control efficiency assumptions for similar climates, ranging from 54 to 75 percent dust control (EPA, 2002).

In summary, the assumption basis for calculation is that there would be 15.2 acres in construction, 25% at the same time, over 331 days with 50% dust control. The result is a PM_{10} emission rate of 25.24 tpy (22.86 mtpy). The maximum PM_{10} emissions from construction-vehicle and equipment engines are estimated to be approximately 25 tpy. These conservatively-calculated results are well below the regulatory threshold rates shown above in Table 4.1.1-1. As noted above, this analysis was developed cumulatively to the project's five components:

St. Johnsbury: This substation project's impacts were included in the above analysis.

Irasburg. This substation project's impacts were included in the above analysis.

Mosher's Tap – Irasburg Corridor: As noted above, there may be local air-quality problems along this corridor, especially near sand and gravel operations. Given the typically sandy soils on upland areas throughout this corridor, VELCO will apply some dust-abatement measures when necessary; however, much of the construction is planned for winter under frozen ground conditions, when dust is typically not a concern, and the corridor's impacts were included in the above analysis.

Highgate: This substation project's impacts were included in the above analysis.

St. Albans: This substation project's impacts were included in the above analysis.

4.1.2 Land Features and Use

Geology and Soils

Geology

The construction and maintenance of this project will have generally little or no impact on the geologic features of the region. All of the existing substations previously used careful siting and designs to minimize impacts in the course of their original construction. The use of an existing transmission corridor also will minimize the impact to the area by avoiding the need to disturb virgin ground. There are no areas identified as unique geological areas on the Vermont Land Capability Maps, and it is thus reasonable to conclude that none exist along the existing corridor.

The transmission structures will be designed to withstand loadings caused by the accumulation of ice and heavy winds that exceed the expected earthquake loads in this area. The proposed design meets or exceeds the strength requirements to which VELCO's existing, 500 miles of high-voltage-transmission line in Vermont have been built. These lines have withstood, without damage, several earthquakes over their 50 years of existence (Guidelines for Electrical Transmission Line Structural Loading (1991), American Society of Civil Engineers, New York, New York).

Stone and gravel resources to be used for foundations, access-road upgrading, and building-construction purposes will be acquired locally. Supply pits located near the project's locations are plentiful and adequate to supply the project without disruption or adverse impact on the pits' ability to supply other construction activities in the area.

According to the Vermont Geological Survey (http://www.anr.state.vt.us/dec/geo/resourceinx.htm), "the U.S. Dept. of Labor, Mine Safety and Health Administration listed 42 mines in full time operation in Vermont in 2000. Of these, 2 were marble (dimension stone), 25 were slate (dimension stone), 1 was granite (dimension stone), 1 was talc and soapstone, 7 were limestone (crushed rock), and 6 were sand and gravel operations. 142 mines were listed with an intermittent operation status. Of these mines, 89 were sand and gravel operations and the rest included slate, granite, marble, sandstone, stone, traprock and limestone."

Soils

The effects on soil of construction and maintenance of the substation improvements and the proposed re-build of the transmission line, are described below. Most soil disturbance would occur during the construction phase of the project. The degree of impact and its duration will depend on construction activities, soil characteristics and construction season. Increases in erosion are likely to occur when the soil is exposed or disturbed, e.g., during clearing of the right-of-way where necessary. These impacts will prevail until sufficient revegetation has occurred to replace soil-retaining ground cover, i.e., for about six to twelve months (seeding and mulching of disturbed areas will occur within one week of disturbance, producing soil-retaining cover several weeks later). The potential for erosion is greatest when rainfall is heavy or during spring snowmelt conditions. The subsequent runoff from the events can cause sheet, rill or gully erosion.

The amount of erosion that will occur along the ROW will be a direct function of the amount of vegetation that must be cleared. In open cleared areas such as fields, erosion rates will remain relatively unchanged during construction because little further clearing is necessary. Because of the small area involved and VELCO’s plan to construct as much as possible when the ground is frozen, erosion due to ROW clearing and substation-site clearing is expected to be negligible.

All substation sites are currently existing and relatively flat, therefore requiring a minimal amount of grading in preparation for the new equipment. All access roads already exist, for both the transmission-line corridor and the substations.

To ensure that erosion will be negligible along the ROW in those sections where additional clearing will have to be done, VELCO will require the contractor to mulch all branches and scrub brush and spread the resulting mulch on the ROW as a ground stabilizer. Additionally, along steep areas, contractors will be required to follow VELCO’s standard erosion-control measures (see Appendix D) and seed and mulch on a daily basis.

All of VELCO’s erosion-control plans will be filed with the Public Service Board and the Vermont Agency of Natural Resources (ANR). VELCO will have to file an Erosion Prevention and Sediment Control Plan with ANR to show conformance with the Agency’s “Erosion and Sediment Control Plan Checklist.” Additionally, VELCO will have someone on site to oversee this compliance, and ANR will make field inspections regularly.

The movement of heavy machinery over the soil during construction and maintenance periods may affect local areas of soil. Such movement may result in compaction of surface soils or removal of upper soil horizons. Mechanical compaction of the soils generally reduces soil productivity by reducing rates of water filtration and percolation, restricting root penetration and increasing surface-water runoff or ponding. However, since the Irasburg-to-Mosher's Tap corridor already exists, construction is planned to occur in winter and existing access roads will be used, there is little potential for compaction impacts. If construction activities were to result in compaction that could adversely affect soil productivity, such as use of the land for agriculture or run-off or ponding, VELCO will mitigate these impacts by raking or plowing the area.

Excavation or backfill activities associated with road and pole construction and site work for the substations may also change soil characteristics, bringing rock fragments or boulders to the surface, interrupting infiltration and drainage and increasing erosion. VELCO intends to employ effective mitigation measures to reduce or eliminate potential impacts that could be associated with such disturbances (see Section 4.3.2).

Erosion problems may possibly still persist after the re-build of the transmission line in a few limited areas such as tower sites, access roads and excavations that have not been adequately restored to a good cover by natural-plant succession or artificial seeding. VELCO will pay special attention to restoration of disturbed areas in the ROW so as to minimize this possibility and to correct areas that have not been properly restored.

Agriculture

A problem that occurred during the 1998 ice storm was that farmers were without power to run milking machines and had to buy or borrow individual on-site generators to prevent critical problems with the milking herds.

Productivity of lands for cultivation or hay can be affected by pole placement. This will be mitigated, however, by placing poles at the edges of fields or in hedgerows, especially angle structures or guyed structures, except where it would be absolutely necessary due to the length of span required (and then placed only where poles already exist).

St. Johnsbury: Activity here will be entirely within the substation fence. There is no active agriculture on the lands surrounding the substation, and there will be no impact on agriculture in the vicinity.

Mosher's Tap – Irasburg Corridor: As noted, approximately 3/8^{ths} of a mile (0.375 mile) of corridor passes over active farmlands, and there are today, and will continue to be after the project's construction, 13 poles in fields such that the farmer must work around the poles. The poles therefore impose a certain constraint on farming in these areas. The proposed project will likely require fewer structures (being taller, they can be placed further apart), so VELCO will mitigate the impact on farming by reducing pole placements—potentially several placements—where possible in farm fields.

VELCO will work with individual land owners, including farmers, to determine optimal pole placements in the final design stage. All final design documents have to be filed with the Vermont Public Service Board and the Vermont Department of Public Service for review and approval prior to the start of construction. Despite passing through some active farmland, the six mile swath of replacement poles should not have a significant impact on the primary agricultural soils of the area.

Clearing and maintenance of the existing, 100-foot-wide corridor will not have an effect on agricultural use. In areas of soils with good agricultural potential, pole placement for this project might constrain future agriculture. Farm abandonment is an ongoing process locally, however, and loss of a few square feet of agricultural land to a pole placement would not affect a farmer's decision to continue or abandon farming.

This corridor would not have an effect on maple-syrup production; VELCO will provide additional aid to farmers in maintaining their maple-sap pipelines across the corridor if the pipelines—which connect tree taps to a sap-collection system—are attached to trees at the edge of the corridor.

Highgate: The substation expansion is planned for an area with no current agricultural use. Although the site has soils suitable for farming, if drained, because there is now no active agriculture on the lands surrounding the substation, there will be no impact on agriculture.

St. Albans: As noted, this site, already owned by VELCO, is in a small field (about 2.15 acres in size) that is currently cropped with hay. The addition of a small switching station will remove approximately 9,912 ft^2 of land for this purpose (less than ¼ acre). This site (84 ft. by 118 ft.), for which VELCO has an easement, will be graded.

An alternative to this tap-switching structure that was originally considered was to have a second line from this location to St. Albans Substation, a distance of approximately one mile. However, such a line would have more impacts, with at least 3 more poles in areas of current use. Furthermore, it would not obviate the need for the second structure at the tap location.

Forest Resources

St. Johnsbury: With all of the proposed activity to take place inside the fence, there would be no impacts on forest resources.

Mosher's Tap – Irasburg Corridor: Since much of this corridor is across farmland or abandoned farmland and along alder swamps, only a few areas of forest growth will need to be removed. In these areas, some trees will be removed to widen the corridor to 100 feet. Since the final design has not yet been completed, VELCO does not yet have an exact determination of all of the trees that might need to be removed; however, the clearing will not create a new corridor through forested areas, and this route will therefore have significantly less impact than the alternate corridors considered (see also mitigation measures described in Section 4.3.2).

The recent FERC order with regard to management of right-of-ways will not pertain to this line, as the project voltages do not exceed 115 kV. However, due to the attention that the FERC report brings to the importance of ROW maintenance to reliability, VELCO believes that the clearing of the corridor must be sufficient to ensure that reliability of service in the area will not be jeopardized.

Highgate: The area does not have any significant forest resources that would need to be cleared for this facility's expansion, such that no impacts will occur.

St. Albans: Since the area of this facility is in a field, no impacts will occur.

Earth Extraction

St. Johnsbury: No impacts are anticipated since the planned work will be all within the existing substation fence.

Mosher's Tap – Irasburg Corridor: Replacement of the structures within areas where gravel has been previously extracted will have no adverse consequences for future extraction. This corridor includes one minor relocation (versus the existing corridor), north of Irasburg Substation, to accommodate the landowner's plans to extract gravel in a particular location. It is possible that other pole relocations will be required in future to accommodate further extraction. VELCO will relocate the poles when necessary to allow extraction.

Highgate: Since there are no significant earth resources in the vicinity of Highgate Substation, there will be no adverse impact on earth resources.

St. Albans: Although existing in the area, earth resources would not be extracted from this already-disturbed location; also, the project will not affect resources adjacent to but not within the substation's site. There will thus be no adverse impact on the area's earth resources.

Recreation

St. Johnsbury: Since all of the proposed activity will take place inside the fence of the existing substation, there will be no impacts to any recreational activity.

Mosher's Tap – Irasburg Corridor: This project is sufficiently remote from the centers of recreation at Lake Memphremagog that there will be no adverse impact to any recreational opportunities. Since the project is contemplated as a pole-for-pole replacement of the existing line, no conflicts with any snowmobile trails that cross the corridor today will result. Some all-terrain vehicle (ATV) use already occurs in this corridor, and VELCO states that it does not expect that ATV use will increase as a result of the existing line's replacement.

Highgate: Existing ATV use of the project lands, which may constitute trespass on land owned by VELCO or Citizens, would probably be diminished outside the fences of the connected and expanded substation as the expansion will encompass a portion of the land (and trails) the ATV riders now use. Additionally, if VELCO determines that it could help limit the access to the surrounding area, an access gate will be constructed at the entry to the access road off Route 78.

Most of the area outside the substation will not belong to VELCO, however, so VELCO will have no jurisdiction over ATV use.

St. Albans: No impacts would be likely to accrue as no nearby recreational uses were observed or are known.

Residential, Commercial and Industrial

St. Johnsbury: No changes in land use of surrounding lands will be required for work inside the substation.

Mosher's Tap – Irasburg Corridor: No direct impacts on residences will be required for the project within this corridor. Any indirect impacts will relate primarily to aesthetics (see Section 4.3.6) or to perceived effects of electromagnetic fields (see Section 4.3.8).

As noted in Section 4.1.2, VELCO has slightly altered the corridor in one location to accommodate sand- and gravel-extraction on one landowner's property, thereby ensuring that no impacts to these extraction activities will thus occur.

Impacts to the "bed and breakfast" and restaurant on Heermanville Road in Coventry will relate primarily to aesthetics; no physical impacts will accrue (see Section 4.3.6). VELCO believes that perceived visual impacts from the presence of the line will not be significant because the line runs along the edge of the tree line at the very back of the property, and at present there are only three poles. In the final design stage, it may be possible by the use of longer spans to actually eliminate one of these poles; and VELCO would effectuate this by use a longer span if it can do so consistent with its design requirements.

Photographs 7, 8, and 9 in Appendix C show how the existing corridor is located along the beginning slope of the ridgeline, and illustrates how the forested hillside provides background that mitigates the view of the line. As seen in Photo 8, it appears that the existing distribution lines alongside the road actually have a more visible impact on the "bed and breakfast" and restaurant than would the transmission line in the background.

This is also true for the church near the tap location at the intersection of Alder Brook Road and State Route 105: the distribution line will have more visual impact than the proposed line as viewed from the church because the forested hillside will serve as a backdrop. Appendix C, Photos 19, 20, and 21, shows the area around the church. The aerial photo, Photo 19, shows that the line and tap location touches just a corner of the church property, away from the church itself.

Highgate: No impacts on residences or businesses would be anticipated, other than temporary traffic and dust impacts for the neighboring residence during construction. The area surrounding the substation is remote, with only one residence in somewhat close proximity (approximately 300 - 400 feet away). VELCO will apply the dust-control measures discussed in Section 4.3.1.

St. Albans: No impacts are anticipated on any residences or businesses, as none are nearby.

Airports, Navigation, Training Areas, Public Facilities and other land uses

St. Johnsbury: No changes in land use of surrounding lands will be required for work inside the substation.

Mosher's Tap – Irasburg Corridor: This corridor will not present conflicts with any such land uses. It is sufficiently remote from the Newport State Airport in Coventry that no air-safety measures are necessary, as mentioned previously in Section 3.2.7.

Highgate: No conflicts with public facilities have been identified, and no impacts are anticipated.

St. Albans: There being no such facilities in the project vicinity, no impacts are anticipated.

4.1.3 Hydrology, Water Quality and Water Use

4.1.3(a) Surface Waters

St. Johnsbury: No additional impervious surfaces will be created and no runoff created, so there will be no changes to any surface waters.

Mosher's Tap - Irasburg Corridor: No impacts are likely to the major rivers and waterbodies in the region. The corridor passes over Ware Brook, Stony Brook, and several intermittent and permanent streams. Ware Brook is in a pasture where the corridor crosses it, is open to the sun, and experiences some stream bank erosion (from cattle trampling). The widening of the corridor to the ROW's full 100 feet may remove some high shade from the other streams; however, shrubs (especially alders) along the streams will be retained, and there will be no significant adverse impacts to surface waters.

VELCO will follow its normal vegetation-management protocol, which does not allow spraying of herbicides within 30 feet of standing water. Normally, the growth of shrubs and thick vegetation along streambanks is promoted by the clearing of trees, and stream banks are stabilized by this growth (unless, as noted, they may be trampled by livestock. Crossing these streams with equipment is not contemplated, and erosion-control measures undertaken during construction, such as are described in Section 4.1.2, will ensure that no adverse impacts will accrue to surface waters. Accordingly, no impacts to the major rivers and waterbodies in the region will occur.

Highgate: A culvert beneath the proposed expansion will direct runoff from the northern portion of the property to the small stormwater pond. Because there will be no impervious surface created (the crushed stone of the substation being semi-pervious or pervious), runoff to this pond area, and subsequently off-site, will not be altered. There will thus not be any undue adverse effects from the expansion.

St. Albans: There being no surface waters in proximity to the St. Albans Tap site, no impacts will occur.

4.1.3(b) Flood Waters

St. Johnsbury: The project is not subject to floodwaters, and no impacts will occur.

Mosher's Tap - Irasburg Corridor: Although several structures along the valley floor of Stony Brook would be within the 100-year floodplain, single-pole power-line structures will not exacerbate flooding as poles will not impede floodwater movement or reduce floodwater-storage capacity.

