February 2017

RHODE ISLAND ENERGY FACILITY SITING BOARD ENVIRONMENTAL REPORT

Burrillville Interconnection Project

Burrillville, Rhode Island

This document has been reviewed for Critical Energy Infrastructure Information (CEII). [February 2017]

Prepared For:
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State of Rhode Island Energy Facility Siting Board
89 Jefferson Boulevard
Warwick, RI 02888

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Rhode Island Energy Facility Siting Board Application

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APPENDIX C VISUAL IMPACT ASSESSMENT: CLEAR RIVER ENERGY CENTER TRANSMISSION LINE PROJECT (FEBRUARY 2017)

GLOSSARY OF TERMS

A	amps
ACGIH	American Conference of Governmental and Industrial Hygienists
ACI	American Concrete Institute
ACSR	Aluminum Conductor Steel Reinforced
AFUDC	Allowance for Funds Used During Construction
AGT	Algonquin Gas Transmission
Ampere (Amp)	A unit of measure for the flow of electric current
ANSI	American National Standards Institute
Applicant	The Narragansett Electric Company d/b/a National Grid and Clear River Energy LLC
ASCE	American Society of Civil Engineers
ASF	Area Subject to Flooding
ASSF	Area Subject to Storm Flowage
ATV	All-Terrain Vehicle
BMPs	Best Management Practices
°C	degrees Celsius
Cable	A fully insulated conductor usually installed underground, but in some circumstances can be installed overhead
CFR	Code of Federal Regulations
Circuit	A system of conductors (three conductors or three bundles of conductors) through which an electric current is intended to flow and which may be supported above ground by transmission structures or placed underground
cm/W	centimeters per watt
CO	Carbon Monoxide
Conductor	A metallic wire which serves as a path for electric current to flow
CREC	Clear River Energy Center generating plant proposed by Invenergy Thermal Developments LLC. See EFSB Docket No. 2015-06
CREC ROW	The approximately 0.8 mile long 250-foot-wide easement granted to CREC located between the TNEC ROW and CREC
CYME	Power Engineering Software
dB	A decibel is a logarithmic unit of measurement that expresses the magnitude of a sound.
dBA	Decibel, on the A-weighted scale. A-weighting is used to emphasize the range of frequencies where human hearing is most sensitive.
DCT	Double-circuit tower

Demand	The total amount of electric power required at any given time by an electric supplier's customers
Distribution Line or System	Power lines that operate under 69 kV
Double-Circuit	Two circuits on one structure
EDR	Environmental Design and Research
EFSB	Rhode Island Energy Facility Siting Board
EFSB Rules	State of Rhode Island and Providence Plantations Energy Facility Siting Board Rules of Practice and Procedure, April 11, 1996
Electric Field	A field produced as a result of voltages applied to electrical conductors and equipment; usually measured in units of kilovolts per meter
Electric Transmission	Facilities ($\geq$ 69 kV) that transmit electrical energy from generating plants to substations
EMF	Electric and magnetic fields
ER	Environmental Report
ESS	ESS Group, Inc.
Fault	A failure or interruption in an electrical circuit (a.k.a. short-circuit)
FERC	Federal Energy Regulatory Commission
FEMA	Federal Emergency Management Agency
Gauss (G)	A unit of measure for magnetic fields; one G equals 1,000 milliGauss (mG)
Gneiss	Light and dark, medium to coarse-grained metamorphic rock characterized by compositional banding of light and dark minerals, typically composed of quartz, feldspar and various amounts of dark minerals
H-frame Structure	A wood or steel transmission line structure constructed of two upright poles with a horizontal cross-arm
Hz	Hertz, a measure of the frequency of alternating current; expressed in units of cycles per second
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEEE	Institute of Electrical and Electronic Engineers
Invenergy	Invenergy Thermal Development LLC
IPaC	Information for Planning and Conservation
IRP	Interstate Reliability Project, see EFSB Docket No. 2012-1
ISO-NE	ISO New England, Inc., the independent system operator of the New England electric transmission system
K	erodibility factor
kcmil	One thousand circular mils, approximately 0.0008 square inches, a measure of conductor cross-sectional area
kV	Kilovolt - one kV equals 1,000 volts

kV/m	Kilovolts per meter - a measurement of electric field strength
Load	Amount of power delivered upon demand at any point or points in the electric system; load is created by the power demands of customers' equipment (residential, commercial and industrial)
LSZ	Landscape Similarity Zone
mG	A unit of measure for magnetic fields; one milliGauss - equals 1/1000 Gauss
Monopole	A single pole structure supporting overhead utility wires
MVA	Megavolt Ampere - measure of electrical capacity equal to the product of the line-to-line voltage, the current and the square root of 3 for three-phase systems; electrical equipment capacities are sometimes stated in MVA
MVAR	Megavolt Ampere Reactive - also called MegaVARS - measure of reactive power in alternating current circuits; shunt capacitor and reactor capacities are usually stated in MVARs
MW	Megawatt - a megawatt equals 1.0 million watts
N-1-1	Occurrence of two separate and unrelated outages within a short period of time
NAAQS	National Ambient Air Quality Standards
NEPOOL	New England Power Pool
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code. The NESC is an ANSI standard that covers basic provisions for safeguarding of persons from hazards arising from the installation, operation, or maintenance of 1) conductors and equipment in electrical supply stations, and 2) overhead and underground electric supply and communication lines. It also includes work rules for the construction, maintenance, and operation of electric supply and communication lines and equipment.
NLEB	Northern long-eared bat
NO_2	nitrogen dioxide
NPCC	Northeast Power Coordinating Council
NPS	National Park Service
NRCS	Natural Resource Conservation Service
O_3	Ozone
OPGW	Optical ground wire – ground wire containing optical fibers
PAC	Planning Advisory Committee lead by ISO-NE
PAL	Public Archaeology Laboratory (a retained cultural resource management firm)
Pb	lead
Phase	Transmission and distribution AC circuits are comprised of three conductors or bundles of conductors that have voltage and angle differences between them; each of these conductors (or bundles) is referred to as a phase.
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter

PM_{10}	Particulate matter less than 10 microns in diameter
POWER	POWER Engineers, Inc.
Project	The construction of the Burrillville Interconnection 345 kV transmission line (3052 Line), relocation of the existing 341 and 347 Lines, improvements to the Sherman Road Switching Station yard, and relocation of the 328 Line termination at the Sherman Road Switching Station
Project ROW	The TNEC ROW and the CREC ROW
PVC	Polyvinyl Chloride
Reactive Power	A component of power associated with capacitive of inductive circuit elements; its unit of measurement is the VAR
Rebuild	Replacement of an existing overhead transmission line with new structures and/or conductors, generally along the same alignment as the original line
Reinforcement	Any of a number of approaches to increase the capacity of the transmission system, including rebuilding, reconductoring, uprating, conversion and conductor bundling methods
RIDEM	Rhode Island Department of Environmental Management
RIDFW	Rhode Island Division of Fish and Wildlife
RIDOT	Rhode Island Department of Transportation
RIGIS	Rhode Island Geographic Information System
R.I.G.L.	Rhode Island General Laws
RIHPHC	Rhode Island Historical Preservation & Heritage Commission
RINHP	Rhode Island Natural Heritage Program
RINHS	Rhode Island Natural History Survey
RIPDES	Rhode Island Pollutant Discharge Elimination System
ROW	Right-of-Way. Corridor of land within which a utility company holds legal rights necessary to build, operate, and maintain power lines
Rules	Rhode Island Fresh Water Wetlands Act and Rules
SEMA	The Southeastern Massachusetts electrical zone
SESC Plan	Soil Erosion and Sediment Control Plan
SF_6	Sulfur hexafluoride, a gas used as electrical insulation
Shield Wire	Wire strung at the top of transmission lines intended to prevent lightning from striking the transmission circuit. These conductors are sometimes referred to as static wire or aerial ground wire and may contain glass fibers for communication use (refer to “OPGW”).
SO_2	sulfur dioxide
Steel Pole Structure	Transmission line structure consisting of tubular steel pole(s) with arms or other components to support insulators and conductors
STP	shovel test pits