Highgate: The project area is not within the floodplain or a floodway, so no impacts will occur.

St. Albans: The project area is not within the floodplain or a floodway, so no impacts will occur.

4.1.3(c) Ground Water and Water Supply

St. Johnsbury: Because this site is outside the local water-supply protection area, no impacts to public water supply will occur. Also, since there will be no additional creation of impervious surface, there will be no adverse water-supply impacts.

Mosher's Tap – Irasburg Corridor: The power line would not affect aquifer recharge, and, as no public-water supplies are located within the corridor, no adverse impacts will occur. Potential impacts to private wells are addressed in VELCO's annual, herbicide-treatment permits, which do not allow herbicide application in proximity to private wells. See Appendix D (VELCO's four-year vegetation management plan) & F (1998 herbicide permit).

Highgate: There being no public or private water supplies near this site, no impacts will occur.

St. Albans: No material impacts to groundwater recharge would accrue from this limited installation. There being no public- or private-water supplies near this site, no impacts will occur.

4.1.3(d) Wetlands

St. Johnsbury: Since all of this project element is contained within the substation fence, there will be no impacts to any wetlands in the vicinity.

Mosher's Tap – Irasburg Corridor: The project corridor passes over several wetlands. Since the project is contemplated as a pole-for-pole replacement of the existing power line, and since the wetlands are for the most part spanned between poles, impacts will have "minor individual and cumulative impacts" as determined by the Army Corps of Engineers General Permit #58 (see Appendix B). The types of wetlands involved–most of them being either alder swamps or "wet meadows" on abandoned farmlands–are not as likely to be seriously affected as would forested wetlands, in which VELCO would have to remove mature trees. A wetland Conditional Use

Determination for the project has been obtained from the Vermont Agency of Natural Resources (see Appendix B), which concludes that the project will not cause adverse impacts to any protected functions and values of the wetlands along this corridor.

Highgate: There will be an impact to approximately 33,881. $ft.^2$ of wetland at this site (less than $4/5^{ths}$ of an acre); it will be filled for expansion of the substation. However, the wetland has demonstrably low scores for functions and values, such that the consequences of this loss of wetland area would not be significant. Because these wetlands were determined to be classified as "Class 3," only the Army Corps of Engineers General Permit was required (Appendix B). As noted in this Permit, the Vermont Agency of Natural Resources does not require a permit for work done in or around Class 3 wetlands. However, the Agency did provide comments to the Army Corps of Engineers in connection with VELCO's application for a General Permit, but the Agency raised no consequential wetland issues.

St. Albans: There are no wetlands in the project vicinity, which is located in an upland field.

4.1.3(e) Water Quality

The Northern Loop Project will not adversely affect water quality since erosion-control plans for the various project elements are being developed that will serve to effectively prevent adverse construction impacts on water quality. There will be no post-construction operational impacts since the vegetation in the corridor will trap sediment, utilize nutrients, and capture any pollutants that may be present.

St. Johnsbury: The installation of additional equipment here, within an existing stabilized-substation area, will not cause any water-quality problems, as VELCO will use appropriate erosion controls. See Appendix D which outlines VELCO's erosion-control plan.

Mosher's Tap – Irasburg Corridor: The proposed project will not have any significant water-quality impacts for the reasons previously given in Section 4.1.2., i.e., implementation of erosion controls during construction and a vegetated corridor post-construction. See Appendix D, an outline of VELCO's erosion-control plan as noted above.

Highgate: The expansion of the substation here will not cause degradation of water quality because it does not require the creation of a significant area of impervious surface; hence stormwater runoff will not be unduly increased, and it will not result in the generation of any pollutants. The presence of a small existing stormwater pond on the site will serve to slow runoff and maintain water quality. Erosion control will be implemented during construction. See Appendix D.

St. Albans: No impacts are anticipated; erosion-control measures will be implemented during construction. See Appendix D.

4.1.4 Ecology

4.1.4(a) Flora - Terrestrial/Uplands

St. Johnsbury: Since all of the project elements at this site are to be within the fence, there would be no impacts to surrounding vegetation.

Mosher's Tap – Irasburg Corridor: There will be incremental clearing of vegetation, including trees, along the edges of the existing cleared corridor in the areas where it is forested. In these areas, grasses, herbs, shrubs, and sapling trees will grow to replace the cleared vegetation and will be managed over time in the same manner as the existing corridor's cleared areas. Given the nature of the area, most of the species expected to be present will be native species. The forest that will be cleared is of a type abundant in the area; accordingly, there would not be any loss of unusual flora. Although there are sugar operations in the vicinity and a plastic pipeline that taps maple trees was noted to cross the corridor, no maple-sugar tree that is tapped will be removed. The habitat is not significant for maple-sugar production, however, especially in comparison to the alternative corridors considered, and is not considered to serve other significant habitat functions. Non-forested areas, such as old fields and scrub/shrub wetlands, will not be altered by clearing.

Highgate: The consolidation and expansion of the two substations will remove some vegetation from the site, none of which is rare or endangered. For a description of this site's vegetation, see Sections 3.4.1 and 3.4.3 above. The plant communities on the undisturbed part of the site will remain in a state similar to their current condition.

St. Albans: Since this area is and will continue to be managed as a hayfield, no changes to vegetation will result after restoration of the hayfield soils following construction.

4.1.4(b) Flora - Aquatic/Wetlands and Waterbodies

St. Johnsbury: No impacts to aquatic or wetland vegetation in the vicinity are expected as construction will be limited to the already-disturbed area within the substation fence.

Mosher's Tap – Irasburg Corridor: Because many of the wetlands along this project corridor are dominated by speckled alder, which typically grows less than 15 – 20 feet tall, these will be retained with trimming. Understory species composition and "wet meadow" wetlands will not be altered as the line will be placed to pass over these wet areas. There is no change anticipated to any purely aquatic habitats, therefore, as again the line will be placed to span the few streams and brooks crossed.

Highgate: The wetland community, outside the one area of direct impact previously described (in Section 4.1.3), is not anticipated to be altered.

St. Albans: There are no wetland communities in the project vicinity.

4.1.4(c) Wildlife

4.1.4(c) i. Wildlife-Terrestrial/Uplands

St. Johnsbury: Because all of the proposed activity will occur within the substation fence, no habitat will be lost and no impacts are anticipated.

Mosher's Tap – Irasburg Corridor: There will be incremental clearing of the corridor, which may affect a few "edge specialists." However, VELCO does not anticipate that there will be any habitat changes that would cause loss of habitat value or wildlife populations or disruption of wildlife movement patterns. The single exception is a single small segment of deer-wintering habitat along the edge of the existing corridor that will be slightly affected. This segment that will be cleared is at the edge of a very large 1332-acre (about 2.1 square miles) mapped area and accounts for only 0.03% (three-tenths of one percent) of the available habitat; the remaining habitat will continue to provide shelter for overwintering deer as at present.

Highgate: There may be some displacement of songbirds; however, there will not be significant disruption of populations. There will be no change to the habitat on adjacent lands, so their use by snipe will be unaffected.

St. Albans: No impacts are anticipated as there is minimal evidence of wildlife use of the site and adjacent land.

4.1.4(c) ii. Wildlife - Aquatic/Wetlands and Waterbodies

St. Johnsbury: There is no aquatic or wetland habitat in the vicinity of St. Johnsbury Substation.

Mosher's Tap – Irasburg Corridor: Impacts are anticipated to be few if any since the power line will mostly span the wetlands and streams. Because the project is separated from South Bay of Lake Memphremagog by a high ridge, no adverse impacts to that resource will occur.

The alder swamps along Stony Brook will be minimally affected principally during construction, but, because that cover type can grow to maturity under power lines without affecting the lines, the existing habitat values will be preserved. Routine corridor maintenance will result in competing, taller, woody vegetation being cut, and successional stages favorable to alder will be preserved by not removing (but only trimming) alder.

Fisheries, found primarily in Stony Brook, will be protected because VELCO will preserve most overhanging shrubby and herbaceous riparian vegetation to maintain cover and erosion control. No construction-equipment crossings of streams are planned, and ROW clearing will be minimized near streams.

Highgate: A small area (approximately 31,881 sq. ft.) of scrub-shrub wet meadow will be lost to the project; however, this is a habitat type common in the area. More valuable, open-water habitats and stream courses nearby will be unaffected.

St. Albans: There is no aquatic or wetland habitat in the vicinity of the St. Albans project site.

4.1.4(d) Rare and Endangered Species

VELCO's consultants surveyed the existing ROW. With the exception of one State-listed species, considered below, the consultants found no federal- or State-listed threatened or endangered species, no rare species tracked by the Vermont Non-Game and Natural Heritage Program, and no other adverse impacts on vegetation or wildlife.

4.1.4(e) Threatened and Endangered Plants

St. Johnsbury: There are no such species in the project area.

Mosher's Tap – Irasburg Corridor: As noted, the State-listed Greene's rush (*Juncus greenei*) occurs in the vicinity of Irasburg Substation. Plants inventoried in 2001 and in July 2003 occurred outside the proposed building envelope and will be avoided during construction. Because plant populations are dynamic, however, there is always a possibility that new individuals, not previously mapped, will be discovered. If so, these will be mapped, and VELCO will avoid them. If these plants cannot be avoided, a permit to take any affected plants must and will be sought from the Vermont Agency of Natural Resources. The majority of the Greene's rush occurs outside the area of the proposed construction so that the population will remain viable. No other species of concern in the project vicinity are known, and no direct or indirect impacts will occur.

Highgate: There are no federally-endangered or State-listed species of plants known in the project vicinity, so no impacts will occur.

St. Albans: There are no federally-endangered or State-listed species of plants known in the project vicinity, so no impacts will occur.

4.1.4(f) Threatened and Endangered Wildlife

No federally-listed species of threatened or endangered wildlife is known to inhabit or use habitats (other than as transient individuals) within or near the project areas, so no impacts will result. Among listed State species, upland sandpiper may occur along the Mosher's Tap-to-Irasburg Corridor, although its presence specifically along this corridor has not been documented. In any case, management of a power-line corridor would be compatible with upland sandpiper which would be retained in the ROW.

4.1.4(g) Natural Areas

There are no identified natural areas at any of the project sites. Some have been identified within one mile of various project components; however, no impacts will occur since there will be no construction outside the specific areas proposed.

4.1.5 Socioeconomic Consequences

4.1.5(a) Population

Because the proposed corridor runs through low-growth agricultural areas and is in an existing corridor, and because the project is planned principally for the purpose of improving reliability for existing electrical loads, little change in future population distribution in Caledonia, Orleans or Franklin counties will result from the project.

4.1.5(b) Institutional Setting

VELCO expects the work crew to be at any one location no more than six months (the construction at the Highgate Substation), and for many locations the duration will only be a couple of months. Most of the individuals who will work on the construction of the re-built line and upgrades to the substations will commute from other areas. Long-range commuting is normal in Vermont, the country's most rural state. Consequently, the project will not affect the provision of local services, such as schools.

4.1.5(c) Employment and Economics

There could be a slight short-term increase in employment and some economic benefit in the towns affected by this project (St. Johnsbury, Irasburg, Coventry, Newport, Highgate and St. Albans) as people will be employed to help build the project. Some of the workers will be VELCO personnel, but others will be hired by contractors. VELCO expects the construction stage to take approximately one year.

Because the project requires special skills and experience, contractors and workers from outside the area will probably make up most of the construction workforce. A survey of transmission-line construction workers shows that local workers are more likely to be hired for clearing ROW than for other project tasks. Because of the large portion of the corridor already trimmed due to the existing line, few people will be hired for this purpose. Thus, constructing the new transmission line and upgrades to the substations will have only a slight, albeit positive effect on local employment.

Because non-local workers will be brought in to construct the project, some short-term increases will occur in local taxes and in sales by local commercial operations (e.g., restaurants, food markets, and entertainment and lodging facilities). The small number of workers, coupled with the short project duration and the ability to commute, will not affect the tourist industry in the area. VELCO estimates that it will take about 10 workers around two or three months to construct the new line, about 8 workers for a duration of six months to construct the improvements at Highgate, and 5 workers to do the work at Irasburg and St. Johnsbury for a period of six months. Assuming that all workers are from outside the region, and using a per diem of $120 (hotel and three meals), there could be an increase in sales of several hundred-thousand dollars.

Additionally, all the affected towns will see an increase in their revenues through taxes on the line and substations. In Vermont, utility facilities are subject to local assessment. VELCO submits the suggested value of its facilities in each town, usually based on construction costs, to the Vermont Public Service Board (PSB). The PSB, in turn, provides each town with the value submitted by VELCO. Each town then assesses these properties at fair market value, applying its and the State's educational tax rates to assess and then collect local and State taxes.

In the past, VELCO has taken an immediate one-time deduction for depreciation; no further depreciation occurs over the life of the facilities. As a result of this process, the towns and State would receive added tax revenues consistent with their tax structure throughout the life of the facilities.

For additions to each individual town's grand list, see Table 4-1 below.

Table 4-1:

Total Estimated Increase in Value of Improvements per Town

St. Johnsbury	$1,200,000
Irasburg	$2,000,000
Highgate	$5,500,000
St. Albans	$1,500,000
Irasburg – Mosher's Tap Line (Would be allocated between Towns of Irasburg, Coventry and Newport City)	$5,700,000

Landowners whose property is crossed by the line will be compensated for the fair market value of the easements. There are 39 landowners along the proposed 6.47 miles of corridor. Since the corridor already has an existing line that has been in place since the 1920s and before the homes were built, these landowners should not experience a drop in property values. Landowners abutting the substations should experience no impact to their property values.

4.1.5(d) Environmental Justice

VELCO and DOE have evaluated whether the project raises issues of environmental justice. VELCO has advised that the project does not raise environmental justice concerns, as discussed below.

Every substation and transmission line that will be affected by this project exists today. Anyone impacted by the project is already affected by the location of these substations or the existing line. VELCO states that it selected the preferred corridor for the line and decided to make related necessary improvements to substations serving what will become a looped transmission line because locating the project at existing sites minimized adverse impacts; VELCO states that it did not choose these locations to avoid non-minority or middle- and high-income populations that might oppose the project or increase easement-acquisition costs.

As stated previously, the areas served by the proposed project, especially the areas located in the Northeast Kingdom, lag the remainder of the state economically. One of the primary purposes of the project is to provide these areas the same level of electric reliability that most of the rest of the state enjoys. With reliable electric service, VELCO believes these areas will have a chance to compete for new industries and businesses and be better positioned to retain existing ones.

4.1.5(e) Housing

The proposed corridor will have little or no effect on housing since this project will not directly contribute to an increase in population. There are 13 houses along the corridor within 500 yards. The power line will be visible from these homes. For the most part, the line is located behind the homes.

The substations are for the most part well hidden, Highgate being the exception. All substations exist today, however, and therefore there should not be any incremental impact on housing values.

It is important to note that the project's ROW corridor is in an area that is already impacted as the transmission-line corridor has been in place since the 1920s. Also, along the roadsides are distribution lines, already affecting the landscape and views.

The effect on the resale value of houses and property in proximity to, or in sight of transmission lines, has been studied in urban, suburban and rural settings. Some studies have identified no long-term effect, finding that the real-estate market is deep enough so that some buyers will pay a price for the land or housing in close proximity to a line that is comparable to prices for similar properties at a distance from a line. After a line is built, buyers will pay a price that is similar to the value prior to the existence of the line (Vredenburgh 1974, 1982). Other studies have shown a 16% to 29% drop in price of properties along a line, with the smallest properties experiencing the greatest drop in selling price. Decreases in selling prices taper off with larger lot sizes and increased distance from the line, regardless of the size of the line (Kellough 1980). A more recent study in Toronto, evaluating more than 27,000 residences and using actual transaction prices, not appraisals, found conclusive evidence of a loss in value between 4% and 6.2% (Haider, Murtaza; Haroun, Antoine; Miller, Eric J.; 2004).

Effects generally appear under two short-term conditions: (1) sales of properties—subdivided before the line was proposed—during planning or construction, or soon after the line is built; and (2) sales or construction in progress that is slowed or cancelled when the line is proposed. Although neither of these conditions may reduce long-term sales values, they might have an adverse effect for a short time. There should be minimal short-term or long-term effects on resale values because power lines and substations already exist throughout the area in essentially the same locations.

4.1.5(f) Transportation

Direct transportation impacts will be limited primarily to the construction period and will be minor. Some slight interference with local and tourist traffic on the routes used by construction-related vehicles might occur, along with a slight increase in noise and dust. The indirect impacts of views from the roads will be greater than direct impacts. The line will be more visible to travelers on some of the roads running through Irasburg and Coventry. See Section 4.1.6 for a discussion of visual impacts.

4.1.5(g) Public Concerns

Starting in 2001 and continuing through 2003, VELCO met on numerous occasions with the planning commissions and selectboards of all of the potentially-affected towns. By letters dated May 28, 2002, and June 13, 2002, provided in Appendix D, VELCO contacted the Coventry Planning Commission, the Northwest Vermont Regional Planning Commission, the Town of St. Johnsbury, the City of Newport, and the St. Albans Town Planning Commission to provide them with the Northern Loop Project plans. Representatives of VELCO then met with the Northeastern Vermont Development Association on May 23, 2002, the Town of Highgate on June 3, 2002, the Town of Irasburg on June 10, 2002, the Town of Coventry on July 8, 2002, the Town of St. Johnsbury on July 17, 2002, and the Town of St. Albans on October 8, 2002 (see Table 3.3 above for a list of town officials to whom notices for this project were sent).

On February 20, 2003, public site visits and a public hearing was held by the State of Vermont Public Service Board. No public attended the site visits, but several persons (including two land owners) attended the public hearing (see transcript in Appendix B). Their main concerns were the aesthetic impact of the new double-circuit line and potential electromagnetic field (EMF) health implications of the new lines.

4.1.6 Visual Resources

4.1.6 (a) Visual Impact Analysis Criteria

While a power line is an intrusion on any scenic rural area, the corridor from Irasburg to Mosher's Tap already has an overhead line (48 kV) as well as numerous distribution lines scattered throughout that are visible from almost any vantage point in or near the proposed new line. In planning and constructing this re-built line, actions will be taken by VELCO to provide mitigating measures that would minimize the impact. See Section 4.3.6.

Although not a sufficient test to satisfy NEPA requirements, the following evaluation is useful and informative as a measure of potential visual impact. The criterion used in the State of Vermont to analyze "adverse, undue" impacts is the "Quechee Test." The Quechee Lakes methodology involves a two-step inquiry. First, will the impact of the proposed project be adverse? The test for adversity turns on "fit," i.e., does the proposed project fit within the context of the area in terms of form, height, color and use? A project would have an adverse impact on the aesthetics of an area if its design is out of context or aesthetically inharmonious with the area in which it is located.

If it is found that the impact would be adverse, the second step is to determine whether such an impact would be "undue." Such a finding would be required if: (1) a proposed project violates a clear written community standard intended to preserve the aesthetics or scenic beauty of the area; (2) it would offend the sensibilities of the average person; or (3) generally available mitigating steps will not be taken to improve the harmony of the proposed project with its surroundings. This project is in conformance with this test.

First (and assuming that project facilities, all proposed to replace or improve existing transmission-line or substation facilities, are out of context and thus “adverse”), there is no clear written community standard that identifies this corridor or this landscape as unique or scenic, and, to the extent there are standards for transmission facilities in relation to scenic resources, the project conforms by using existing ROWs as noted in Section 2.2.

Second, this project should not be “shocking or offensive” to the casual observer: It is a normal expansion of an existing and accepted land use and service to support increased electrical demand and improve reliability, and the proposed facilities are not in contrast with, and do not compromise the quality of, unique, rare, or even high-quality scenic landscapes.

Third, the project will use mitigation measures to minimize any adverse visual effects, measures described below in Section 4.3.6.

Overall, the line’s visual impact will not be significant as the reconstructed transmission line will have the same location and the impact of its increased height will be offset by the mitigation measures described below in Section 4.3.6. In addition, VELCO will consult adjacent landowners about the specific location of each pole, which typically can be moved by up to 20 feet from the placements for the existing poles to reduce adverse visual impacts.

4.1.6(b) Visual Impacts along the Proposed Route

The description of the existing corridor that will be used for the project is provided in Section 2.1.1. Co-locating the transmission circuits on the same pole structures, along with maintaining the existing 100-foot-ROW width, will require the new poles to be approximately 20 feet higher than the existing structures in most locations (from approximately 44 feet above ground to 66 feet above ground). See photo simulations in Appendix C. Since most mature woodland is in the 60-70 feet range, substantial screening is provided in most of the wooded areas (3.5 miles out of the 6.47-mile corridor).

There now exist two sections of this line that are under-built with distribution. In those two sections of the line where the existing Citizens 12.5-kV distribution line is co-located on the existing 48-kV structures, the new poles will need to be approximately 30 feet higher (to about 70 feet). The first segment is approximately 1.1 miles long, from Citizens' Irasburg Substation to the Linton Parcel, and the other section is approximately 1.3 miles long, along Alderbrook Road in Coventry from the Knight Parcel to the W. & G. Lawson parcel.

The first segment with distribution under-build is not visible for the first one-half mile from the Citizens substation. It is visible, however, when it crosses the open landscape from Back Coventry Road to Heermanville Road, a distance of 1000 feet. Because of the single pole and insulator symmetry, the change to the existing situation will not be conspicuously evident. The second 1.3-mile segment occurs along Alderbrook Road near Mosher's Tap; mitigation of visual impacts for this segment is described in Section 4.3.6.

The existing transmission corridor, which has been in this location for many years, extends approximately 6.47 miles. With the exception of a few locations, the existing line is located in wooded areas or is otherwise remote from view, and the line upgrade will occupy the same corridor. Accordingly, the upgrade should be hardly noticeable in these wooded areas.

The areas of most visual significance (with respect to both the existing line and the proposed new line) are limited to two areas: (1) where the corridor currently extends approximately 1000 feet from Back Coventry Road to Heermanville Road (at approximately mile 1.1 – 1.3) and (2) in the Alderbrook Road neighborhood, including Mosher's Tap. Mosher's Tap currently consists of two structures with rigid insulators for two 120-kV circuits. The southern circuit is Citizens' former 48–kV line, where the line from Irasburg connects. The proposed project is to carry the 115-kV circuit under the existing two circuits to an H-frame north of the 120-kV line and then back south to tie into the existing 120-kV line formerly owned by Citizens. VELCO also proposes to add a new double-switch structure on steel poles east of Alderbrook Road. It appears that the area under the existing tap is wetland, and, since it is close to the road, it will be difficult to screen. See photos in Appendix C. Mitigation is discussed in Section 4.3.6.

4.1.6 (c) Visual Impacts at Substations

4.1.6 (c) i. St. Johnsbury Substation

All of the improvements will be within the existing fence, and none of the substation is visible from the closest roads. Therefore, there will be no adverse aesthetic impact.

4.1.6 (c) ii. Irasburg Substation

The Irasburg Substation is set back several hundred feet behind a densely-vegetated hill and is not visible from the roadway. The new improvements will also not be visible from the roadway. There will be no adverse aesthetic impact.

4.1.6 (c) iii. Highgate Substation

By combining the two existing substations and utilizing only one of the two access driveways, the entire complex will be better screened with conifers, cedar and hemlock planted by VELCO. The proposed planting includes a cedar hedge (4 – 5 ft.) along the south and partial east side of the substation fence (exposed Route 78 frontage). The hedge will be planted a minimum of 10 feet from the fence line, to meet the safety-clearance standards. The east side of the substation is already partially screened. At the former access drive, VELCO will plant three 2”-caliper, native apple trees and 35 gray dogwoods (3 to 4 ft. tall), which are native shrubs suitable for the conditions of the substation site, to screen the yard service and equipment from view. Roadside plantings and a loose cedar hedge (4 – 5 feet will screen substation equipment located 58 feet back from the fence line.[15])

The combination of the two substations into one organized facility served by only one roadway will also improve the visual impact (Boyle, 2002).

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15 A note on the type of trees that can be planted for mitigation: Since there are numerous overhead transmission lines going in and out of the substation, the type of plantings that can be used are limited to slow-growing trees and shrubs (see discussion in the ROW Maintenance Plan, Appendix D).

4.1.6(c) iv. St. Albans Substation

Although there will be improvements (see Section 2.1.2 for a complete description of improvements), such as grading and the addition of a control hut, the site is not visible to the public due to its remote location. Additionally, the existing switch will be removed, and the disconnect switches replacing it will be 30 feet lower in height (a reduction from 85 feet to 55 feet).

4.1.7 Cultural Resources

In November of 2001, VELCO retained the services of the University of Maine at Farmington's (UMF) Archaeological Research Center to perform a preliminary site-sensitivity study along the existing 48-kV line from Irasburg to Mosher's Tap and at the Highgate Substation area. See Appendix F.

In the summer of 2002, as the project became more defined, Douglas Frink of Archaeology Consulting Team was retained to assess the entire project's archaeological impacts. Mr. Frink performed an Archaeological Resource Assessment Study (ARA) for the Irasburg, Coventry and Newport area as well as for the St. Albans area. Due to the high sensitivity of the Highgate region, Mr. Frink also conducted a Phase I Archaeological Site Identification Study for the Highgate Substation area.

VELCO filed Mr. Frink’s ARA (see Appendix F) for the proposed Irasburg-to-Mosher’s Tap, 115-kV line with Mr. Scott Dillon of the Division of Historic Preservation on September 17, 2002.

On March 31, 2003, VELCO received a letter from Emily Wadhams, State Historic Preservation Officer, making six recommendations to be included as conditions to the Certificate of Public Good issued by the Vermont Public Service Board. In a stipulation between VELCO, Citizens, the Vermont Department of Public Service, and the Vermont Agency of Natural Resources, which was accepted by the PSB in connection with its issuance of a Certificate of Public Good for the project, VELCO affirmed that it would comply with all the recommendations (Appendix B). See list supplied below.

The Division concurred with the consultants’ conclusion that no historic properties will be affected by the improvements proposed at St. Albans Tap or Highgate Substation (see letter in Appendix B).

The consultants did identify twenty potential precontact (prehistoric) and two historic, archaeologically-sensitive areas along the proposed Irasburg-Mosher's Tap upgrade; the twenty-two archaeologically-sensitive areas are depicted in the survey in Appendix C. The Division requires additional archaeological evaluation if the identified areas cannot be avoided or protected from impacts during project construction, and VELCO accordingly decided to avoid all identified areas so that no such review will be required.

The Division, again, recommended six conditions which were incorporated into the stipulation (see Appendix B) included in the Vermont Public Service Board's Certificate of Public Good for the Northern Loop Project. The six conditions are:

1. VELCO will map the twenty-two archaeologically sensitive areas on the site plan and label them as not-to-be-disturbed buffer zones. Copies of this revised site plan will be submitted to the Public Service Board and to the Division.

2. Topsoil removal, grading, scraping, cutting, filling, stockpiling, logging or any other type of ground disturbance is prohibited within the buffer zones without written approval of the Public Service Board and the Division. The project contractor will be fully notified about the buffer-zone restrictions.

3. In the event that maintenance of one or more of the buffer zones is not possible due to project constraints, an archaeological study to identify sites in the buffer zone will be carried out by a qualified archeologist prior to construction. The study will be scheduled accordingly so that mitigation measures that may be necessary can be satisfactorily planned and accomplished prior to construction.

4. All archaeological studies and assessments must be conducted by a qualified consulting archeologist and must follow the Division's "Guidelines for Conducting Archaeological Studies" in Vermont. VELCO's archaeological consultant should submit any scope of work to the Division for review and approval.

5. No archaeological sites will be impacted until any necessary mitigation measures have been carried out. Mitigation may include but is not limited to further site evaluation, data recovery, redesign or one more proposed project components, or specific conditions that may be imposed during construction.

6. Proposed mitigation measures will be discussed with and approved by the Division prior to implementation, and a copy of all mitigation proposals will be filed with the Public Service Board. The archaeological studies will result in one or more final reports, as appropriate, that meet the Division's Guidelines for Conducting Archaeological Studies in Vermont. Copies will be submitted both to the Division and to the Department of Public Service.

The areas under consideration for the Northern Loop Project will not affect "traditional Cultural Properties." Although the Abenaki (aka Western Abenaki) are not recognized by the State of

Vermont, Mr. Douglas Frink of Archaeology Consulting Team presented the project to Chief April Rushlow of the Abenaki, and she did not identify any cultural resources that would be affected or raise other concerns.

The Project will not have an undue adverse impact on historic sites. No known archaeological sites exist within the project boundaries.

As noted, the University of Maine at Farmington’s (UMF) Archaeological Research Center performed a preliminary site-sensitivity study along the existing 48-kV line from Irasburg to Mosher’s Tap and at the Highgate Substation area. The report concluded that 22 archaeologically-sensitive areas exist in the Irasburg-to-Mosher’s Tap corridor and that, if the identified areas were to be affected by the project, additional archaeological work would be necessary. See Appendix F for the complete report.

The UMF report divides the corridor into three sections. The first is the Black River segment, and in this segment 15 archaeologically sensitive areas (ASA) where identified. All but two ASAs within this segment are sensitive for Native American cultural resources and can generally be characterized as small, discrete portions of glacial features overlook the Black River floodplain. These areas provide potential travel routes.

Two ASAs are sensitive to potential historic Euroamerican cultural resources; one is a stone cellar hole located outside of the 100-foot corridor, and the second is sensitive because of a discontinued historic road is located nearby along with a stone foundation remnant.

The second section, the Stony Brook segment, contains 5 archaeologically sensitive areas. The ASAs within this segment are sensitive for Native American cultural resources.

The last section, the Alderbrook Road segment, has 2 archaeologically sensitive areas that are considered sensitive for Native American cultural resources.

Douglas Frink of Archaeology Consulting Team also performed Archaeological Resource Assessments (ARA) for the entire project. For the proposed St. Albans-area improvements, he concluded that although predictive modeling ranks the location moderately high for archaeological sensitivity, the ground slope is too steep to have supported Native American residential or resource-processing camps. No further archaeological investigation was recommended by Mr. Frink (see Appendix F). The stipulation from the Department of Historic Preservation (mentioned in Section 3.7 above) also covers this area, and VELCO will comply.

The ARA for the VELCO and Citizens' Highgate Substation area identified the site as highly sensitive for historic properties. Mr. Frink conducted a Phase IB Archaeological Site Identification Study, which yielded no significant Native American or European American archaeological information. VELCO filed Mr. Frink's reports on the Highgate Substation area with the Department of Historic Preservation and will comply with its stipulation as discussed above (refer to Appendix B).

4.1.8. Health and Safety

4.1.8 (a) Substation Environment

4.1.8 (a) i. Electric and Magnetic Effects

All matter contains electrically-charged particles. Most objects are electrically neutral because positive and negative charges are present in equal numbers. When the balance of electric charges is altered, electrical effects, such as static-electricity attraction between a comb and hair, or sparks when walking on a synthetic carpet in the wintertime, are experienced. Electrical effects both in nature and in society's use of electricity (generation, transmission and consumption) produce electromagnetic fields (EMF) (www.niehs.nih.gov/emfrapid; Valberg, 2002).

The work put into electrically charging something is measured by the voltage. Voltage is the "pressure" of the electricity and is analogous to the pressure of water in a plumbing system. Electric charges push and pull on each other. Opposite charges attract, and like charges repel. Each electric charge generates an electric field that exerts force on other nearby charges. An electric field is a measure of force per unit charge but is usually expressed in units of volts per meter (V/m) (www.niehs.nih.gov/emfrapid; Valberg, 2002).

When electric charges move, an electric current exists, and a current generates a magnetic field. Units of electric current are amperes (A), and current measures the "flow" of electricity, somewhat like the flow of water in a plumbing system. The current of moving electric charges produces a magnetic field that exerts force on other moving charges. As such, a magnetic field expresses the force per-unit length of current-carrying wire (newtons per amp-meter) but is usually expressed in units of gauss (G) or milligauss (mG). Electric motors use magnetic-field forces to turn electricity into mechanical work. Conversely, generators rotate loops of wire through magnetic fields and generate electric power from mechanical energy (www.niehs.nih.gov/emfrapid; Valberg, 2002).