Study Area	A 5,000-foot-wide corridor measured 2,500 feet on either side of the 3052 Line (see Figure 6-1).
Substation	A fenced-in yard containing switches, circuit breakers, power transformers, line terminal structures, and other equipment enclosures and structures; voltage changes, adjustments of voltage, monitoring of circuits and other service functions take place in the substation
Swamp mats	Swamp mats consist of timbers that are bolted together and placed over wetland areas to distribute equipment loads and minimize impacts to the wetland and soil substrates in accordance with National Grid's ROW Access, Maintenance, and Construction Best Management Practices (EG-303).
Switching Station	Same as Substation except with no power transformers; switching of circuits and other service functions take place in a switching station
TGP-28	National Grid Transmission Group Procedure 28 - Transmission Planning Guide
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load - maximum allowed pollutant load to a water body without exceeding water quality standards
TNEC	The Narragansett Electric Company d/b/a National Grid
TNEC ROW	The approximate 6.0 mile portion of the existing transmission line right of way in Burrillville located between the junction of the CREC ROW and the Sherman Road Switching Station. The ROW ranges from approximately 300 feet to 500 feet wide.
Transmission Line	An electric power line operating at 69,000 volts or more
Tribes	Federally-recognized tribes, e.g., The Narragansett Indian Tribe and Wampanoag Tribe of Gay Head (Aquinnah)
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United Stated Geological Survey
VIA	Visual Impact Assessment
Visual Study Area	The area within a one mile radius of the ROW used to develop the Visual Impact Assessment
V/m	Volts per meter - a measure of electric field strength
VOC	Volatile Organic Compound
Voltage	Electric potential difference between any two conductors or between a conductor and ground

Wire	Refer to "Conductor"
WISCP	Wetland Invasive Species Control Plan
XLPE	Cross Linked Polyethylene - a type of underground cable

1.0 INTRODUCTION

1.1 Project Overview

The Narragansett Electric Company d/b/a National Grid (TNEC),[1] and Clear River Energy LLC, a project company of Invenergy Thermal Development LLC (Invenergy) (collectively the Applicant) are proposing to construct a new approximately 6.8 mile 345 kilovolt (kV) transmission line (the 3052 Line) in the Town of Burrillville, Rhode Island, to interconnect the proposed Clear River Energy Center (CREC)[2] to the existing electric transmission system (the Burrillville Interconnection Project or the Project). The 3052 Line will begin at the proposed CREC to be located off of Wallum Lake Road in Burrillville. From the CREC facility, it will extend approximately 0.8-mile within a new right-of-way (ROW) on an easement owned by CREC (CREC ROW) to its intersection with an existing TNEC transmission line ROW (TNEC ROW). The 3052 Line will then continue east approximately six miles within the TNEC ROW to the existing Sherman Road Switching Station in Burrillville (refer to Figure 1-1). The 3052 Line will share the TNEC ROW with the two existing 345 kV lines, the 347 Line and the 341 Line. The 341 Line was recently installed as part of the Interstate Reliability Project (IRP).[3]

This Application is being submitted to satisfy the applicable requirements of Rhode Island General Laws (R.I.G.L.) 42-98-1 et seq., the Energy Facility Siting Act. Section 4 of the Energy Facility Siting Act states that “No person shall site, construct, or alter a major energy facility within the state without first obtaining a license from the siting board pursuant to this chapter.” Transmission lines with a design rating of greater than or equal to 69 kV are classified as major energy facilities. The Rhode Island Energy Facility Siting Board (EFSB) application filing requirements and associated procedures for a major generating facility are established in the “State of Rhode Island and Providence Plantations Energy Facility Siting Board Rules of Practice and Procedure, April 11, 1996” (the EFSB Rules).

1.2 Project Team

This Application to the EFSB has been prepared by TNEC and Invenergy. Numerous employees and consultants retained by TNEC and Invenergy, including planners, engineers, and legal personnel, contributed to the Application. The description of the affected natural and social environments, and impact analyses were prepared by ESS Group, Inc. (ESS) and POWER Engineers, Inc. (POWER). Other consultants contributing to the Application include Gray and Pape for cultural resources; Environmental Design and Research (EDR) for visual resources; and Exponent for analysis of health effects of electric and magnetic fields (EMF), and EMF modeling and calculations. POWER is responsible for Project engineering and design.

[1] The Narragansett Electric Company d/b/a National Grid, a subsidiary of National Grid USA, is an electric distribution and transmission company serving approximately 465,000 customers in 38 Rhode Island communities. National Grid USA is a public utility holding company. Other subsidiaries of National Grid USA include operating companies such as New England Power Company, Massachusetts Electric Company, Nantucket Electric Company (in Massachusetts), and Niagara Mohawk Power Corporation (in New York), as well as National Grid USA Service Company, Inc., which provides services such as engineering, facilities construction and accounting.

[2] RI EFSB Docket No. SB-2015-06 Invenergy Thermal Development LLC’s Application to Construct the Clear River Energy Center Power Plant in Burrillville, RI.

[3] RI EFSB Docket No. SB-2012-01 Interstate Reliability Project – National Grid.

1.3 Compliance with EFSB Requirements

Compliance with the EFSB Rules is addressed in the Application which is filed under separate cover with the EFSB.

2.0 EXECUTIVE SUMMARY

2.1 Introduction

This Environmental Report (ER) has been prepared in support of an application to the EFSB for construction of jurisdictional facilities and for submission with other state and local applications required for the Project. The ER has been prepared in accordance with the EFSB Rules to provide information on the potential impacts of the electric transmission system improvements proposed by the Applicant. The ER describes the Project and explains the need for the Project. The ER also discusses the alternatives to the Project that were considered and analyzed, describes the specific natural and social features that have been assessed for the evaluation of impacts, discusses potential impacts, presents a mitigation plan for potential impacts associated with the construction of the Project, and describes permit requirements.

The Purpose and Need for the Project is detailed in Section 3.0 of this ER. Section 3.0 summarizes the studies and forecasts completed by Independent System Operator-New England (ISO-NE) and TNEC that support the need for the proposed transmission line interconnection. Section 4.0 provides a detailed description of each of the components of the Project, and also discusses construction practices, ROW maintenance practices, EMF, safety and public health considerations, estimated costs for the Project, and anticipated Project schedule. An analysis of alternatives to the Project, together with reasons for the rejection of each alternative, is presented in Section 5.0 of this report. Detailed descriptions of the characteristics of the natural and social environment within and immediately surrounding the Project location are included as Sections 6.0 and 7.0, respectively. Section 8.0 of this report identifies the potential impacts of the Project on the natural and social environments. Section 9.0 summarizes proposed mitigation measures which are intended to offset or eliminate the potential impacts associated with the Project. Finally, Section 10.0 lists the federal, state, and local government agencies that may exercise licensing authority and from which the Applicant may be required to obtain approvals prior to constructing the Project. Volume 2 of this ER, bound separately, contains supporting mapping and figures.

2.2 Project Description and Proposed Action

The Applicant is proposing to construct a dedicated 345 kV Line (the 3052 Line) for the purpose of interconnecting the CREC to the existing electric transmission network. The 3052 Line will be built within the proposed CREC ROW and the existing TNEC ROW. The TNEC ROW is currently occupied by two 345 kV transmission lines, designated as the 341 and 347 Lines. The components of the Project are as follows:

- Construct a new 6.8-mile 345 kV transmission line between the CREC and the Sherman Road Switching Station, which includes modifications to the 341 and 347 Lines. The Project ROW consists of the following three segments:
  - Segment 1 – CREC ROW from the CREC to the TNEC ROW (0.8 mile)
  - Segment 2 – TNEC ROW from the junction of CREC ROW to a point 0.19 mile west of the Clear River (1.6 miles)
  - Segment 3 – TNEC ROW from 0.19 mile west of the Clear River to the Sherman Road Switching Station (4.4 miles)

- Improvements to the existing Sherman Road Switching Station, including the realignment of an approximate 260 foot span of the existing 345 kV 328 Line at the station.

Figure 1-1 (United States Geological Survey [USGS] Topographic Map) provides an overview of the Project location, Figure 2-1 provides a schematic representation of the Project, and Figure 2-2 (Sheets 1-13) provides Project alignment details.

2.3 Purpose and Need

The need for this Project is driven exclusively by the proposed interconnection of the CREC to the New England electric system. ISO-NE performed a feasibility study to explore interconnection options and to preliminarily identify any reliability issues with the CREC. The ISO-NE study concluded that the CREC should be connected by a dedicated 345 kV line into the existing Sherman Road Switching Station.

2.4 Alternatives

In accordance with requirements of the EFSB, the Applicant evaluated alternatives to the Project. An important goal in the planning and development of the proposed electric transmission interconnection was to ensure that the solutions selected meet the electrical system needs, are the most appropriate in terms of cost and reliability, and that environmental impacts are avoided, minimized and mitigated to the fullest extent possible. Analyses were undertaken to evaluate the feasibility of alternatives to the Project to ensure these objectives were met.

The alternatives that were considered and evaluated by the Applicant included: the “No Action” alternative; electrical alternatives; alternative overhead routes; overhead alternatives utilizing the existing ROWs with varying configurations; and underground transmission line alternatives. Some of these alternatives were eliminated based on feasibility assessments, or the inability of the alternative to address the identified interconnection need. Other alternatives that were found to be feasible and capable of addressing the identified need were further examined on the basis of estimated costs, operability, environmental impact assessments and reliability assessments. The proposed Project was found to best meet the identified need with a minimum impact on the environment, at the lowest possible cost.

2.5 Summary of Environmental Impacts and Mitigation

Construction of the Project will result in temporary and permanent impacts to wetlands and water resources along the Project ROWs. Temporary impacts will result from the placement of swamp mats for construction access and for construction work pads. Swamp mats will be removed after construction is completed, allowing vegetation to regrow. Permanent impacts will result from the placement of fill required for structure installation, and conversion from forested wetland to scrub-shrub and/or emergent wetland within the CREC and TNEC ROWs.

The proposed transmission line construction may cause a displacement of soil due to water and wind erosion. This may result in minor siltation of water bodies and wetlands. However, these impacts will be short-term and localized. To minimize these impacts, standard Best Management Practices (BMPs) such as the installation of soil erosion control devices (i.e., straw bales and/or silt fences) and the re-establishment of vegetation will be used during construction.

The Project will be designed and constructed in a manner that minimizes and mitigates the potential for adverse environmental impacts. The Project will have minimal direct impact on geologic, soil, surface water, and wetland resources. Short-term, localized impacts may be expected on wildlife; however, measures will be taken to avoid adverse impacts to rare, threatened, or endangered species through the implementation of avoidance plans and time of year restriction on tree clearing activities.

An important goal of the Project's design was to avoid and/or minimize adverse impacts on wetlands and water resources. The initial design aligned the proposed structure locations in-line with existing structures on the ROWs. This design approach was based on the assumption that aligning the new structures with existing structures will maximize the use of existing access roads which are already situated to reach existing structures, minimize changes to the visual environment, create an appearance of symmetry, and mimic existing span lengths to reduce the potential for clearance violations under certain high wind conditions.

Following this preliminary structure siting, each proposed structure location was further evaluated to assess other factors, such as potential environmental (natural and social) impacts. Detailed constructability field reviews of the entire Project ROW and proposed structure locations were conducted to assess the constructability of the Project and to identify ways to avoid and/or minimize impacts from construction activities. The Applicant sought a Project alignment that will maximize the use of upland areas that do not contain sensitive environmental features for structure locations, construction pads and access roads. However, the ability to avoid all impacts is limited because of engineering constraints, including minimum and maximum span length criteria, horizontal and vertical clearance standards, and fixed locations where it is necessary to locate angle structures because the ROW alignment changes direction. The Project design reflects the results of the Applicant's constructability review and the measures taken to avoid and/or minimize adverse impacts. Where impacts to wetland resource areas cannot be avoided, appropriate mitigation measures will be provided. The Applicant is currently preparing a compensatory wetland mitigation plan that is intended to provide compensation for impacts to wetlands, as required by the United States Army Corps of Engineers (USACE) and the Rhode Island Department of Environmental Management (RIDEM).

In addition to these mitigation measures, the Applicant will retain the services of an environmental compliance monitor throughout the entire construction phase of the Project. The primary responsibilities of the environmental monitor will be to regularly monitor compliance with all applicable federal, state, and local permit conditions and the Applicant's construction BMPs. In addition, the environmental monitor will monitor the effectiveness of the BMPs and make recommendations as necessary to maintain compliance with permits and approvals.

2.6 Summary of Social Impacts and Mitigation

2.6.1 Social and Economic

The construction of the Project as described herein is not expected to adversely impact the overall social and economic conditions of the Project area. The Project is necessary to enable the CREC to meet the needs of the state and/or region for electric generation. The Project is cost justified and can be expected to transmit energy at the lowest reasonable cost to the consumer consistent with the objective of ensuring construction and operation of the Project in compliance with applicable laws and regulations. The Project will not cause unacceptable harm to the environment and will enhance the socio-economic fabric of the state by providing the interconnection of a new source of electric generation.

2.6.2 Land Use

Because the majority of the Project is located within an established ROW, it will not require, nor will it lead to, long-term residential or business disruption. The development of the CREC ROW is to occur on property currently owned by an existing utility company (Spectra Energy).

2.6.3 Cultural and Historic Resources

The Project will be permitted through the USACE, and therefore must be in compliance with legislation and regulations concerning the impact to archaeological properties from federally-funded or permitted activities. These include Section 106 of the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, Executive Order 11593, 1971, Procedures for the Protection of Historic and Cultural Properties, and the Archaeological and Historic Preservation Act of 1974. It is expected that the Rhode Island Historical Preservation and Heritage Commission (RIHPHC) will review the Project under Section 106, in consultation with the USACE. The USACE has initiated Section 106 consultation with The Narragansett Indian Tribe and Wampanoag Tribe of Gay Head (Aquinnah) (collectively, the Tribes).

Gray & Pape has completed background research and a file review for the proposed 3052 Line at both the RIHPHC and the Massachusetts Historical Commission. A Phase I(b) Archaeological Reconnaissance survey was conducted for the entire length of the Project. The results of the background research and reconnaissance survey and in consultation with the RIHPHC Gray & Pape are recommending Phase I (c) Site Identification survey testing in approximately 60 locations. This survey will require permitting from RIHPHC. Prior to this survey, the Applicant will enter into discussions with the USACE and the Tribes to assure that they have an opportunity to review the proposed testing strategy and can be present during the survey, if desired. The result of the Phase I(c) survey will be to identify areas that might need to be avoided and preserved, or evaluated further for historical significance. The Applicant will continue to include the RIHPHC and USACE, as well as the Tribes, in the survey process.