Everyone is exposed to a wide variety of natural and man-made electric and magnetic fields each day. EMF fields can be slowly varying or steady (DC fields) or can vary in time (AC fields). When the time variation of interest corresponds to that of power-line currents, i.e., 60 cycles per second, the fields may be called 60 Hertz (Hz) EMF (www.niehs.nih.gov/emfrapid; Valberg, 2002).

Man-made magnetic fields are common in everyday life. Many childhood toys contain magnets. "Permanent magnets" can generate strong, steady magnetic fields. Typical household magnets (e.g., refrigerator-door magnets) produce 0.1 to 0.5 G. Magnetic resonance imaging (MRI) is a medical diagnostic procedure that puts humans in much larger fields (20 G) and is preferred over X-ray because of its safety. These are primarily DC magnetic fields (www.niehs.nih.gov/emfrapid; Valberg, 2002).

The earth's atmosphere produces slowly varying electric fields (about 100 to 10,000 V/m) that regularly discharge as lightening strikes. Magnetic fields are produced by the earth's core and can be easily demonstrated with a compass needle. The size of the earth's magnetic field in North America is about 570 mG. Knowing the strength of the earth's field provides a perspective on the size of power-line electric and magnetic-field measurements. The earth's steady electric and magnetic fields do not have the 60-cycles-per-second (60 Hz) time-variation characteristic of power-line EMF but are otherwise indistinguishable. For example, a magnet spinning at 60 Hz can produce a magnetic field just like the magnetic field produced by 60 Hz power-line currents (www.niehs.nih.gov/emfrapid; Valberg, 2002).

Higher magnetic field levels are found near operating appliances. For example, can openers, mixers, blenders, refrigerators, fluorescent lamps, electric ranges, clothes washers, toasters, portable heaters, vacuum cleaners, electric tools, and many other appliances produce magnetic fields of size 40 – 300 mG at distances of 1 foot. Magnetic fields from personal-care appliances held within one-half foot (such as shavers, hair dryers, massagers) can produce 600 – 700 mG. In the school and work environment, copy machines, vending machines, video-display terminals, electric tools, lights and motors are all sources of EMF (www.niehs.nih.gov/emfrapid; Valberg, 2002); see also a recent study available at http://www.dhs.ca.gov/ehib/emf/RiskEvaluation/riskeval.html; a recent study from the U.K. National Radiological Protection Board at http://www.nrpb.org/press/press_releases/2004/press_release_5_04.htm , and http://www.nrpb.org/ publications/documents_of_nrpb / abstracts/absd15-2.htm; and a recent paper issued by the Pacific Northwest National Lab by Steven Goheen, summarized at http://www.pnl.gov/news/2004/04-02.htm).

Electric-transmission lines, distribution lines, and electric wiring in buildings carry alternating currents (AC) and voltages that produce 60 Hz EMF. The size of the magnetic field is proportional to the current, and the size of the electric field is proportional to the voltage; both fields decrease rapidly with distance from the source of the electric field. When EMFs are produced by different sources (e.g., adjacent wires), the net EMF may be the sum total of both or the net EMF may be less (EMFs may add or partially cancel). Inside residences, typical baseline, 60-Hz magnetic fields (away from appliances) range from 0.5 to 2.0 mG. These fields arise from electric appliances, outdoor distribution wiring, indoor wiring and ground-return pathways. The time-varying, power-line magnetic fields add or subtract to the steady field of the earth (570 mG) (www.niehs.nih.gov/emfrapid; Valberg, 2002).

For the substations in this project, VELCO does not believe that the EMF levels will be changed significantly. VELCO proposes no changes to the substations that will create more EMF directly. The only change in the level of EMF will be the flows on the transmission lines in and out of the substations, addressed in Section 4.1.8. See EMF measurements in Appendix F. Modeling results of peak loadings ("worst case") show a predicted EMF level at the edge of the 100-foot ROW (50 feet on both sides of centerline) of approximately 16 mG which is below any existing U.S. standard. This level of EMF is about the same as the level found 1 foot from an electric shaver. (See the table of "Bathroom Sources" and more discussion on EMF levels that appear below in section 4.1.8 (b), "Transmission Line Environment."

4.1.8 (a) ii. Audible Noise

Audible noise will emanate from transformers, reactors and the cooling fans used on equipment. St. Johnsbury Substation will have no such new equipment added; therefore, there should be no increase in audible noise. The same applies at Irasburg and St. Albans Substations.

VELCO had considered installing synchronous condensers as additional equipment at Highgate that would have had to meet noise specifications; Synchronous condensers do have a noise component, which is vendor- and design-specific such that VELCO could not state at this time what the exact nature of the noise might have been. For example, one vendor's information states that its synchronous condensers, at 1 meter (39.37 inches) distance and depending on the enclosure type, could have a noise component ranging from 80 to 90 decibels (dBA).

Under the proposed general arrangement of the substation, the synchronous condensers were to be located in the northwest corner of the proposed substation. However, VELCO has decided not to install the synchronous condensers at this time.

4.1.8 (a) iii. Radio and Television Interference

In the process of the substation upgrades, VELCO will make sure that the improvements will be designed so that radio or television interference will not exceed 100 microvolts/meter at a distance of 1500 feet from any energized component in the substation. This limit applies to all frequencies between 0.4 megahertz (MHz) and 400 MHz. This frequency range also covers television interference for which the terminal will be designed to ensure that there are no "gap-type" discharges from switches, buswork, or insulator hardware.

The substation improvements will also be designed to ensure that any interference with power-line carrier and open-wire, carrier-communication systems, which generally have a frequency spectrum of 5 kilohertz (kHz) to 500 kHz, is reduced to permissible levels. As noted in Section

4.3.9 below, VELCO will ensure that any interference with radio or television reception is eliminated.

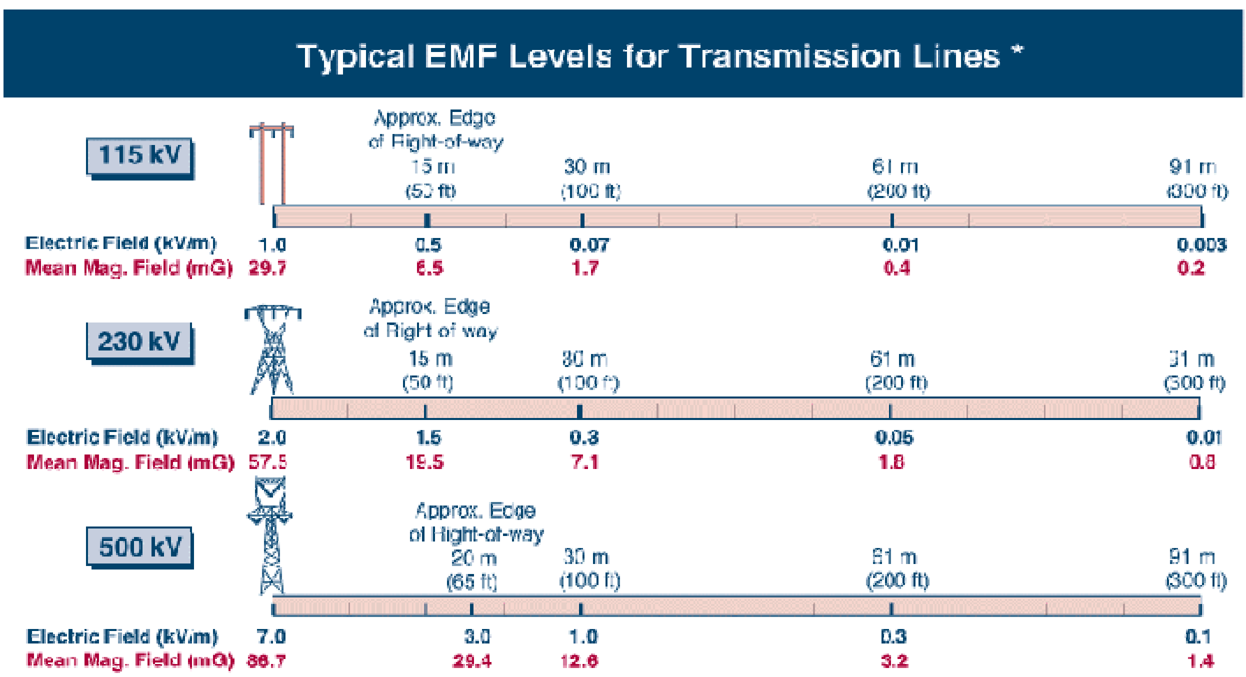
4.1.8 (b) Transmission Line Environment

The proposed line from Irasburg to Mosher's Tap will be a double-circuit, 115-kV/48-kV transmission line. The maximum current per phase in the line will be 217 Amps with peak loads of 43 MW. The proposed line will be constructed as shown in Figure 1-6. The proposed right-of-way is 100 feet and will be cleared. Edge-of-ROW values used herein are based on that 100-foot cleared area. Corona-generated audible noise and radio and television interference are not expected from the proposed line.

Corona effects from transmission lines include audible noise, radio interference, television interference, visible light, and production of photochemical oxidants, especially ozone. These effects are produced by ionization of the air (corona) near the surface of the high-voltage, transmission-line conductors and are primarily associated with transmission lines that have voltages of 230 kV or higher. VELCO maintains its lines regularly and acts promptly in response to landowner or other inquiries to make repairs, to ensure that corona effects from leakage do not increase above the levels produced at given voltages. This project involves voltages of 115 kV and lower so there will be no corona effects.

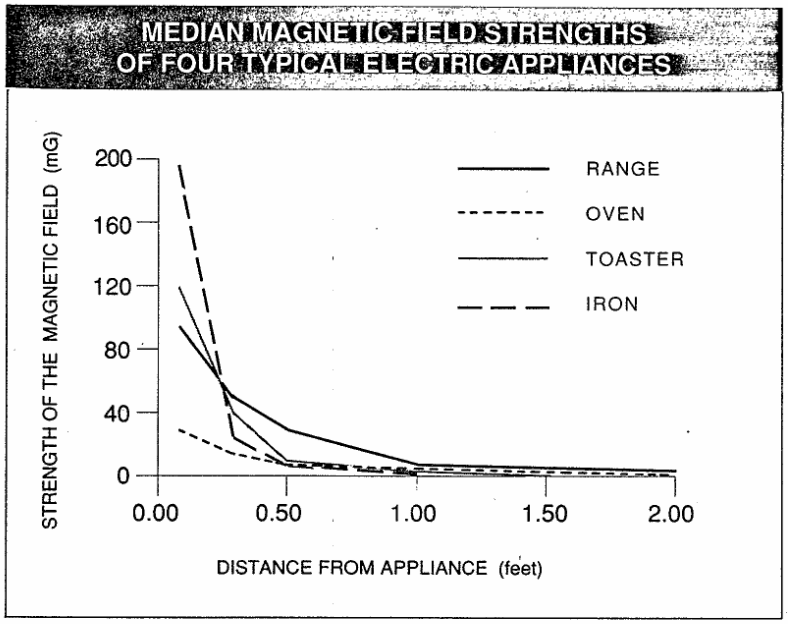
On the Irasburg-to-Mosher's Tap line, the EMF generated by the new double-circuit line, with no distribution on the pole, is expected to have a maximum of 55.9 mG and 1.875 kV/m at center line and a maximum of 16.4 mG and 86 V/m at the edge of the ROW (50 feet from ROW center). Where the distribution is attached, the transmission lines are higher, and thus the maximum forecasted EMF will be lower. Under present conditions, with only one 48-kV circuit, the maximum EMF at centerline is around 27mG and 280 V/m. At ROW edge, the EMF is approximately 4.5 mG and 66 V/m.

As discussed above, adding the new circuit increases the EMF at the edge of right-of-way. The addition is not a significant increase (at maximum power flows, an increase of approximately 12 mG), however; is well below the standard set in two states, Florida and New York, that have established edge-of-ROW standards (150 mG and 200 mG, respectfully) (www.niehs.nih.gov/ emfrapid); and is comparable or less than the fields emanating from typical power lines and common household appliances, as illustrated by the following figure and chart:



Electric fields from power lines are relatively stable because line voltage doesn't change very much. Magnetic fields on most lines fluctuate greatly as current changes in response to changing loads. Magnetic fields must be described statistically in terms of averages, maximums, etc. The magnetic fields above are means calculated for 321 power lines for 1990 annual mean loads. During peak loads (about 1% of the time), magnetic fields are about twice as strong as the mean levels above.

Source: Information Ventures, Inc., on the web at http://infoventures.com/private/federal/q&a/qaenvn2a.html



Source: EMF in Your Environment: Magnetic Field Measurements of Everyday Electrical Devices, Publication 402-R-92-008, U.S. EPA, Dec. 1992

BATHROOM SOURCES

Distance from Source	6"	1'	2'	4'
HAIR DRYERS				
Lowest	1	-	-	-
Median	300	1	-	-
Highest	700	70	10	1
ELECTRIC SHAVERS				
Lowest	4	-	-	-
Median	100	20	-	-
Highest	600	100	10	1

Magnetic field measurements in units of milligauss (mG)

Source: EPA, as above.

KITCHEN SOURCES				
Distance from Source	**6"**	**1'**	**2'**	**4'**
BLENDERS				
Lowest	30	5	-	-
Median	70	10	2	-
Highest	100	20	3	-
CAN OPENERS				
Lowest	500	40	3	-
Median	600	150	20	2
Highest	1500	300	30	4
COFFEE MAKERS				
Lowest	4	-	-	-
Median	7	-	-	-
Highest	10	1	-	-
CROCK POTS				
Lowest	3	-	-	-
Median	6	1	-	-
Highest	9	1	-	-
DISHWASHERS				
Lowest	10	6	2	-
Median	20	10	4	-
Highest	100	30	7	1
FOOD PROCESSORS				
Lowest	20	5	-	-
Median	30	6	2	-
Highest	130	20	3	-

Magnetic field measurements in units of milligauss (mG)

More “kitchen source” data follow.

The source for the two “kitchen source” tables is the EPA publication cited above.

KITCHEN SOURCES

Distance from Source	6"	1'	2'	4'
GARBAGE DISPOSALS				
Lowest	60	8	1	-
Median	80	10	2	-
Highest	100	20	3	-
MICROWAVE OVENS				
Lowest	100	1	1	-
Median	200	40	10	2
Highest	300	200	30	20
MIXERS				
Lowest	30	5	-	-
Median	100	10	1	-
Highest	600	100	10	-
ELECTRIC OVENS				
Lowest	4	1	-	-
Median	9	4	-	-
Highest	20	5	1	-
ELECTRIC RANGES				
Lowest	20	-	-	-
Median	30	8	2	-
Highest	200	30	9	6
REFRIGERATORS				
Lowest	-	-	-	-
Median	2	2	1	-
Highest	40	20	10	10
TOASTERS				
Lowest	5	-	-	-
Median	10	3	-	-
Highest	20	7	-	-

Magnetic field measurements in units of milligauss (mG)

4.1.8 (c) Herbicide Use in Right-of-way Management

Overview. VELCO will follow its Four Year Right-of-Way Vegetation Plan (see Appendix D) in maintaining the newly-acquired rights-of-way, which describes VELCO's ROW policy, i.e., to manage vegetation growing on its transmission-line ROW in accordance with federal and Vermont laws (VELCO is also required to have a permit for use of herbicides, see Appendix D) and regulations and with the guidance of the Independent System Operator (ISO)'s vegetation-management standards. There are two general methods of vegetation control that VELCO uses: mechanical and chemical. The mechanical methods are generally used in areas where herbicides are either restricted by regulations or prohibited by a landowner.

Chemical Management. VELCO states that it has assessed all of the significant benefits and risks of the use of chemicals (herbicides) and their alternatives in the maintenance of ROW. It has concluded that the risks of using the specific herbicides that it employs, in the manner in which it uses them, are small and that the benefits are substantial. It has therefore concluded that it will continue to use herbicides in a limited and selective manner.

Specifically, no herbicides will be used for ROW maintenance unless the herbicide is (1) registered for general use by the U.S. Environmental Protection Agency (under authority of the Federal Insecticide, Fungicide, and Rodenticide ACT (FIFRA), EPA must classify all pesticides projects for either "general" or "restricted" use), (2) approved for use by the Vermont Agency of Agriculture, and (3) determined by the Company's experience, or the experience of others, to be effective for purposes for which it is used.