2.6.4 Visual Resources

The visual impact assessment and viewshed analysis performed by EDR indicates that based on topography alone, potential views of the proposed structures increased approximately 0.5 percent as compared to visibility of the existing transmission lines and by 0.8 percent where both topography and vegetation were considered. Field verification and photo documentation were conducted to verify potential visibility of the proposed transmission facilities from ground-level vantage points. Based on the field assessment, eight viewpoints were selected for simulations from the field photography. Before and after simulations prepared for each of the viewpoints were presented to a panel of registered landscape architects for evaluation of the effect of the proposed Project on visual conditions. The panel concluded that that the Project would not significantly alter the visual character and scenic quality of existing views. The visual impact analysis for the Project indicates that the proposed transmission line will have a similar degree of visibility to that of the existing transmission lines. This is due in large part to the use of existing transmission ROWs.

2.6.5 Noise

Noise generated by construction is generally temporary and intermittent, and will result from the operation of construction equipment such as trucks, excavating equipment, drilling equipment, structure erection equipment (cranes), and wire stringing rigs. All construction equipment will be kept in good working condition with proper mufflers to minimize noise impacts. During construction, continuous noise sources that may operate during the day, such as generators or air compressors, will be located away from populated areas to the greatest extent practicable.

While most transmission lines do not generate appreciable noise during normal operations, 345 kV transmission lines may be audible under certain weather conditions. Any operational noise associated with the proposed new transmission line would attenuate quickly with distance from the transmission line. Noise could increase somewhat during wet weather; however, in such conditions, there typically would be few receptors near the transmission lines to hear the increase in sound levels.

Noise associated with electric substations generally results from power transformers located within substations. No new transformers or other noise-generating equipment are proposed as a result of the Sherman Road Switching Station improvements.

2.6.6 Electric and Magnetic Fields

TNEC designed the Project to optimize the phasing of the 3052 Line on the ROW in order to minimize magnetic fields at the edge of the ROW, subject to constructability and structural constraints. The 3052 Line is not calculated to significantly increase the electric field level at the ROW edge in Segment 3 because of the very wide ROW in that section. Rebuilding of the existing 341 Line nearer the northwest ROW edge in Segment 2 is expected to slightly increase electric field levels. On the CREC ROW, EMF levels are similar to those in Segments 2 and 3, but levels at the northeastern ROW edge are slightly higher due to the placement of the 3052 Line approximately 75 feet from the northeastern ROW edge. However, this interconnection on Segment 1 will be constructed entirely on private property. The closest residences are more than 1,000 feet from the 3052 Line interconnection, and no increase in EMF levels off-site is anticipated. Because of the variations in the physical arrangement and loadings on the lines on the ROW, some edge of ROW electric and magnetic field levels will increase after the Project is completed and some will decrease. The results of the EMF calculations are presented in Sections 7.8 and 8.16 of this report.

2.7 Conclusion

Completion of the Project will satisfy the needs of the CREC in a cost-effective manner that minimizes environmental and social impacts. Mitigation will be provided for all impacts to state and federal regulated wetland resources. Impacts to rare, threatened, or endangered species will be avoided and/or minimized through appropriate avoidance or minimization techniques. Similarly, impacts to cultural resources will be avoided or minimized. The potential for significant impact to other environmental or social receptors in the Project vicinity is anticipated to be minimal, with the work practices and mitigation proposed for the Project.

To the extent that impacts cannot be avoided, they will be addressed through mitigation techniques as discussed in Section 9.0 of this report.

3.0 PROJECT NEED

3.1 Introduction

The Project is needed to interconnect the CREC to the electric transmission system. As described in Section 3.2 below, TNEC and ISO-NE performed a multistage analysis of the proposed interconnection to determine that the generator will not have a significant adverse impact on the New England system. TNEC as the Transmission Owner, is obligated to provide the generator with access to the electric transmission system to allow it to supply electricity into the electric system. This is distinguishable from a typical need description which begins with a summary of the transmission planning process under which TNEC and ISO-NE identify needed upgrades to the transmission system.

3.2 Interconnection Analyses

When a new generator such as the CREC is proposed, ISO-NE performs a feasibility study to explore interconnection options and to preliminarily identify any reliability issues relative to the criteria and standards of ISO-NE, the New England Power Pool (NEPOOL), the Northeast Power Coordinating Council (NPCC), the North American Electric Reliability Corporation (NERC) as well as those contained in the National Grid Transmission Group Procedure 28 - Transmission Planning Guide (TGP-28). After this study is completed, and if the generator developer decides to continue in the interconnection process, a preferred interconnection option is selected and a more detailed system impact study is initiated. The feasibility study for the CREC interconnection (Feasibility Study Report for Generation Interconnection Request: Queue Project 489 (August 7, 2015)) examined the impact of connecting the CREC to the existing 345 kV 347 Line, to the existing 345 kV 341 Line, and to both of the 347 and the 341 Lines. The study concluded that each of these interconnection alternatives would adversely impact the import capability of the Southeastern Massachusetts/Rhode Island electrical zone under an N-1-1 contingency scenario. However, ISO-NE determined that connecting the CREC into the Sherman Road Switching Station via a dedicated 345 kV line avoided this adverse impact. Consequently, the study concluded that the CREC should be connected to the electric transmission system via a new dedicated 345 kV line into the Sherman Road Switching Station.

3.3 Conclusion

The need for this Project is driven exclusively by the proposed interconnection of the CREC to the New England electric system. The studies prepared by ISO-NE demonstrate that the connection must be through a dedicated 345 kV transmission line to the Sherman Road Switching Station.

4.0 PROJECT DESCRIPTION AND PROPOSED ACTION

4.1 Introduction

In this section of the ER, the overall scope of the Project is identified and the individual components and facilities comprising the Project are described. This section of the ER also details the Applicant's construction and ROW maintenance practices, safety and public health considerations, community outreach, estimated costs, and the anticipated construction schedule for the Project.

The Applicant is proposing to construct the 3052 Line for the purpose of interconnecting the CREC to the existing electric transmission network (see Figure 1-1, Project Overview Map). The 3052 Line will be built within the CREC and TNEC ROWs. The TNEC ROW is currently occupied by two 345 kV transmission lines, designated as the 341 and 347 Lines. The 341 Line is primarily supported by steel H-frame structures, with a typical height of approximately 88 feet. The 347 Line is currently primarily supported by wooden H-frame structures, with a typical height of approximately 78 feet. The components of the Project are as follows:

- Construct a new 6.8-mile 345 kV transmission line between the CREC and the Sherman Road Switching Station, which includes modifications to the 341 and 347 Lines. The Project ROW consists of the following three segments:
    - Segment 1 – CREC ROW from the CREC to the TNEC ROW (0.8 mile)
    - Segment 2 – TNEC ROW from the junction of CREC ROW to a point 0.19 mile west of the Clear River (1.6 miles)
    - Segment 3 – TNEC ROW from 0.19 mile west of the Clear River to the Sherman Road Switching Station (4.4 miles)
- Improvements to the existing Sherman Road Switching Station, including the realignment of an approximate 260 foot span of the existing 345 kV 328 Line at the station.

The new transmission structures will be weathering steel and the new Sherman Road Switching Station termination structures will be galvanized steel. The new transmission line will be three phases of bundled 1,590 kcmil (one thousand circular mils) 54/19 "Falcon" aluminum conductor steel reinforced (ACSR) with two overhead shield wires.

4.1.1 Segment 1 - 0.8 mile on CREC ROW

Segment 1 of the 3052 Line is the entire length of the CREC ROW. The Applicant proposes to construct eight H-frame structures to support the new line. The CREC ROW will be 250 feet wide, of which approximately 150 feet will be cleared for the 3052 Line (refer to Figure 4-1, Typical ROW Cross-Sections). The typical height of the structures in Segment 1 will be 86 feet. The new 3052 Line will connect into the switching station located at the CREC.

4.1.2 Segment 2 - 1.6 Miles on TNEC ROW

Segment 2 consists of 1.6 miles of the TNEC ROW running northeasterly from the CREC ROW to a point 0.19 mile west of the Clear River. The TNEC ROW is 300 feet wide in Segment 2. The existing 347 and 341 Lines will be reconfigured to provide space for the 3052 Line (refer to Figure 4-1, Typical ROW Cross-Sections). Specifically, the 341 Line will be shifted north onto new steel monopole structures that will be approximately 110 feet tall. The existing structures and wires of the 341 Line located to the north will become the 347 Line. The existing 347 Line will be removed and replaced with new steel H-frame structures, conductors, shield wire and Optical Ground Wire (OPGW) for the 3052 Line. The new H-frame structures will be approximately 88 feet tall. A 55-foot width of trees and vegetation will be cleared along the northerly side of the ROW in Segment 2 to accommodate the new 341 Line structures; however, no new property rights will be needed.

4.1.3 Segment 3 - 4.4 Miles on TNEC ROW

Segment 3 consists of 4.4 miles of the TNEC ROW from a point 0.19 mile west of the Clear River to the existing Sherman Road Switching Station. The TNEC ROW is 500 feet wide in Segment 3. The 3052 Line will be located to the south of the existing lines within the existing TNEC ROW and will be supported by 35 new H-frame structures approximately 88 feet in height. The Applicant will clear an 85-foot wide swath of trees and vegetation along the southerly side of the ROW in Segment 3 to accommodate the new transmission line structures (see Figure 4-1, Typical ROW Cross-Sections).

4.1.4 Upgrades to Sherman Road Switching Station

The upgrades to the Sherman Road Switching Station will occur within the existing fence line. The improvements include the construction of: (i) a new bay southeast of the existing station bays together with two additional breakers and associated disconnect switches; and (ii) a new termination structure.

Work at the Sherman Road Switching Station also involves realigning an approximate 260 foot span of the existing 328 Line. A new structure will be installed outside the station fence line. The 328 Line will be transferred onto the new structure and enter into the new bay position proposed for the station.

4.2 Construction and Maintenance Plan Overview

4.2.1 Transmission Line Construction Sequence

The Project will be constructed using conventional overhead electric transmission line construction techniques. The Applicant and its consultants conducted detailed constructability field reviews to assess proposed structure locations, determine access and work space requirements, and evaluate measures to avoid or minimize environmental impacts.

The transmission line will be constructed in a progression of activities that typically proceed in the sequence and with the equipment described in Table 4-1.

TABLE 4-1 TYPICAL CONSTRUCTION EQUIPMENT

CONSTRUCTION PHASE	TYPICAL EQUIPMENT REQUIRED	
Vegetation Removal and ROW Mowing	• Grapple trucks • Track-mounted mowers • Chippers • Log forwarders • Brush hogs, skidders • Bucket trucks	• Motorized tree shears • Chain saws • Box trailers • Low-bed trailers, flatbed trucks • Bulldozers, excavators • Pickup trucks

CONSTRUCTION PHASE	TYPICAL EQUIPMENT REQUIRED	
Soil Erosion/Sediment Controls	• Stake body trucks • Pickup and other small trucks	• Small excavators • Trencher
Access Roads Improvement and Maintenance	• Dump trucks • Bulldozers • Excavators • Backhoes • Front end loaders • Graders	• 10-wheel trucks with grapples • Cranes • Pick-up trucks • Low-bed trailers • Stake body trucks
Removal and Disposal of Existing Transmission Line Components	• Cranes • Flatbed trucks • Pullers with take-up reels • Excavators • Vacuum trucks	• Backhoes • Trucks with welding equipment • Dump trucks • Storage containers
Installation of Foundations and Structures	• Backhoes • Bulldozers • Front-end loaders • All-terrain vehicles • Tracked carriers or skidders • Concrete trucks • Excavators • Rock drills mounted on excavators or tracked equipment • Cranes	• Cluster drills with truck mounted compressors • Aerial lift equipment • Tractor trailers • Bucket trucks • Large-bore foundation drill rigs • Hand-held equipment such as shovels, pumps, and vibratory tampers • Dump trucks • Generators, air compressors
Conductor and Shield Wire Installation	• Bucket trucks • Puller-tensioners • Conductor reel stands	• Cranes • Flatbed trucks • Pickup trucks • Tracked carriers or skidders
Restoration of the ROW	• Pickup and other small trucks • Excavators • Backhoes • Bulldozers	• Dump trucks • Tractor-mounted York rakes • Straw blowers • Hydro-seeders

4.2.1.1 Removal of Vegetation and ROW Mowing in Advance of Construction

Construction of the 3052 Line will require tree clearing and vegetation removal to open up a corridor for the proposed overhead electric transmission line. As noted above, the widths of clearing for each segment is as follows: Segment 1 - 150 +/- feet; Segment 2 - 55 feet +/- along the northerly side; and Segment 3 - 85 feet +/- along the southerly side. Please refer to Figure 4-1: Typical ROW Cross-Sections. All clearing will be within the limits of the respective ROWs. Tree clearing and vegetation removal activities are needed to provide safe vehicular access to existing and proposed structure locations, to facilitate safe equipment passage, to provide safe work sites for personnel within the ROWs, and to maintain safe clearances between vegetation and transmission line conductors for reliable operation of the transmission facilities. In the future, the vegetation on the ROWs will be managed in accordance with National Grid's Right-of-Way Vegetation Management Plan and subsequent updates.

Prior to vegetation removal and mowing, the boundaries of wetlands will be clearly marked to prevent unauthorized encroachment of equipment into wetland areas. Appropriate forestry techniques will be implemented within wetlands to minimize ground disturbance. Other sensitive resources will be flagged and enclosed with protective fencing prior to removal of vegetation on the ROW. Existing access routes along the ROWs will be used by the tree removal personnel and equipment to the extent practicable, and road improvements will be kept to a minimum during this phase of the work. The use of temporary swamp mats will be required to gain access to and across forested wetlands, to minimize wetland disturbance, and to provide a stable platform for safe equipment operation (Refer to Figure 4-2). Temporary corduroy (log) roads will be used as necessary to facilitate tree removal.

Tree removal operations, where required, will include the removal of all tall-growing woody species within the targeted portions of the ROWs. Tall-growing trees just outside the maintained ROW edges will be assessed for their potential to damage the transmission lines. To ensure reliability, any "danger trees" that are identified may have to be pruned or removed.

Generally, trees will be cut close to the ground, leaving the stumps and roots in place in order to reduce soil disturbance and erosion. In locations where grading is required for access road improvements or at structure sites, stumps will be removed and disposed of off-site. Small trees and shrubs within the ROWs will be mowed as necessary with the intent of preserving roots and low-growing vegetation to the extent practical. Brush, limbs, and cleared trees will be chipped or removed from the site. Wood chips may be applied to upland areas as an erosion control measure. Temporary "landing areas" will be established along the ROW to serve as locations to load timber, temporarily stage a wood chipper, and to park tree clearing vehicles and equipment.

In certain environmentally sensitive areas such as wetlands, it may be necessary and desirable to leave felled trees and snags and allow them to decompose in place rather than to disturb soft organic substrates. Where the ROWs cross streams and brooks, vegetation along the stream bank will be selectively cut to minimize the disturbance of bank soils and the potential for Project related soil erosion. To the extent feasible, the Applicant will maintain a minimum of a 25-foot-wide riparian zone along watercourses and adjacent to vernal pools/special aquatic sites.

4.2.1.2 Installation of Soil Erosion and Sediment Controls

Following tree clearing and vegetation removal activities, the Applicant will install proper soil erosion and sediment control devices, such as straw wattles/bales, siltation fencing, and/or chip bales in accordance with approved plans and permit requirements. The soil erosion and sediment control program for the Project will follow the procedures identified in the Rhode Island Soil Erosion and Sediment Control Handbook, the Rhode Island Stormwater Design and Installation Standards Manual, the RIDEM Wetland BMP Manual: Techniques for Avoidance and Mitigation, and National Grid's ROW Access, Maintenance and Construction Best Management Practices (EG-303).