General-use pesticides, as defined by the EPA, are those that will not cause unreasonable adverse effects to the user or the environment when used in accordance with the label instructions. Restricted-use pesticides are those that may cause adverse effects to the applicator or the environment unless applied by persons who have been specifically trained in their use. VELCO does not use any restricted herbicides. VELCO uses three general-use herbicides: Roundup®, Orthotriox®, and Weed-B-Gone®. Application methods used are all manual methods that target individual plants or compact clusters of plants.

In general, herbicides used in ROW management have not been identified as sources of excess adverse health risks or as sources of excess cancer in the general public (National Academy of Sciences 1975; U.S. Department of Energy 1982). Members of the general public may potentially be exposed to herbicides used in ROW management by (a) inhalation of mists or vapors while the herbicides are dissipating into the atmosphere shortly after application; (b) absorption of freshly-applied herbicides through the skin upon contact with treated plants, grasses and soils; (c) ingestion of contaminated fruits, berries, herbs or leafy vegetables grown in the ROW; (d) ingestion of meat from wild and domestic animals and fish eating the herbicides; and (e) ingestion of contaminated water.

Because of the low volatility of the herbicides and the use of selective, ground-level application techniques, the general public is not expected to be exposed to biologically-harmful levels of herbicides by inhalation. Similarly, direct skin contact with freshly treated foliage is expected to be an insignificant source of exposure due to low application rates. The ingestion pathway produces the greatest potential for adverse health effects. Land used for raising foodstuffs will accordingly not be treated by VELCO with herbicides.

Also, VELCO employs a new spraying technique ("ultra-low volume") when applying herbicides. This new technique cuts the actual amount of chemical being applied in tenths over the amount applied in the previously-used water/chemical mix. VELCO does not spray any

ROWs that are actively farmed or grazed. In the ROWs that are treated, the half-life of the products used (all approved by the Vermont Department of Agriculture) is very short (sprayed one day, gone within the week).

Mechanical Method. The mechanical method of ROW maintenance is an alternative to the use of herbicides. These methods are much more labor-intensive and expose workers to increased risks of injuries from accidents in tool, equipment and brush handling. Although more risky for workers, these methods present little or no risk to the public. Vegetation management using herbicides, on the other hand, substantially reduces health and safety risks for the workers while slightly increasing the risks of toxic effects to the public, especially from erosion and spill-related events.

In conclusion, although the herbicides proposed for use in the ROW have low degrees of toxicity to animals and humans, their application according to label directions and VELCO's four-year, vegetation-management plan will comply with state and federal regulations and allow for their safe use. See Appendix D.

4.2 Potential Environmental Impacts Of Alternatives To Proposed Project

4.2.1 Alternate Designs and Corridors

4.2.1 (a) Alternate Design

As discussed in detail in Sections 2.4.1 and 2.4.2, ***modifying the line-design criteria*** would entail various impacts on the project and on the environment. Reducing the 115-kV circuit's conductor size from 1272 ACSR to 556 ACSR would reduce the current-carrying capacity of the line by over 25%, which VELCO rejected in favor of using higher-capacity conductor so that increased loads may be carried in the future, thereby avoiding the additional impacts to the environment that would result in the future from having to reconductor the line.

Reducing the pole spacing would place more structures closer together along the corridor, which VELCO learned would be unacceptable to the adjacent property owners. Furthermore, reduced spans across wetlands and watercourses would have a negative impact on the environment that might not be acceptable. Finally, the increased number of structures would also increase the overall cost of the line as compared to the steel-pole line originally proposed.

Reconfiguring the double-circuit framing by any of the methods considered previously would have negative impacts on the project and the environment. It would increase the visual presence of the line by doubling the number of poles at each tangent location required and would also require additional ROW and vegetation clearing if used in succession. Additionally, within any wetlands guyed, wood-pole structures would increase the disturbance to these protected areas. Finally the "over/under" circuit configuration would impose undesirable maintenance restrictions and reduce the lines' reliability.

Undergrounding the circuits is 8 to 10 times as expensive. As noted in Section 2.4 above, undergrounding impacts the environment in many ways that overhead transmission does not. Therefore, due to both the cost and the environmental impact, VELCO does not propose to place any transmission or substation facility underground.

4.2.1 (b) i. Alternate Corridors.

Mosher's Tap – Irasburg corridor (*New Corridor Alternative*): This potential corridor is similar to the preferred corridor proposed by VELCO but follows higher ground and does not follow the valley floor in any segment. As such, it is on more steeply-sloping terrain throughout and at somewhat higher average elevation than the preferred corridor. The highest elevation is more than 925 feet.

Bedrock along this corridor is the Northfield formation of middle and upper Silurian age. This formation consists of dark gray to black quartzite-sericite slate or phyllite with fairly widely-spaced interbeds, a few inches thick of siltstone and silty crystalline limestone like that of the Waitsfield formation (Doll, 1961). The bedrock is overlain with glacial till and alluvium, especially near Stony Brook at State Route 14 where bedrock has been extensively quarried for sand and gravel.

Soils in this corridor are similar in nature to the preferred corridor but differ mostly due to steeper slopes and are consequently rockier and stonier. There are similar areas of borrow (gravel and sand extraction). Soils on elevated terrain include some areas of Cabot silt loam (a hydric soil not found on the preferred corridor). Some of the soils along this corridor are also considered primary agricultural soils (Table 2). Approximately 28.5% of the corridor occupies lands with soils that are considered to have good agricultural potential, and about 63% of these lands, or about 18% of the corridor, is actually used for agriculture at present (Countryman Environmental, unpublished data), which compares to approximately 17.5% in the preferred corridor.

Table 2. Soils in the Mosher's Tap corridor. Data from NRCS (1997).

Primary agricultural soils	
Colonel fine sandy loam	3–8% slope
Colonel fine sandy loam	8-15%
Colton-Duxbury complex	0-3%
Colton-Duxbury complex	3-8%
Irasburg loamy fine sand	3-8%
Nicholville silt loam	8-15%
Vershire-Glover complex, rocky	8-15%
Adams loamy fine sand	3-8%
Cabot silt loam	3-8%
Roundabout silt loam	0-5%
Other soils	
Colton-Duxbury complex	15-25% slope
Colton-Duxbury complex	25-60%
Buckland very fine sandy loam, very stony	8-15%
Buckland very fine sandy loam, very stony	35-60%
Adams loamy fine sand	8-15%
Adams loamy fine sand	15-25%
Adams loamy fine sand	25-60%
Glover-Vershire complex, very rocky	8-15%
Glover-Vershire complex, very rocky	15-35%
Glover-Vershire complex, very rocky	35-60%
Cabot silt loam, very stony	0-8%
Cabot silt loam, very stony	8-15%
Salmon very fine sandy loam	25-50%
Vershire-Glover complex, rocky	15-25%
Vershire-Glover complex, very stony	8-15%
Vershire-Glover complex, very stony	15-35%
Tunbridge-Lyman complex, very stony	35-60%
Wonsqueak muck	0-2%
Pits, gravel and pits, sand	

A portion of this alternate route crosses over areas that are currently farmed. Agriculture in this area is predominantly dairy, and the fields are cropped in hay or field corn or used as pasture. Most of the areas in current use are on the valley floor and on ridge tops, not on valley sides. This alternate route crosses approximately 1.25 miles of active field, predominantly in corn and hay.

The corridor also passes across approximately 0.2 miles of sugar bush (i.e., areas of forest used for maple-sugar production) and across additional lands with northern-deciduous-hardwood forest that may be suitable for maple-sugar production.

A significant gravel-extraction operation exists on the Pike Industries/ Carroll Concrete properties on State Route 14 where this alternate would cross the road. There are extensive gravel pits, a road system, loading facilities, and settling ponds.

There also are eleven residences located within 500 feet of the New Corridor Alternative corridor, most of them in rural and rural residential areas. More distant residential areas are the village of Coventry and the City of Newport.

The major commercial use on this corridor is the Pike Industries/Carroll Concrete facility located on Route 14. There is also a junkyard located on Hancock Hill Road and a “bed and breakfast” with a restaurant on Heermanville Road in Coventry. Other land uses are dedicated primarily to farming and forestry.

A commercial facility serving several businesses and self-storage units is located in and adjacent to the 120-kV corridor on Route 105 just west of the Mosher’s Tap location. There is a small, locally-maintained wayside area without facilities on Route 105, just north of the potential tap location.

A water tower for the City of Newport municipal water system is located approximately 500 feet to the north of the location of the tap structure into the existing 120-kV line.

Surface waters along this route are the same as for the preferred corridor: Ware Brook, an unnamed tributary to the Black River, tributaries to Stony Brook and Alder Brook, and Stony Brook itself. Alder Brook is not within the project area, being approximately 1500 to the east. The New Corridor Alternative would cross at least 9 additional seasonal or small permanent streams that are tributaries to the above-named streams.

The New Corridor Alternative corridor would be closer to Walker Pond and the other ponds noted above than the preferred corridor. Settling ponds at the gravel pits may also be within this corridor, but no other surface waters are known. This corridor also more or less parallels the course of the Black River, which flows north into Lake Memphremagog, but it is further from the river than the preferred corridor.

This alternative is mostly further upslope than the preferred corridor, so less of the corridor is within floodplain. Because it would also cross Ware Brook, that segment would, however, cross the 100-year floodplain; this is the only floodplain area identified on this corridor.

Wetlands along this corridor were not delineated but were assessed using topographic maps, National Wetland Inventory Maps (USFWS, 1979 *et seq*.), and recent orthophotography, with limited field verification by personnel of Countryman Environmental; see the appended orthophotos with these estimated wetlands locations. Overall, the New Corridor Alternative corridor crosses a lesser amount of wetland as compared to the proposed route because it is on more elevated and more sloping terrain. The wetlands are generally similar in nature to those of the preferred corridor, but because this alternative is generally located in areas of steeper topographic relief, the “alder swamp” type of wetland is not as common. That community is, however, present along Ware Brook where it is crossed perpendicular to its length.

There are also forested wetlands and “wet meadow” communities on abandoned farmland, similar to the preferred corridor. The functions and values of these wetlands, in the aggregate, are similar to those of the preferred corridor, with the exception of protection of stream habitats, since they are mostly not associated with surface waters in the manner that some extensive wetlands of the preferred corridor are associated with Stony Brook. Refer to Table 2.2 below; also see VELCO Appendix F.

Upland terrestrial communities are similar to those noted for the preferred corridor; however, the percentage of forest lands is greater. As noted, this corridor would be an entirely-new intrusion into forests rather than the widening of an existing corridor. Following clearing, the types of upland communities that would develop would be similar in nature to those of the existing corridor, i.e., a mix of saplings, low shrubs, brambles, ferns, grasses and forbs common to the region.

With regard to critical wildlife habitat, the New Corridor Alternative, being further upslope than the existing corridor, passes through a deer-wintering area on the southeastern slope of Cleveland Hill, rather than following along its edge as does the proposed corridor; the linear distance affected is approximately 500 feet or about 5,000 square feet. No other critical habitat is known along this corridor.

This alternate crosses about four times as much agricultural land as the preferred corridor and specifically more land currently cropped with corn. In these areas, there is little potential for utilizing fencerows and edges of fields to minimize impacts, and farmers would need to work around the utility poles.

This corridor would also affect approximately 0.2 square miles (2.4 acres) of sugar bush (i.e., areas of forest used for maple-sugar production), as noted, and would cause the loss of an estimated 200-240 trees for production. There is an estimated total of approximately 0.4 miles (4.8 acres) of potential sugarbush along this corridor.

Table 2.2 List of Wetlands, Alternate Route.

Sources: USGS topographic maps, NWI wetlands maps, and recent orthophotography with limed field verification by personnel of Countryman Environmental.

Note: Wetlands have not been delineated and all information in this table is subject to field verification and correction.

Identifier & Sheet #	Approximate Mile	Approximate linear distance of crossing (feet)	Class (Cowardin et al, 1979)	Notes
1, Sheet 1	0.5	175	PSS/PFO	Ware Brook crossing
2, Sheet 1	0.6	125	PSS/PFO	
3, Sheet 2	0.8	250	PEM/PSS	Seasonal stream, tributary to Ware Brook
4, Sheet 2	2.0	100	PEM/PSS	
5, Sheet 2	1.2	100	PEM/PFO	Seasonal stream, tributary to Ware Brook
6, Sheet 3	1.8	100	PFO/PSS	Unnamed tributary to Black River
7, Sheet 6	4.1	250	PEM	
8, Sheets 6 & 7	4.5+	1600	PEM/PSS/ & PFO	
9, Sheet 7	5.0	100	PFO	
10, Sheet 7	5.2	150	PFO/PSS	
11, Sheet 9	6.6	100	PEM	Pasture
12, Sheets & 10	6.75	600	PEM	Pasture
13, Sheet 10	7.0	150	PEM/PSS	Swale
14, Sheet 10	7.1	100	PEM/PSS	Tap structure

This alternate would require a new corridor through approximately 2.75 miles of forest cover. The longest segments would pass through forests for distances of between 0.25 and 0.5 miles. Such areas would likely be large enough to manage for forestry. Other segments would pass through smaller patches of woodland that may not be large enough for management but that may provide firewood.

As noted, a significant, ongoing gravel-extraction operation occurs on the Pike Industries/ Carroll Concrete properties on Route 14 where this alternate would cross the road. As with the preferred corridor, poles might need to be located or potentially relocated over time so as not to interfere with operations or to be sure that the pit could be operated in a safe manner. However, the presence of a powerline *per se* would not prevent extraction of earth resources in the manner that, for example, a housing development would.

The creation of a new corridor may create an opportunity for a new snowmobile trail or for rerouting of existing trails in the region. It may also provide foot access to some previously remote areas for hunting of upland game. Overall, however, this corridor would not likely have a measurable effect on recreation in the region.

No direct impacts on residences would result from this corridor. Since there are no existing transmission lines near the 11 residences located within 500 feet of this corridor, however, issues of aesthetics and electromagnetic effects may be greater than for the existing corridor, where residents have experience with the presence of a powerline.

4.2.1 (b) ii. Mosher's Tap-Irasburg Corridor (*Partially New Corridor Alternative*).

This alternate corridor is slightly longer than New Corridor Alternative or the preferred corridor and has the same impacts as the preferred corridor from Irasburg Substation to mile 4.9 and essentially the same impacts as the New Corridor Alternative from mile 4.9 to mile 7. Please refer to Section 4.2.1 (b) i, above, for discussion of the impacts of the last 2.1 miles of the New Corridor Alternative, as the impacts for the Partially New Corridor Alternative would be almost identical to those for the New Corridor Alternative in that segment. The Partially New Corridor Alternative uses the preferred (and existing) route until the corridor reaches the area of Alderbrook Road. At that location, the Partially New Corridor Alternative moves away from the existing corridor along Alderbrook Road, traversing to the other side of the valley. There it runs parallel to Alderbrook Road until meeting up with the existing corridor north of Mosher's Tap.

4.2.2 Comparison of Corridor Options

The merits of using the existing corridor, where the present line has been located for years, are thought by VELCO to be a sufficient basis to reject the two alternate corridors as noted in Section 2.2 and discussed below, including a summary comparison table.

Any new power line right-of-way creates exposures and problems that can not be anticipated. Time has a way of blending physical features, and as such VELCO believes that the addition of another circuit in the present corridor will not present a significantly different profile from the present situation.

More careful attention to pole locations in the existing corridor should help soften any visual impacts. Additionally, the line should not affect the abutting landowners, all of whom purchased their property at a time when the 48-kV line was already in service. Considering all these factors, along with the extra cost of building in an entirely-new corridor, VELCO believes it is preferable to stay within the existing corridor.

While the alternate corridors, especially the New Corridor Alternative, would have less impact on wetlands and floodplains, the corridors would have a greater impact on forest resources and actively-farmed lands, cross a deer-wintering area (as compared to the preferred corridor's passing of the area on its edge), be visible to more homes and be located on steeper, stonier soils where the risk of erosion would be of greater concern. Overall, the potential environmental impacts of using the existing, preferred corridor appear to be significantly less than the potential impacts from locating the double-circuit line in the "New Corridor Alternative" or in the "Partially New Corridor Alternative" corridors.