The installation of these sediment control devices will be supervised by the Applicant's environmental monitor. During construction, these devices will be periodically inspected and monitored by the environmental monitor, and the environmental monitor's findings will be reported regularly to the Applicant's Construction Supervisor (see Section 4.3.4 below). The soil erosion and sediment controls will be installed between the work area and environmentally sensitive areas (such as wetlands, streams, drainage courses), roads and adjacent property when work activities will disturb soils and potentially cause soil erosion and sedimentation. The devices will function to mitigate construction-related soil erosion and sedimentation, and will also serve as a physical boundary to delineate resource areas and to contain construction activities within approved areas.

Where dewatering is necessary during excavations for structures within or adjacent to wetland areas, water will be pumped into appropriate dewatering basins. Any dewatering will be performed in compliance with National Grid's EG-303. The basin and all accumulated sediment will be removed following dewatering operations and the area will be seeded and mulched. Where appropriate to protect resource areas, soil erosion and sediment controls will be used to contain excess soils prior to their removal from the work sites.

Where feasible, staging areas and equipment storage will be situated outside of watershed protection areas, 50-foot perimeter wetlands, and other environmentally sensitive areas. Equipment refueling (except for fixed equipment such as drill rigs) will occur outside of environmentally sensitive areas (such as waterways, wetlands, and drinking water sources). In the event that extenuating circumstances arise requiring refueling within or in close proximity to sensitive areas, secondary containment devices and other spill prevention best management practices, such absorbent pads, will be used during refueling. Where structures requiring concrete foundations are located in or near wetlands, proper soil erosion and sediment controls will be installed to prevent impacts to these areas.

Swamp mats, soil erosion and sediment controls, and other measures will be implemented as appropriate in accordance with BMPs in resource areas temporarily disturbed by construction. Herbaceous vegetation in disturbed areas will be restored using a native wetland or conservation seed mix. Enhancements proposed as mitigation for important wildlife features lost as a result of tree removal and construction activities may include: seeding, planting native shrub species, leaving snags and placing woody debris and slash or stone piles to create wildlife cover. At the end of construction, swamp mats will be removed and cleaned prior to being moved to another location or off-site.

4.2.1.3 Construction of Access Roads, Access Road Improvements, Work Pads, and Road Maintenance

Access roads are required along the ROWs to construct, inspect and maintain the existing and proposed transmission line facilities. Typical access roads are 20 feet wide with a travel lane of approximately 16 feet to accommodate the vehicles and equipment needed for the Project.

The Applicant is planning to use the existing network of access roads to the greatest extent practicable. For instance, the Applicant plans to use portions of an existing woods road within the CREC ROW to avoid and/or minimize impacts to wetlands, watercourses and other environmental resources. Within the TNEC ROW, it may be necessary to improve existing access roads in certain locations to facilitate new construction. For example, clean gravel or trap rock may be necessary to stabilize and level the roads for construction vehicles, and stabilized construction entrances may need to be refreshed where the ROW crosses public roadways.

The Applicant may also need to establish new access roads to construct the Project. New access road spurs will be constructed within the TNEC ROW to access the proposed transmission line structures. In addition, new access roads will be built within the CREC ROW to support the proposed construction activities. New access roads will be located to avoid or minimize disturbance to water resources, to follow the existing contours of the land as closely as possible, and where practicable, to avoid severe slopes. In addition, access roads will be constructed to avoid significantly altering existing drainage patterns. New access roads will be established over native soils if practicable; unstable soils may be removed and replaced with imported clean fill material.

The proposed access road in the CREC ROW will cross two streams and several of the existing access roads located within the TNEC ROW cross streams. These stream crossings will be evaluated in order to determine if the crossings require the installation or replacement of culverts. Otherwise, temporary timber mat bridges will be installed to span over watercourses to allow for unimpeded flow.

Access across wetlands and streams, where upland access is not available, will be accomplished by the placement of temporary swamp mats. Such temporary swamp mat access roads will be removed following completion of construction and areas will be restored to re-establish pre-existing topography and hydrology. Swamp mats or similar matting may also be used to cross land in active agricultural use or in other environmentally sensitive areas.

Any access road improvements and/or maintenance will be carried out in compliance with the conditions and approvals of the appropriate federal and state regulatory agencies. Exposed soils on access roads will be wetted and stabilized as necessary to suppress dust generation during construction. Crushed stone aprons/tracking pads will be used at all access road entrances to public roadways to clean the tires of construction vehicles and minimize the migration of soils off-site.

Upland work pads will be constructed at structure locations by grading or adding gravel or crushed stone to provide a level work surface for construction equipment and crews. Once construction is complete, the work pads in uplands will remain in place, and will be stabilized with topsoil and mulched to allow vegetation to re-establish. In wetlands, these work pads will be constructed with temporary swamp mats and will be removed after the completion of construction activities.

4.2.1.4 Removal and Disposal of Existing Transmission Line Components

In order to accommodate the construction of the 3052 Line, TNEC will remove approximately 14 existing wooden transmission line structures in Segment 2. TNEC proposes to recycle as much of the removed material as possible. Those components not salvaged and any debris that cannot be recycled will be removed from the ROW to an approved off-site facility. Handling of such materials will be performed in compliance with applicable laws and regulations and in accordance with National Grid’s policy and procedures.

4.2.1.5 Installation of Foundations and Structures

The proposed transmission line structures include H-frame structures, 3-pole structures, and monopoles (see Figures 4-3 to 10, Typical Structure Types). A majority of the H-frame structures will be direct embedded. Excavation for direct embedment structures will be performed using a soil auger or standard excavation equipment depending on field conditions. Excavations will range from approximately 10 to 20 feet in depth, with diameters typically between three and five feet. A steel casing will be placed vertically into the excavation hole and backfilled. The poles will be field assembled and inserted by cranes into the embedded steel casings. The annular space between the pole and the steel casing will then be backfilled with crushed stone.

Certain structures, including some H-frames, the 3-pole structures, and the monopoles, will require concrete caisson foundations that typically will be 15 to 30 feet deep, with diameters between 6 and 10 feet (see Figures 4-3 to 4-10, Typical Structure Types). Caissons will be constructed by drilling a vertical shaft, installing a steel reinforcing cage, placing steel anchor bolts, pouring concrete, and backfilling as needed. Structures will be lifted by a crane and placed onto the anchor bolts.

Excavated material will be temporarily stockpiled next to the excavation; however, this material will not be placed directly into resource areas. If the stockpile is in close proximity to wetlands, the spoils will be enclosed by staked straw bales or other sediment controls. Additional controls, such as watertight mud boxes, will be used for saturated stockpile management in work areas in wetlands where sediment-laden runoff would pose an issue for the surrounding wetland. Following the backfilling operations, excess soil will be spread over unregulated upland areas or removed from the site in accordance with National Grid's policies and procedures. Dewatering may be necessary during excavations or pouring concrete for foundations. Any dewatering will be performed in compliance with National Grid's EG-303.

Rock that is encountered during foundation excavation will generally be removed by means of drilling with rock coring augers. This method allows the same drill rig to be used and maintains a constant diameter hole. However, in some cases, rock hammering and excavation may be used to break up the rock.