No Action Alternative:

Implementation of the No Action Alternative would preclude most of the anticipated effects to the environment that would be associated with the Proposed Action. Minor adverse effects, however, would result from the increasingly frequent repairs and maintenance activities. Since there would be no reason to rebuild any of the existing line at this time, there would be no alteration of the location of the poles with regard to aesthetic impact and wetland impact.

Additional clearing of the existing right-of-way by VELCO would still occur at some locations along the corridor to comply with VELCO's ROW standards.

The following table 2.3 summarizes the advantages and disadvantages of the three corridors considered and of the No Action alternative:

Table 2.3

Impact	Proposed	New Corridor Alternative	Partially New Corridor Alternative	No Action
Agricultural Land	Yes	More	More	Minimal
Removal of Trees	Limited to widening of corridor at discrete locations	New corridor	New Corridor	Limited to widening of corridor at discrete locations
Aesthetic/ Visibility	One existing line would be rebuilt	Two lines - new line and existing line - would remain	Two lines - new line and existing line - would remain	Existing line would remain as is – no improvements to sensitive areas.
Wetlands	As proposed	New line less than proposed, but existing line remains so total is more	New line less than proposed, but existing line remains so total is more.	Existing line would remain as is – no improvements to sensitive areas.
Floodplains	Yes	Yes	Yes	Yes
Wildlife/Habitat Impact	Little or none	Some additional cutting in deer-wintering area	Some additional cutting in deer-wintering area	None

4.3 Mitigation Measures

4.3.1 Air Quality

Any construction that will need to take place in identified wetlands will be undertaken in winter or during the dry season, and since most of the work is either along an existing corridor or involves existing substations, there will be little dust generated. When necessary, dust-control measures will be undertaken, such as the application of solid chloride pellets, to ensure that dust is controlled.

4.3.2 Land Features and Use

No mitigation measures are proposed: No land-use changes are anticipated except for the conversion of some areas of forest along the existing corridor's edge from forest to a managed, lower-height-vegetated corridor. See Subsections 4.3.2 (a) for VELCO's Soil Erosion Control Measures and 4.3.2 (c) for VELCO's Forestry Practices below.

4.3.2 (a) Soils

Erosion-control measures will be implemented around disturbed areas to retain soil. These measures will include, where necessary, haybale fences, silt dikes, and mats. Along the newly-cleared ROW, all non-usable branches will be chipped and spread as a ground stabilizer. See Appendix D, VELCO's Soil Erosion and Control Plan. With proper implementation of erosion-control measures, no significant loss of soils will occur. The project will meet Vermont Water Quality Standards (Appendix D).

Streambank erosion is not anticipated to occur since there are no stream crossings required to access structure locations.

4.3.2 (b) Agriculture

Disruption to agriculture will be minimal and affect primarily hay fields and pasturage at about 13 pole locations. With the use of taller poles, longer spans can be implemented, and poles will be placed carefully so as to disrupt agriculture as little as possible. Winter or off-season construction will also mitigate any effects. VELCO will also work with the individual landowners in the final determination of pole locations to minimize any potential impacts.

4.3.2 (c) Forestry

The project will have an insignificant impact on forestry resources so no mitigation is proposed. Following VELCO's normal practice, wood products associated with felling trees for additional clearing will be offered to the landowner, or the landowner will be compensated for the market value of the trees.

4.3.2 (d) Recreation

No mitigation measures are proposed: There are no identifiable impacts to recreational opportunities and, specifically, none to fishing or hunting opportunities. VELCO will continue to work with the Vermont Association of Snowmobile Travelers to assure that there will be no disruption to snowmobile trails during construction.

4.3.2 (e) Natural Areas

No mitigation measures are proposed: All natural areas are remote from the project area.

4.3.3 Hydrology, Water Quality and Water Use

No impacts to hydrological regimes will result from the project, so VELCO proposes no mitigation measures.

For water quality, erosion control will be implemented during construction, and implementation of VELCO's vegetation-management plan will ensure no degradation of water quality in the project area thereafter.

As for water use, there will be no interruption of water supplies or use associated with the project, so no mitigation is proposed.

4.3.4 Ecology

4.3.4 (a) Terrestrial

VELCO believes that its vegetation-management plan is effective at maintaining suitable plant communities and wildlife habitat in northern Vermont, and VELCO accordingly proposes no additional mitigation.

In particular, communication with the Vermont Department of Fish and Wildlife has indicated that there will be no undue adverse impacts to the deer-wintering areas adjacent to the corridor. Accordingly, VELCO does not propose mitigation specific to this one area, such as a wildlife-crossing lane.

4.3.4 (b) Aquatic (including Wetlands)

With the implementation of erosion control during construction and VELCO's vegetation-management plan, VELCO believes that impacts to these resources will be insignificant, and no special additional measures are proposed.

The vegetation-management plan, Appendix D, provides for buffer zones along streams and other waters of the state where no herbicide will be applied. VELCO believes that the shrubby vegetation along Stony Brook and its minor tributaries will continue to provide shade to the waters, so that fisheries will not be adversely affected.

Conditions of the ANR Conditional Use Determination for work in significant wetlands affected by the project include use of silt fences where necessary to prevent eroded soils from reaching wetlands. ANR also imposed a condition that these wetlands be monitored for the presence of the nuisance aquatic species, common reed (*Phragmites communis*) and purple loosestrife (*Lythrum salicaria*). If found, they are to be destroyed. The CUD says the vegetation "be pulled by hand and disposed of by burial or burning in a non-wetland location." See Appendix B.

4.3.4. (c) Threatened and Endangered Species

VELCO will avoid the State-listed plant on the project site, *Juncus greenei*. Another project that is expected to be started after the work on this project will require an endangered-species permit from ANR. Such permits typically require transplantation as a mitigative measure. ANR has already stated that the three identified plants will need to be transplanted and the remainder of the outlying population managed.

4.3.5 Socioeconomics

VELCO proposes to undertake several measures to help mitigate the effects of this project on the socioeconomics of the area. Contractors will be encouraged to employ local labor consistent with project tasks, thus decreasing local unemployment and increasing the number of non-local workers.

On the basis of meetings and consultations to date, there do not appear to be significant public concerns about the project. However, communication with town selectmen, planning commissions, regional planning commissions, individual land owners, other concerned individuals and state agencies, including the Department of Public Service, will continue so that any concerns that may exist are considered. Because the exact placement of the poles along the double-circuit line was of concern to some members of the public, special attention has been and will continue to be given to working with landowners and others most affected by pole locations. Additionally, copies of this draft Environmental Assessment are being distributed to known concerned parties for review and comment.

Once the final design stage is reached, VELCO (or its consultant) will approach each affected landowner if a reasonable change in pole placement would help mitigate any impact. These movements of poles would stay within the existing ROW, but span lengths could be altered to help mitigate environmental or visual impacts.

4.3.6 Visual Resources

4.3.6. (a) Irasburg to Mosher’s Tap Corridor:

The existing transmission-line corridor, which has been in this location for many years, extends approximately 6.47 miles. With the exception of a few locations, discussed below, the existing line is located in wooded areas or is otherwise remote from view, and the line upgrade will not have a significant visual impact in these areas. The areas of most visual significance (with respect to both the existing line and the proposed new line) are limited to two: (1) where the corridor currently extends approximately 1000 feet from Back Coventry Road to Heermanville Road (at approximately miles 1.1 - 1.3, marked on Ortho Sheet 1–Appendix C); and (2) in the Alderbrook Road neighborhood, including Mosher's Tap (Ortho Sheet 3–Appendix C).

As shown on Ortho Sheet 1 of the orthophoto maps included in Appendix C, the existing 48-kV circuit departs Irasburg Substation heading northeast to an angle structure located on the hillside above State Route 14. This existing angle structure is also shown by the photograph exhibit from the nearest residence on Route 14. See Photo 1 in Appendix C. The new angle structure will be about 20-feet taller to accommodate the two circuits but will not be particularly noticeable from Route 14.

From this point, the existing corridor heads north, paralleling Route 14 for a distance of approximately 1000 feet for several spans before it disappears into a thickly wooded area. The exposure here will not be noticeable to the average motorist. From this point, the line remains out of sight for approximately one mile before it again reappears at the hillside behind the Djanikian and Bennett residences (mile 1.0 depicted by a marker shown on Ortho Sheet 1– Appendix C). Photo 2 in Appendix C is a photograph of this section of line looking south from the Djanikian residence. Since this clearing will be widened, VELCO proposes to plant–and will plant if acceptable to the landowners–pines at the lawn edge. VELCO will also clear selectively at this location to reduce the exposure of this hillside.

The line then crosses Coventry Back Road (mile 1.1; see Ortho Sheet 1 – Appendix C). Photo 3 in Appendix C is a view looking north to the McInnis property from Coventry Back Road at mile 1.1, depicting the existing landscape for the next .2 miles; photo 4 in Appendix C is a view looking north along Coventry Back Road from the Djanikian and Bennett parcel that indicates the existing and proposed crossing; photo 5 is a view looking south to the McInnis parcel from Heermanville Road (mile 1.3) at the transmission corridor on the hillside above Djanikian and Bennett properties, where planting and selective vegetation is recommended as mitigation.

At mile 1.3, the line leaves open landscape and enters second-growth vegetation and pasture west and north of Heermanville Road (see Survey Sheet 1 – Appendix C and photo 6 in Appendix C). Photo 7, Appendix C, is a view from further north on Heermanville Road at the same second-growth pasture on the Maikshilo and Dellert Parcel, showing limited visual impact occurs in this broken landscape with a wooded background.

The line then enters a wooded section at mile 1.7, crossing Linton Road (gravel) at mile 1.8. Photos 8 and 9, Appendix C, are photographs that show that the existing 48-kV line is hardly visible from Heermanville Road. As evident from the photographs, throughout this section it is difficult to see the existing structures because of the wooded hillside background. This would be true also of the new taller structures. Because of the mix of deciduous and coniferous vegetation and the hillside providing background for the line, the new line will be difficult to notice.

After the Linton hillside, the line continues to the north on the wooded hillside and does not again become visible from Route 14 until the corridor crosses the so-called "A & P Marsh Farm" (shown on Survey Sheet 2– Appendix C). The corridor in this section (mile 2.7 to mile 3.5) is located at the interface of the active agricultural land and the steep wooded hillside to the west, so that any structures seen from the parallel Route 14, which is a thousand feet distant, will be backgrounded by the mostly coniferous hillside and not be very visible.

At approximately mile 3.8, the line crosses Route 14 and stays parallel with Route 14 on the east side at a distance varying from 50 to 100 feet. The normal cone of vision of the driver through this section is represented by photographs shown in Appendix B3, Photos 10, 11, 12, and 13 in sequence; Photos 10 and 11 indicate the curvature of the road and the likelihood that the 20'-taller poles will be backgrounded; and Photos 12 and 13 show the nature of the transmission corridor pulling away from Route 14. The existing double-circuit, roadside-distribution line is more visible than the proposed transmission line through this narrow valley.

The line then continues north across Nadeau Park Road (mile 4.1 – mile 4.3) before entering a dense wooded area through Pike Industries' land and breaking into the open at mile 4.9 on the Parry Parcel, 400' to the east of Alderbrook Road (Survey Sheet 3 Appendix C). The existing and the proposed line will not be visible on this parcel or from the next parcel on Alderbrook Road because of foreground vegetation at the road frontage.

The distribution "under-build," a segment where the transmission line will have distribution line attached below the transmission conductors on the same poles (see previous Figure 2-1), begins along Alderbrook Road in Coventry at the Knight Parcel and continues to the W. & G. Lawson Parcel, providing service to both sides of Alderbrook Road for the next 1.2 miles. The line is partially visible from Alderbrook Road for the next one-half mile as it passes behind the residences of Mathieu, Durocher and Maclure (Appendix C, Photos 14 through 18) before entering a dense wooded area, which continues for the next .5 miles. Although the existing line setback from Alderbrook Road varies from 100' to 400' from Alderbrook Road, the line is not visible because of the vegetation along the Alderbrook Road in this area.

At the Mishou rental parcel, the line angles to the west and joins Alderbrook Road (mile 6.2), where it is in the open landscape along the Alderbrook Road ROW as a double circuit for 700' or two spans. At this point, the distribution line departs to a pole on the north side of Alderbrook Road, and the 48-kV (and the proposed double) circuit continues the remaining 900' to the Mosher's Tap. At the south boundary of Mosher's Tap, the line enters a conifer plantation and is not visible from Alderbrook Road. The combined circuits will tie into the 48-kV and 115-kV circuits in an open area north of the Mosher pines (see Photos 20 and 21, Appendix C).

The existing under-built Citizens 12.5-kV distribution line, as mentioned above, starts at the Knight Parcel on Alderbrook Road in Coventry and, along with the 48-kV line, is set back behind the houses (Matheiu, Durocher & Maclure, as shown on Survey Sheet 3 of Appendix C). The degree of exposure represented by the existing 48-kV line is depicted on Appendix C, Photos 14 through 18; Photo 14 is a view to the northeast from Alderbrook Road showing the existing line uphill behind P&S Mathieu, backgrounded by the tree line. The upper portion of the new structure will break the treeline from this perspective.

The 30-foot extension will cause the transmission circuits to be above the tree line and thus visible to a greater extent than the existing line. VELCO will consult affected landowners on pole placements, which present the opportunity to move the pole a short distance, an option not available if the existing line is not replaced because the project does not go forward. Moreover, the poles and under-built distribution have vegetation in the background. In some instances, the distribution poles connecting the under-build to houses are more noticeable than the 48-kV line. This will be true after the 115/48-kV line is constructed as well.

Photo 15, Appendix C, shows a similar situation to Photo 14 from a few hundred feet further north; Photo 16, from Alderbrook Road, shows the next properties north (Durocher in the foreground and Maclure in the background); Photo 17 looks southeast at the existing line uphill from Maclure; and Photo 18 looks southeast and again shows the extent of exposure through the open-landscape section beyond the foreground house on Alderbrook Road.

As mentioned, this is an area of exposure. The ROW clearing at the Mosher's pines will be widened. As discussed with the Moshers, VELCO will plant approximately 80 evergreens, between 8’ and 12’ in height, to fill the 100' ROW at the beginning and end of the clearing on Mosher’s property. The Mosher house is located up a long drive, approximately 900' from the line. The Moshers will see the clearing and some of the structures as they enter their driveway, but the above-mentioned planting will mitigate visual impacts since visibility into the clearing will be diminished by above-eye-height pines.

Several other measures will be taken to decrease the visibility of the proposed route:

One measure is to use techniques that will blend the line into the natural environment. For example, Corten™ steel poles will be used when wood or laminated wood poles cannot be used: Corten™ naturally oxidizes, so from a distance the pole looks like wood and therefore quickly blends into the natural environment. VELCO, again, will also consult with adjacent landowners about pole placement.

Screening will be used when possible to minimize exposure. In two of the more visible sections, VELCO will plant trees and shrubs for screening purposes. As discussed above, in section 2.1, the existing transmission-line corridor has been in this location since the 1920’s.

With the exception of a few locations, discussed next, the existing line is located in wooded areas or is otherwise remote from view, and the line upgrade will not have a significant visual impact in these areas. The areas of most visual significance (with respect to both the existing line and the proposed new line) are limited to two: (1) where the corridor currently extends approximately 1000 feet from Back Coventry Road to Heermanville Road (at approximately miles 1.1 - 1.3, marked on Sheet 1 of Appendix C); and (2) in the Alderbrook Road neighborhood, including Mosher's Tap (Sheet 3 of Appendix C).

Photo 2, Appendix C, is a photograph of the first section of line, looking south from the Djanikian residence. Since this clearing will be widened, VELCO will plant pines at the lawn edge if acceptable to the landowner and clear the ROW selectively to reduce the exposure of this hillside.

The ROW clearing at Mosher's pines, the second section of corridor that requires mitigation, will be widened (Appendix C, Photos 19 and 20). White pines will be used to fill the 100' ROW at the beginning and end of the clearing on Mosher’s property. The Mosher house is located up a long drive, approximately 900' from the line. The Moshers will see the clearing and some of the structures as they enter their driveway, but the above-mentioned planting will help screen their view of the line since its visibility into the clearing will be diminished by above-eye-height pines.