4.2.1.6 Installation of Conductor, Optical Ground Wire and Shield Wire

Following the construction of transmission line structures, insulators will be installed on the structures. The insulators isolate the energized power conductors from the structure. OPGW, shield wire, and power conductors will then be installed using stringing blocks and wire stringing equipment. The wire stringing equipment is used to pull the conductors from a wire reel on the ground through stringing blocks attached to the structures to achieve the desired sag and tension condition. During the stringing operation, temporary guard structures or boom trucks will be placed at road and highway crossings and at crossings of existing utility lines. These guard structures are used to ensure public safety and uninterrupted operation of other utility facilities by keeping the wire that is being installed away from other utility wires and clear of the traveled way at these crossing locations.

Construction of temporary wire stringing and pulling sites will be required (i) to provide a level work space for equipment and personnel and (ii) to establish remote wire stringing set-up sites at angle points in the transmission line and at dead-end structures.

In instances where there is an expansive wetland, large watercourse, open water body or otherwise sensitive environmental resource, alternate means will be assessed for stringing the lead ropes and wire to avoid and/or minimize crossing of these water resources.

4.2.1.7 Restoration of the ROW

Restoration efforts, including removal of construction debris, final grading, stabilization of disturbed soil, and installation of permanent sediment control devices (water bars/diversion channels/rock fords), will be completed following construction. All disturbed areas around structures and other graded locations will be seeded with an appropriate conservation seed mixture and/or mulched to stabilize the soils in accordance with applicable regulations. Temporary sediment control devices will be removed following the stabilization of disturbed areas. Existing walls and fences will be restored. Where authorized by property owners, permanent gates and access road blocks will be installed at key locations to restrict access onto the ROWs by unauthorized persons or vehicles. Regulated environmental resource areas that are temporarily disturbed by construction will be restored to pre-construction conditions to the extent practicable, in accordance with applicable permit conditions.

4.2.2 Project Construction Traffic

The Project will cause intermittent and temporary additional traffic during the construction period. Construction equipment typically will access the ROWs from public roadways crossing the ROWs in various locations along the route. Because each of the construction tasks will occur at different times and locations over the course of the construction, traffic will be intermittent at these entry roadways. Traffic will consist of vehicles ranging from pick-up trucks to heavy construction equipment to large trailers delivering steel poles.

The Applicant’s contractors will coordinate closely with the Rhode Island Department of Transportation (RIDOT) to develop acceptable traffic management plans for work within state highways. The Applicant will coordinate with local authorities in the Town of Burrillville for work on local streets and roads. At locations where construction equipment must be staged in a public way, the contractors will follow a pre-approved work zone traffic control plan with appropriate police details.

4.2.3 Project Construction Work Hours

Proposed construction work hours for the Project will be between 7:00 a.m. and 7:00 p.m. Monday through Friday when daylight permits and between 7:00 a.m. and 5:00 p.m. on Saturday. Burrillville has codified regulations limiting construction work hours, and the Applicant will be seeking relief from the Town to allow limited work activities to occur outside of standard work hours when needed to complete certain activities. For example, some work tasks such as concrete pours and transmission line stringing, once started, must be continued through to completion and may go beyond normal work hours.

In addition, the nature of transmission line construction requires line outages for certain procedures such as transmission line connections, equipment cutovers, or stringing under or over other transmission lines. Availability of these outages, which is dictated by the ISO-NE based on regional system load and weather conditions, can be very limited. Such scheduled outages will have no effect on electric service to local customers. Work requiring scheduled outages and crossings of certain transportation and utility corridors may need to be performed on a limited basis outside of normal work hours, including on Sundays and holidays.

Prior to and during construction, the Applicant will notify landowners, abutting property owners, municipal officials, the Burrillville Department of Public Works, and Burrillville Police and Fire Chiefs of the details of planned construction including the normal work hours and any extended work hours.

4.2.4 Environmental Compliance and Monitoring

Prior to the start of construction, all Project personnel will be trained on Project environmental requirements and permit conditions, including environmental, rare species, storm water management, and cultural resources. Refresher training will be held as new crew members join the Project work force and as otherwise necessary. The Applicant will conduct regular construction progress meetings to reinforce the contractor’s awareness of these issues. Pre-construction “look-ahead meetings” will take place in the field with appropriate Project personnel. The Applicant’s environmental monitor will attend these meetings to provide feedback on environmental requirements and compliance to construction personnel.

During the construction process, the environmental monitor will verify and report on compliance with all federal, state, and local permit requirements and National Grid's policies and procedures. At regular intervals and during periods of prolonged precipitation, the environmental monitor will inspect all locations to determine whether the environmental controls are functioning properly and to make recommendations for correction or maintenance in accordance with the anticipated Rhode Island Pollutant Discharge Elimination System (RIPDES) permit.

In addition to retaining the services of an environmental monitor, the Applicant will require the construction contractor to designate an individual to be responsible for the daily inspection and maintenance of environmental controls. This person will also be responsible for providing direction to the other members of the construction crew regarding matters such as wetland access, appropriate work methods, driving safety, and good house-keeping practices along the ROW.

4.2.5 ROW Vegetation Maintenance

Once the proposed transmission lines are energized and operational, vegetation along the ROW will continue to be managed on a regular basis: 1) to provide clearance between vegetation and electrical conductors and supporting structures so that safe, reliable delivery of power to consumers is assured; and 2) to provide access for necessary inspection, repair, and maintenance of the facilities. All vegetation maintenance is carried out in strict compliance with National Grid's Right-of-Way Vegetation Management Plan.

Vegetation maintenance methods along the ROW include hand and mechanical cutting and selective application of herbicides. Herbicides are applied by hand by licensed applicators to select target species. In sensitive areas such as standing water or within designated protective buffer areas associated with wells, surface waters, and agricultural areas, herbicides are not applied and vegetation is selectively cut by hand. National Grid currently utilizes a four- to five-year vegetation maintenance cycle on its transmission ROWs.

National Grid's vegetation removal and maintenance methods, as described in the management plan noted above, encourage the growth of low-growing shrubs, ferns, wildflowers and grasses, thus helping to stabilize the cleared areas against soil erosion and providing some degree of natural control of tall-growing vegetation. These practices promote a diversity of low growth scrub-shrub and herbaceous habitats that are utilized by a variety of native wildlife species.

4.3 Safety and Public Health Considerations

The Applicant will design, build, and maintain the facilities for the Project so that the health and safety of the public are protected. This will be accomplished through adherence to all federal, state and local regulations, and industry standards and guidelines established for protection of the public. Specifically, the Project will be designed, built, and maintained in accordance with the National Electrical Safety Code (NESC) and other applicable electrical safety codes. The facilities will be designed in accordance with sound engineering practices using established design codes and guides published by, among others, the Institute of Electrical and Electronic Engineers (IEEE), the American Society of Civil Engineers (ASCE), the American Concrete Institute (ACI), and the American National Standards Institute (ANSI).

Practices that will be used to protect the public during construction will include, but not be limited to, contractor safety training, establishing traffic control plans for construction traffic to maintain safe driving conditions, restricting public access to potentially hazardous work areas, and using temporary guard structures at road and utility line crossings to prevent accidental contact with the conductor during installation.

Following construction of the facilities, all transmission structures and substation facilities will be clearly marked with warning signs to alert the public to potential hazards if climbed or entered. Trespassing on the ROWs will be inhibited by the installation of gates and/or barriers at entrances from public roads where approved by owners of properties upon which easements are located.

A discussion of the current status of the health research relevant to exposure to EMF is attached as Appendix A. This report was prepared by Exponent.

4.4 Hazardous Substances

4.4.1 Sherman Road Switching Station

Sulfur hexafluoride (SF_6) is a gas which is used as an insulator in the existing and proposed circuit breakers at the Sherman Road Switching Station. SF_6 is classified as potentially hazardous by the United States Environmental Protection Agency (USEPA).

SF_6 emissions are regulated by the USEPA and its transport is regulated by the United States Department of Transportation (USDOT). SF_6 is a colorless, odorless and nonflammable gas that is commonly used in lieu of insulating oil.