Also, wherever possible VELCO has located the line at the landscape edge between forest and field within the existing corridor. This is one of the best techniques to screen a powerline since the woods act as a backdrop, thus minimizing visual impact.

Property owners in most cases, however, have the potential to screen structures from their living areas by planting vegetation, such as conifer trees. By co-locating the transmission facilities with the existing transmission line, which Citizens operated in this location for many years, VELCO has mitigated potential impacts that would otherwise be caused by the addition of a second line and a new corridor.

4.3.6 (b) Substations:

Irasburg and St. Johnsbury:

The St. Johnsbury Substation is remote and not visible from either Interstate 93 or Higgins Hill Road (where it is located). Irasburg Substation is located off State Route 14, set back several hundred feet behind a densely vegetated hill. It is not visible from the roadway. Improvements at both substations will not have any adverse aesthetic impact.

Highgate Substation:

The proposed Highgate Substation, located immediately off of State Route 78, will be a consolidation of the existing VELCO Highgate Substation and the existing Citizens Highgate Substation, allowing better screening from Route 78. Currently there is a heavy screen of brush along Route 78, including alders, poplars, ash and dogwood, with an interruption of the screen by the VELCO access drive. By using the existing Citizens drive and discontinuing use of the VELCO access drive, and therefore eliminating this interruption, better screening can be provided along Route 78. Specifically, VELCO will plant conifers at this location. When adequately planted, there will be minimal adverse visual conditions, and the combination of the two substations into one organized entity served by a common access road along the east side of the site will mitigate adverse visual impacts.

St. Albans:

This is a particularly good location as there are no houses or roads in close proximity. The closest house is over the hill, and the new equipment will not be visible and thus this facility will have no adverse aesthetic impact. In fact, the existing switch (GOAB), shown in the photo in Appendix 11 is 85' tall and will be removed. The tallest equipment proposed is 55'.

4.3.7 Cultural Resources

VELCO retained both the University of Maine at Farmington (UMF) and Douglas Frink, principal investigator for Archaeology Consulting Team, Inc., to assess the archaeologically-sensitive areas along the existing corridor and the existing substations. Refer to both reports in Appendix F.

UMF performed an Archaeological Resource Assessment Study (ARA) for both the line corridor and Highgate Substation. Mr. Frink performed an Archaeological Resource Assessment Study (ARA) for the Irasburg, Coventry and Newport areas affected by the project as well as the St. Albans area. Due to suspected high sensitivity of the Highgate region, Mr. Frink conducted a Phase I Archaeological Site Identification Study for that area, found in Appendix F.

The archaeologically-sensitive areas are shown on the preliminary survey, provided in Appendix C. As recommended by Mr. Frink, VELCO's final design for the new transmission structures will avoid impacting the sensitive sites wherever possible. Mr. Frink's ARA was filed with the Division for Historic Preservation, and VELCO's compliance with the design is a condition to the project approval issued by the Vermont Public Service Board. The State Historic Preservation Officer (SHPO) recommended six conditions dealing with mitigation measures that would be necessary if avoidance is not possible, and these conditions were included in the Certificate of Public Good received from the Vermont Public Service Board (see Section 4.1.7 above).

If unanticipated archaeological or human remains are encountered during construction, all construction will be halted in that area and the remains protected intact until the Division of Historic Preservation decides if further mitigation is necessary.

4.3.8 Electric, Magnetic and Noise Hazards

Electric and Magnetic Hazards

As discussed in Section 4.1.8, neither the improvements in the substations nor the re-build of the transmission line will result in significant change in the electric and magnetic fields or ion generation. The potential effects, including radio interference, television interference, visible light and the production of photochemical oxidants, will be negligible.

Noise Hazards

The audible-noise level, due principally to the synchronous condensers if installed at Highgate Substation, will be under 55 dBA at the property line (which compares to the typical noise level of a suburban living room area). See, for example, the Sound Level Chart below that provides typical noise level data for familiar noise sources. Accordingly, no mitigation measures are proposed.

Sound Level Chart

Location	Minimum (dBA)	Maximum (dBA)
Inside Home	25	45
Inside Office	35	50
Inside Airplane Cabin	75	85
Inside Factory	65	100
Talking @ 3 ft	55	65
Shouting @ 3 ft	75	85
Clothes Dryer @ 3 ft	55	65
Vacuum @ 3 ft	65	80
Chain Saw @ 3 ft	100	120
Clothes Washer @ 3 ft	55	75
Car @ 25 ft @ 65 mph	70	80
Airplane @ 1000 ft	95	110
Traffic @ 300 ft	40	60
Rural Ambient	25	35

Source: http://www.rfcafe.com/references/general/sound_level.htm

Herbicide Use

To ensure the safe use of herbicides in right-of-way management, only those pesticides and herbicides that are approved by the U.S. Environmental Protection Agency and the Vermont Agency of Agriculture, upon the advice of the Vermont Pesticide Advisory Council, will be used. In addition, all federal and state requirements for application of herbicides will be followed. Herbicide applications will be made by certified personnel according to all label instructions. See Appendix D.

State regulations adopted by the Vermont Agency of Agriculture will be followed for herbicide application near open water, wetlands, water supplies or homes. Herbicides will not be applied during rain or when rain is likely. The public will be notified during times of herbicide application by publishing notice of VELCO's proposed use of herbicides in newspapers of general circulation in the area, as required by Vermont law.

4.3.9 Radio and Television Interference

The proposed project is not expected to create any significant radio or television interference, so no mitigation measures are proposed. VELCO will, however, work with nearby homes and businesses complaining of interference to determine the cause and mitigate any interference.

4.4 Adverse Environmental Effects That Cannot Be Avoided if Project is Implemented

4.4.1 Air Quality

The proposed project will not have any significant air-quality impacts, other than the possibility of fugitive dust emissions during construction, which will be controlled using the techniques described previously in Section 4.1.1.

4.4.2 Land Use

There are few adverse environmental effects along the proposed corridor, especially since that corridor exists today. Where the route runs through agricultural land, the negative land-use effects will, for the most part, be mitigated. If there are any poles that must be placed on agricultural land, approximately .002 acres immediately under and adjacent to the pole will be unavailable for farming as is the case today where the existing poles are placed in agricultural land.

In the wooded and residential areas within the 100 foot right-of-way, current and future land use will be restricted to maintenance activities for the line. Farming activities may continue as before. Furthermore, the affected area will be very small, since poles and the ROW already exist.

4.4.3 Geology and Hydrology

The erosion-control plan, provided in Appendix D, is designed to ensure that no discharges of water will occur that would violate the Vermont Water Quality Standards, and VELCO will require its contractors to apply the techniques required in, and will monitor their compliance with, this plan. Because the proposed project is within an existing corridor, any impacts on hydrology, such as increased evapotranspiration[16] or increased runoff, are anticipated to be insignificant.

4.4.4 Forestry and Natural Areas

There will be conversion of some 100-foot-ROW areas from forest-corridor edge to a managed corridor with lower-growing vegetation. This conversion will not affect forestry in the region adversely.

4.4.5 Ecology

4.4.5 (a) Terrestrial

There will likely be some shift in plant communities but not of an adverse nature, because the areas of additional clearing will develop into communities similar to those within the existing ROW.

4.4.5 (b) Aquatic (including Wetlands)

While the potential for adverse consequences is present, the mitigation measures outlined in Section 4.3.4 will minimize unavoidable impacts. A permanent conversion of wetlands to land for the substation expansion at Highgate and for pole placements along the preferred corridor will occur, totaling 35,249 square feet (0.91 acres; about ¼ of the wetlands in and immediately

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16 Loss of water from the soil both by evaporation and by transpiration from the plants growing thereon. Ref.: Merriam-Webster on line (http://www.m-w.com).

surrounding the substation), and has been permitted by the US Army Corps of Engineers under Vermont General Permit Number 58.

4.4.5 (c) Floodplains

There will be only be minimal loss of floodplain area along Ware Brook and Stony Brook due to the placement of several poles.

4.4.5 (d) Critical Wildlife Habitat

Only a minimal loss of critical wildlife habitat will result from additional clearing along the edge of one identified deer-wintering area. Some impacts to general wildlife habitat in the region will occur, but these impacts will not affect critical habitat. See Section 4.1.4.

4.4.5 (e) Endangered Species

No impacts are anticipated. If necessary, a few plants of the State-endangered Greene's rush might be impacted, but, if this were to occur, the plants would be transplanted to adjacent habitat.

4.4.6 Health and Safety

4.4.6 (a) Electric and Magnetic Hazards

As discussed in Sections 4.1.8, and 4.3.8, electrical fields will increase at the time of maximum loading by 12 mG, which is less than what would typically be measured about 6 inches from a household dishwashing machine. Neither the improvements in the substations nor the re-build of the transmission line will cause increases of electric and magnetic fields or ion generation that come close to posing any hazard. The potential effects, including radio interference, television interference, visible light and the production of photochemical oxidants, will be negligible.

4.4.6 (b) Herbicide Use

Herbicide use will occur, as described in Appendix D (See VELCO’s Four Year Right-of-Way Vegetation Management Plan and the Vermont Department of Agriculture’s Permit to Conduct ROW Herbicide Treatment). No herbicides will be used for ROW maintenance unless the herbicide is (1) registered for general use by the U.S. Environmental Protection Agency (under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), EPA must classify all pesticide products for either “general” or “restricted” use), (2) approved for use by the Vermont Agency of Agriculture, and (3) determined by the company’s experience, or the experience of others, to be effective for the purpose for which it is used.

VELCO will be prohibited from using any herbicides unless it has obtained a permit from the Agency of Agriculture approving the compound, concentration of chemical and method of application. It must, moreover, publish notice of its planned use of herbicides in newspapers of general circulation in the area, and concerned landowners may contact the Agency of Agriculture before the permit issues. Thus, the use of herbicides is regulated, and VELCO will only receive authorization to use herbicides if the Agency of Agriculture issues a permit after finding that VELCO’s use of herbicides meets the requirements of state law and will be safe.

4.5 Irreversible and Irretrievable Commitments of Resources

In general, the project does not use land irretrievably as the land on which the project will be built is used today for substation or transmission-line purposes. At some future date, the substations and line could be removed, and the underlying land would over time succeed to a natural state.

4.5.1 Geology and Hydrology

The small areas of soils disturbed by foundation structures and general construction activities will be permanently altered by the proposed project. Soil fertility will be decreased slightly by these activities, and very small losses due to erosion will occur where existing access roads cross or exist near surface-water systems. Sedimentation rates may be increased and may alter the surface-water system's characteristics, especially in first-order watersheds. Planned mitigation measures will reduce and limit any adverse impact. See Section 4.3.2.

4.5.2 Ecology

4.5.2 (a) Terrestrial

Although wildlife habitat would be somewhat altered due to the widening in places of the ROW, cover similar to existing habitat could be partially recovered by selective clearing and re-vegetation. In this regional setting, the widening of the existing corridor will not have an adverse effect on wildlife, which migrate throughout the area in which the corridor is located and are not dependent on habitat found only in that part of the corridor that must be cleared and naturally revegetated.

As noted, the woodcock habitat along Alder Brook will remain essentially intact because alders can be spanned without cutting, and the minor widening of the corridor for a short distance along the edge of the deer-wintering area will not significantly impact that critical habitat, as determined by the Vermont Department of Fish and Wildlife regional biologist who reviewed the project.

Purdue University Professors Dr. William Byrnes and Dr. William Bramble conducted a wildlife-impact research project over the last 47 years. The project concentrated on the vegetation on utility ROWs and the relationship to the habitat of wildlife. The research documented the effects that many different vegetation-management techniques have on food and cover for whitetail deer, cottontail rabbit, ruffed grouse, wild turkey, songbirds and other small mammals and birds and concluded that the impacts of the changed habit are beneficial to wildlife.

Selective clearing and VELCO's vegetation-management techniques will create low-growing shrubs and other vegetation that will support wildlife and provide food for some species such as deer.

4.5.2 (b) Aquatic

Aquatic and wetland habitat commitments (e.g., for right-of-way clearing) would be relatively minor. The greatest would be the loss of approximately ½ acre of habitat, mostly for songbirds, at Highgate Substation.

4.5.3 Socioeconomics

Potential developers of residential land through which the line will (and does) pass could lose income from loss of sales and cancellation of building plans. Sale values of land and residences along the line could decrease during the construction period and for the first sales following the project's completion. Because of the lines that exist today and the use by VELCO of the same corridor, this outcome will not be significant and is an unavoidable consequence of locating a transmission line.

4.5.3 (a) Property Value Impact

The project could possibly cause minor negative impacts on property values. Existing property values already account for the presence of the 48-kV transmission line in the viewsheds of nearby residences. Studies of the potential effects of transmission lines on property values have been conducted, but very little statistical information exists on the relationship between property values and the construction of new transmission lines in existing ROW.

The Edison Electric Institute published an inventory of the major research to date on how the public perceives transmission lines (EEI March 1992). The study concluded that overhead transmission lines have the potential to reduce the sale price of residential and agricultural property. This effect is generally small (0 to 10%) for single-family homes and diminishes over time after construction.

A study in Connecticut (Real Estate Counseling Group of Connecticut, 1984) found that 90% of all real-estate professionals surveyed thought the presence of transmission lines generally had a negative effect on sales price, but a statistical analysis showed only 4 to 6% of the property owners reported paying lower prices because of the presence of transmission lines. Also, see a similar study conducted in Toronto, summarized in Section 4.1.5.

← Contents

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<u>Note</u>: Much of the material used in this document was developed for the 30 V.S.A. §248 filing:

Joint Petition of Vermont Electric Power Company, Inc. ("VELCO"), and Citizens Communications Company, d/b/a Citizens Energy Services ("Citizens"), for a Certificate of Public Good authorizing VELCO to install a 115 kV circuit on Citizen's existing 48 kV, 6.47 mile Irasburg – Mosher's Tap line located in the City of Newport and the Towns of Irasburg and Coventry, Vermont, and to make certain substation and line improvements in the Towns of St. Johnsbury, Irasburg, Highgate and St. Albans, Vermont, to be known as the Northern Loop Project, Vermont PSB Docket No. 6729 (Dec. 20, 2002).

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 Ferrisburg, 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, Vermont PSB Docket NO. 6860 (June 5, 2003).

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Chapter 7. APPENDICES

PLEASE NOTE: Appendix A, "Glossary, Acronyms, and Abbreviations," is provided both here in this printed EIS and on the accompanying CD-ROM. However, Appendices B through F are provided on the enclosed CD-ROM. They are not included in this printed volume because of the large quantity of material. The CD-ROM is complete, with the Executive Summary, the entire EA, and all of the appendices available in Adobe PDF format. All of the files are connected with the table of contents by active hyperlinks for your convenience. Also, all references to internet web addresses are linked directly to the web sites. (*Hyperlinks to the web depend on your internet browser and internet connection.*) If you would like help with the CD-ROM, or require a paper copy of any portion of the appendices, please contact Mr. Peter W. Lind, VELCO, directly at 802-770-6292 or plind@velco.com, or Dr. Jerry Pell, DOE, at 202-586-3362 or jerry.pell@hq.doe.gov, and we will be glad to accommodate your needs.

Appendix A

Glossary, Acronyms and Abbreviations

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Appendix A
GLOSSARY, ACRONYMS AND ABBREVIATIONS

ACSR – Aluminum conductor, steel reinforced conductor wire.

Alternating Current – Electric current that reverses direction sinusoidally, usually many times per second. Household utility current in most countries is AC with a frequency of 60 hertz (60 complete cycles per second), although in some countries it is 50 Hz. The radio-frequency (RF) current in antennas and transmission lines is another example of AC.

ANR – Vermont State Agency of Natural Resources - The state agency whose purpose is "to protect, sustain, and enhance Vermont's natural resources, for the benefit of this and future generations."

Ampere – The unit of measurement of electric current. It is proportional to the quantity of electrons flowing past a given point on a conductor or one second.

ARA – Archaeological Resource Assessment – A process used by the archaeologist to study the possible impact on protected historic sites.

ATV – All-terrain vehicle – An off-road motor vehicle designed for use on rough, sandy, or marshy ground, as well as on roads.

Background – The viewing area of a distance zone that lies beyond the foreground – middleground from a travel; route, use area, or other observer position.

Block-loaded - A certain amount of predefined load that is electrically connected to only one transmission grid.

Bus – An electrical conductor that serves as a common connection for two or more electrical circuits.

Ca – circa (meaning "about")

Capability – The maximum load which a generating unit station, transmission system or other electrical apparatus can carry under special conditions per a given period of time without exceeding approved limits or temperature and stress.

Capacitor – A device that stores electrical charges and can be used to maintain voltage levels in power lines and improve electrical system efficiency.

CFR – Code of Federal Regulations, the compilation of federal regulations adopted by federal agencies through a rule-making process.

Circuit – A conductor or system or conductors through which an electrical current is intended to flow.

Climatology – Science of climates, their phenomena, and their causes.

Climax – A climax community is one that has reached the stable stage. Stability is attained through a process known as succession, whereby relatively simple communities are replaced by those more complex. In addition to trees, each successive community harbors many other life forms, with the greatest diversity populating the climax community. Ref.: Columbia Electronic Encyclopedia, 6th ed. Columbia Univ. Press, e.g. at http://education.yahoo.com/reference/encyclopedia/

Community (plant community) – An assembly of plants living together, reflecting no particular ecological status.

Community Types (vegetation) – A group of plants living in a specific region under relatively similar conditions.

Conductor – Any material which is capable of carrying an electrical current.

Conglomerate – A sedimentary rock compromised of an unstratified mixture or stratified layers of cobbles, gravel, and sand.

Coniferous Forest – A forest dominated by cone-bearing, usually evergreen, trees.

Contrast – The effect of striking a difference in the form, line, color, or texture of the landscape features within the area being viewed.

CPG – Certificate of Public Good - Permission needed by an electric utility before they can build or modify any portion of their system per Vermont statute (30 V.S.A. Section 248). The Vermont Public Service Board, after determination that the project promotes public good and meets all the criteria listing in the 248 statute.

Critical Habitat – Sensitive use areas that are of limited abundance and/or possess unique qualities, thereby constituting irreplaceable, critically necessary, habitat.

CUD – Conditional Use Determination – a permit from the Water Quality Division of the Vermont Agency of Natural Resources' Department of Environmental Conservation for wetland impacts.

Cultural Resources – The archaeological and historical remains of human occupation or use. Includes and manufactured objects, such as tools or buildings. May also include objects, s ites, or geological/geographical locations significant to Native Americans.

Cumulative Effects – As defined by 40 CFR 1508.7, cumulative effects are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative affects can result from individually minor but collectively significant actions taking place over a period of time.

Current – The movement of electricity through a conductor.

CVPS – Central Vermont Public Service Corporation, a Vermont electric utility.

dBA – The sound pressure levels in decibels measured with a frequency weighting network corresponding to the A-scale on a standard sound level meter, The A-scale tends to suppress lower frequencies, e.g., below 1,000 Hz.

decibels (dB) – Units for describing amplitude of sound frequencies to which the human ear is sensitive. A unit used to express relative difference in power or intensity, usually between two acoustic or electric signals, equal to ten times the common logarithm of the ratio of the two levels. Ref.: American Heritage Dictionary on-line (http://www.bartleby.com/61/).

Deciduous – Trees or shrubs which lose their leaves each year during a cold or dry season.

Deciduous Forest – a forest characterized by tree and shrubs which lose their leaves each year during a cold or dry season.

Demographic – Pertaining to the study of human population characteristics including size, growth rates, density, distribution, migration, birth rates, and mortality rates.

Direct Impacts – As defined by 40 CFR 1508.9, these are effects which are caused by the action and occur at the same time and place as the action.

Direct Impact Area – An area analyzed for the effects of an action that would occur at the same place in time.

Disturbance – An event that changes the local environment by removing organisms or opening up an area, facilitating colonization by new, often different, organisms.
Disturbed Areas – Area where natural vegetation and soils have been removed or disrupted.
Diversity – The distribution and abundance of different plant and animal communities and species within an area.
Double-circuit – A transmission line consisting of two systems of conductors (or wires) through which electric current flows.
Drainage – Natural channel through which water flows sometime of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.

E

EA – Environmental Assessment:

(a) Means a concise public document for which a Federal agency is responsible that serves to:

(1) Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact (FONSI).

(2) Aid an agency's compliance with NEPA when no environmental impact statement (EIS) is necessary.

(3) Facilitate preparation of a statement when one is necessary.

(b) Shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted. 40 CFR 1508.9

Effects – Environmental consequences as a result of a proposed or alternative action. Included are direct effects, which are caused by the action and occur at the same time and place, and indirect effects, which are caused by the action and are later in time or further removed in distance but which are still reasonable foreseeable. Also referred to as impacts.
EIS – Environmental Impact Statement. A detailed written statement as required by section 102(2)(C) of NEPA. 40 CFR 1508.11. (See also EA and NEPA.)
EMF – Electromagnetic field. Invisible lines of force, produce by voltage and current, that surround any electrical device or electrical power line. The energy that radiates from all things in nature and from man-made electronic systems. It includes cosmic rays, gamma rays, x-rays, ultraviolet light, visible light, infrared light, radar, microwaves, TV, radio, cell phones and all electronic transmission systems. Electromagnetic radiation is comprised of electric and magnetic fields that move at right angles to each other at the speed of light. Ref.: Amer. Heritage Dictionary on-line, e.g. at http://education.yahoo.com/reference/dictionary/
Endangered Species – Any species or animal or plant which is in danger of extinction throughout all or significant portions of its range and has been designated "endangered" in the Federal Register by the U.S. Secretary of the Interior. Disturbance of the habitat or endangered species is prohibited by the Endangered Species Act of 1973, as amended.
Environment – The aggregate of physical, biological, economic, and social factors affecting organisms in an area.
Environmental Analysis – An analysis of alternative actions and their predictable environmental effects, including physical, biological, economic, and social consequences, and their interactions; short- and long-term effects; direct, indirect, and cumulative effects.
Environmental Assessment – See EA.
Environmental Impact Statement – See EIS.

Erosion – Detachment or movement of soils or rock fragments by water, wind, ice, or gravity. Accelerated erosion is much more rapid than normal, natural or geologic erosion, primarily as a result of the influence of activities of man, animals, or natural catastrophes.

Escarpment – An island cliff or steep slope, formed by the erosion of inclined strata of hard rocks, or possibly as a direct result of a fault.

Fisheries – Streams and lakes used for fishing.

Fisheries Habitat – Streams, lakes, and reservoirs that support fish.

Floodplain – That portion of a river valley, adjacent to the channel, which is built of recently deposited sediments and is covered with water when the river overflows its banks at flood stages.

FONSI – Finding of No Significant Impact. See EA.

Forage – Vegetation used for food by wildlife, particularly big game wildlife and domestic livestock.

Foreground-Middleground – The area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape, and vegetation is apparent only in pattern or outline.

Gauss – The centimeter-gram-second unit of magnetic flux density, equal to one maxwell per square centimeter. Ref.: American Heritage Dictionary on line, e.g. at http://www.bartleby.com/61/

Habitat – The place or type of site where a plant or animal naturally or normally lives and grows; includes all biotic, climatic, and soil conditions, or other environmental influences affecting living organisms.

Habitat Diversity – The distribution and abundance of different plant and animal communities and species within a specific area.

Habitat Type – The aggregate of all areas that support or can support the same primary vegetation at climax.

Herbaceous – The plant strata which contains soft, not woody, stemmed plants that die to the ground in winter.

Irretrievable – Applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievable while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

Irreversible – Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity and aspen regeneration. Irreversible also includes loss of future options.

Kilovolt (kV) – 1,000 volts.

Land Use – Land uses determined for a given area that establishes the types of activities allowed (e.g., mining, agriculture, residential, and industrial).

Load – The amount of electric power drawn at a specific time from an electric system or the total power drawn from the system.

Long-Term Effects – Effects that would remain permanently following completion of the project.

Losses – The general term applied to energy and power lost in the operation of an electric system. Losses occur principally as energy transformations from kilowatt-hours to wasted heat in electrical conductors and apparatus. Specifically, in electricity transmission lines, losses are due to the resistance of the copper or aluminum wires themselves.

m – meter. 1 meter = 3.28 feet = 39.37 inches.

mG – milligauss; a measurement of magnetic flux density. One one-thousandth (1/1000) of a Gauss in strength.

Mitigate – To lessen the severity of an impact to a resource.

Mitigation – Actions to avoid, minimize, reduce, eliminate, or rectify the impact of a management practice.

Monitor – To systematically and repeatedly watch, observe, or measure environmental conditions in order to track changes.

mv – millivolt**.** One one-thousandth (1/1000) of a volt.

MVAR – Mega Volt Ampere Reactive. Reactive power that produce magnetic fields which allow useful work to be done. The energy required to maintain electric and magnetic fields associated with power lines and equipment must be supplied by reactive power.

National Register of Historic Places – A list, maintained by the National Park Service (U.S. Department of the Interior), of areas which have been designated as being of historical significance.

Native Species – Plants that originated in the area in which they are found, i.e., they naturally occur in the area.

NEPA – The National Environmental Policy Act of 1969, as amended. This is the national charter for protection of the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations 40 CFR 1500-1508 implement the act.

Not-to-be-disturbed Buffer zones – An environmentally sensitive area designated by any federal, state, or local agency. Rights-of-way would be granted only in cases where there is a prevailing need or no practical alternative exists, and then only with provisions to protect the sensitive resources.

Ozone – A molecule containing three oxygen atoms (O_3) produced by passage of an electrical spark through air or oxygen. An unstable, poisonous allotrope of oxygen that is formed naturally in the ozone layer from atmospheric oxygen by electric discharge or exposure to ultraviolet radiation, also produced in the lower atmosphere by the photochemical reaction of certain pollutants. It is a highly reactive oxidizing agent used to deodorize air, purify water, and treat industrial wastes. Ref.: Amer. Heritage Dictionary on line, e.g. . http://www.bartleby.com/61/

Paleontology – The science which deals with the history and evolution of life on earth.

Peak Flow – The greatest flow attained during melting of winter snow pack or during a large precipitation event.

PSB – Public Service Board, the same entity as the Vermont Public Service Board, a quasi-judicial board that supervises the rates, quality of service, and overall financial management of Vermont's public utilities: cable television, electric, gas, telecommunications, water and large wastewater companies. It also reviews the environmental and economic impacts of energy purchases and facilities, the safety of hydroelectric dams, the financial aspects of nuclear plant decommissioning and radioactive waste storage, and the rates paid to independent power producers.

Radial line – Lines that are not connected through (looped) to a transmission grid.

Raptor – A bird of prey with sharp talons and strongly curved beaks which preys on living animals (e.g., eagles, hawks, falcons, and owls).

Reliability – Electric system reliability consists of two components: adequacy and security. Adequacy is the ability of the electric system to supply the total electrical demand and energy requirements of the customers at all times, taking into account scheduled and unscheduled outages. Security is the ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system facilities.

Resistance – In electricity, the opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. Often represented by the Greek letter omega (**Ω**). Ref.: Amer. Heritage Dictionary, e.g. at http://www.bartleby.com/61/

Riparian – Land areas which are directly influenced by water. They usually have visible vegetative or physical characteristics showing water influence. Stream banks, borders of lakes, and marshes, are typical riparian areas.

ROW – Right of Way. The right to use a parcel of land for a particular purpose.

Runoff –Precipitation that is not retained on the site where it falls, is not absorbed by the soil, and that may appear in surface streams.

Scoping – Procedure under NEPA by which agencies determine the extent of analysis necessary for a proposed action, (i.e., the range of actions, alternatives, and impacts to be addressed; identification of significant issues related to a proposed action; and the depth of environmental analysis, data, and task assignments needed).

Sediment – Soil or rock particles that have been transported to stream channels or other bodies of water. Sediment input comes form natural sources, such as soil erosion and rock weathering, as well as from agricultural or construction practices.

Short-Term Impacts – Short-term impacts are defined as those effects that would not last longer than the life of the project.

Significant – As used in NEPA, determination of significance requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

Single-circuit – A transmission line consisting of one system of conductors (or wires) through which electric current flows.

Stormwater Runoff – Overland runoff from snowmelt or a precipitation event.

Substation – An assemblage of equipment for the purpose of switching and/or changing or regulating the voltage of electricity.

Tap – A point where transmission lines are connected to other transmission lines without circuit breakers and associated protection equipment.

Threatened Species – Any species of animal or plant which is likely to become endangered within the foreseeable future throughout all or significant portions of its range, as designated in the Federal Register by the Secretary of the Interior as a threatened species. Disturbance of the habitat of threatened species is prohibited by the Endangered Species Act of 1973, as amended.

UMF – University of Maine at Farmington

Volt –The International System unit of electric potential and electromotive force, equal to the difference of electric potential between two points on a conducting wire carrying a constant current of one ampere when the power dissipated between the points is one watt. Ref.: Amer. Heritage Dictionary on line, e.g. http://www.bartleby.com/61/

Voltage – A measure of the force which transmits electricity.

VPSB – Vermont Public Service Board. See Public Service Board.

Watershed – All the land that drains surface water to a given stream above a designated point (usually the mouth of the stream); also called a stream drainage or drainage basin.

Wetlands – Areas that are inundated by surface or ground water with a frequency sufficient to support, and under normal circumstances does or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

YBP – Years Before the Present

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Appendix B

VELCO Permits and Letters of Approval

This is a hyperlinked page. "Clicking" on the highlighted words will take you directly to that file on the CD.

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ENVIRONMENTAL ASSESSMENT

Appendix C

Photographs of the Proposed Project, Including VELCO's Preferred Corridor

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1. Photograph of the existing (present) substation
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14. General arrangement plan of the existing (present) substation
15. General arrangement plan of the proposed (future) substation

16. Survey of Corridor, Irasburg to Mosher's Tap

ORTHOGRAPHIC PHOTOGRAPHS

17. Irasburg to Mosher's Tap Corridor, overall view
18. Irasburg to Mosher's Tap Corridor, miles 1 and 2 (See overall view)
19. Irasburg to Mosher's Tap Corridor, miles 3 and 4 (See overall view)
20. Irasburg to Mosher's Tap Corridor, miles 5 and 6 (See overall view)

21. Photo album of the preferred corridor; 22 photographs

22. Artist's conceptions and existing (actual) photos; 5 sets of 2

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Appendix D

Additional Reference Documents

This is a hyperlinked page. "Clicking" on the highlighted words will take you directly to that file on the CD.

1. Advisory Circular, Federal Aviation Administration
2. Certificate of Public Good and VELCO's Petition, Vermont Public Service Board
3. Erosion Prevention and Sediment Control Plan Checklist, Vermont Water Division
4. Northwest Regional Planning Commission Regional Plan
5. Northwest Regional Planning Commission Regional Plan for the NE Kingdom
6. Permit to Conduct Herbicide Treatment, Department of Agriculture
7. VELCO Erosion Control Plan
8. VELCO Letters of Notification to Towns
9. VELCO Vegetation Management Plan
10. Water Quality Standards, State of Vermont

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Appendix E
Photographs of the Alternative Corridors

This is a hyperlinked page. "Clicking" on the highlighted words will take you directly to that file on the CD.

1. Alternative A, Orthographic Photographs (10)

2. Alternative A, Actual Corridor Photographs (8)

3. Alternative B, Partially New Corridor; Orthographic Photographs (10)

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Appendix F
Environmental Reference Documents

This is a hyperlinked page. "Clicking" on the highlighted words will take you directly to that file on the CD.

1. Archaeological resource assessment study
2. Archaeological study, University of Maine at Farmington
3. Bald eagles, article; Burlington Free Press
4. EMF (Electromagnetic field); actual measurements
5. Endangered and threatened animals of Vermont
6. Endangered and threatened species of Vermont
7. Environmental study of wetlands
8. Ice storm information; Vermont web sites
9. Map, Average annual precipitation in Vermont
10. Memorandum on streams, consultant's report
11. Table, average frost freeze dates in Vermont
12. Tables and maps of wildlife
13. Vermont natural areas