Although SF_6 emissions are regulated by the USEPA, there is no risk of general public exposure because the circuit breakers are located inside the fenced Sherman Road Switching Station yard. The circuit breakers are installed and maintained by trained technical staff and they are checked for integrity during bi-monthly operation and maintenance inspections by TNEC personnel. Alarms are in place to alert TNEC personnel in the event of a significant leak.

4.4.2 Transmission Line

There are no hazardous substances associated with the proposed transmission line and structures.

4.5 Project Community Outreach

Invenergy initiated a stakeholder engagement plan for its proposed CREC generation plant (RI EFSB Docket No. SB-2015-06) to support its application, filed on October 29, 2015. TNEC is implementing a community and public outreach process for the Burrillville Interconnection Project to establish and maintain communications with stakeholders (e.g., project abutters, residents, and local and state officials). This process includes opportunities for public education and input regarding the need for the Project, the permitting and siting processes, the dissemination of construction updates and outreach during construction, and follow-up outreach after Project completion. The process is designed to engage the community, facilitate transparency throughout the Project, foster public participation, and solicit feedback from stakeholders. The outreach plan includes the following:

- Open dialogue with landowners, Project abutters, local officials and the community.

- Project Open House in the town of Burrillville.

- A Project Website providing background information on the Project, Project updates, and contact information.

- A Toll-free Project Hotline (1-844-344-1900).

- Comprehensive communications plan for outreach during Project construction.

4.5.1 Neighborhood Outreach

Landowners and abutters whose property may be directly affected by tree clearing or ROW access will be the focus of the Applicant's initial outreach. The Applicant's local engagement team will be ready to respond to requests for meetings.

The Stakeholder Relations representatives have prepared a fact sheet to explain the Project, the proposed route, estimated Project timeline and means for obtaining additional information. Project-specific door hangers have been developed for the stakeholder engagement team to use when they contact landowners and abutters.

The Applicant will conduct door-to-door outreach with property owners directly abutting the Project ROW and affected by ROW clearing. When the property owner is home, the Applicant's representatives will discuss the Project, the permitting timeline, the potential impacts to their particular property and the construction timeline. If an owner is not home, a door hanger will be left behind with a Project fact-sheet and contact information. Special requests for landscape plantings and specific post-construction restoration measures, including saving timber/firewood, will be considered.

4.5.2 Open House

The Applicant will hold an Open House in Burrillville to provide interactive information about the need for the Project, its location, its purpose, and what to expect during each phase of Project construction. The Open House will also provide residents with an opportunity to express concerns and ask questions regarding the Project. Key communication tools to be used at the Open House include:

- Google Earth™ route simulations that will allow stakeholders to view their property or area of interest in relation to the Project.

- Preliminary Project Plans will be available to allow the public to view the proposed transmission line alignment and proposed structure locations.

- Individual stations providing information on the proposed route, Project need, proposed schedule, visual impacts and buffers, EMF, tree clearing and vegetation maintenance, wood program, public involvement, the environment, construction, and post-construction restoration. At each station, an expert in that subject matter will be available to respond to questions and concerns from the public.

4.5.3 Project Website

The Applicant is developing a Project website to provide the public with easy access to updated Project information, including background, updates, and contact resources. The Applicant will keep the website up-to-date for the duration of the Project. Interested parties may also sign up to receive Project updates by email.

4.5.4 Project Hotline

A toll free number (1-844-344-1900) has been designated as the Project Hotline. The Project Hotline number will be listed in all Project outreach materials including factsheets, subsequent mailings, and the website. Prior to construction, this number will be provided to all abutters within a 200-foot radius of the Project so it is readily available should any questions or concerns arise during construction.

4.5.5 Construction Outreach

A critical element of the Applicant's communication plan includes outreach during construction to inform residents, fire, police, other emergency personnel, and municipal officials regarding work schedules, work locations, and construction activities.

The Applicant is preparing a construction outreach plan to maintain continuity of communication with potentially affected landowners. Recognizing the varying needs of its stakeholders, the Applicant is developing various communication methods to inform stakeholders throughout construction, including, as needed: work area signage; advance notification of scheduled construction; personal contact with residents and businesses along the transmission line ROWs; and regular email updates to residences and local officials that will include information on upcoming construction activity.

The Applicant will designate an ombudsman for the Project who will be responsible for continuing outreach during construction and who will provide a consistent point of contact for the public. As noted above, the Project website will be kept up-to-date during the construction phase and a bi-weekly status update email will be sent to those who have provided an email address and who have expressed an interest in receiving such updates.

TNEC has developed a Wood Program to inventory and track the disposition of timber and wood products that are generated during the ROW tree clearing phase of the Project. Each affected landowner will have an opportunity to make a request to retain the wood products that are harvested on their land.

4.5.6 Estimated Project Costs

A brief summary of the expected Project costs is set forth below. We note that the Project is being privately financed, without ratepayer funds, and the power produced will be sold into the competitive ISO-NE market through a competitive bidding process. This structure does not impose a burden on ratepayers but rather shifts the costs for development and operations to Invenergy.

TNEC prepared conceptual grade estimates of the costs associated with the Project. Conceptual grade estimates are prepared prior to detailed engineering plans using historical cost data, data from similar projects, and other stated assumptions of the Project engineer. The accuracy of a conceptual grade estimate is expected to be -25 percent/+50 percent. Estimated costs in 2016 dollars include costs of materials, labor and equipment. The estimated cost of the Project is $47.2 million as presented in Table 4-2.

TABLE 4-2 ESTIMATED PROJECT COSTS

PROJECT COMPONENTS	ESTIMATED COST ($M)
Transmission Line Facilities[1]	$41.0
Sherman Road Switching Station Upgrades	$ 6.2
Total	$47.2

Note: [1]Transmission Line Facilities estimate includes all work proposed on the new 3052 Line, and the existing 347, 341 and 328 Lines as described in Section 4.1.

Annual operation and maintenance activities for transmission lines include periodic ROW vegetation management, helicopter patrol, and miscellaneous route inspections. Invenergy will be required to pay a Direct Assignment Facilities charge to TNEC to cover ongoing operation and maintenance costs without any ratepayer funding.

4.6 Project Schedule

The Applicant has developed a preliminary schedule based on time estimates for planning and engineering, permitting and licensing, and construction (Table 4-3). The Project is expected to be completed in the winter of 2018 and in-service by the summer of 2019.

TABLE 4-3 PROJECT SCHEDULE

ACTIVITY	ESTIMATED START DATE	ESTIMATED COMPLETION DATE
Planning and Engineering	Fall 2016	Winter 2016/ 2017
Permitting and Licensing	Winter 2016/2017	Winter 2017/ 2018
Construction	Spring 2018	Winter 2018/ 2019
Facilities In-Service	Summer 2019	

5.0 PROJECT ALTERNATIVES

5.1 Introduction

This section describes the alternatives to the Project that were considered to address the need to interconnect the proposed CREC to the existing electric transmission system. The need for this Project is driven exclusively by the proposed interconnection of the CREC to the New England electric system. As a result, the alternatives are limited by the need for a direct connection to Sherman Road Switching Station, as identified by the ISO-NE.

Selecting a preferred design option involves evaluating a suite of feasible project alternatives, which includes screening of each project component, analyzing the alternative routes and configurations, general ranking of alternatives and identification of initial recommendations in the selection of a preferred solution. TNEC's overriding goal has been to select the alternative that best meets the Project need, with a minimum impact on the environment, at the lowest possible cost.

Section 5.2 describes the no-action alternative. Section 5.3 describes the electrical alternatives. Section 5.4 and Section 5.5 describe an alternative overhead route and the overhead alternatives using the existing ROW, respectively. Section 5.6 describes several underground transmission alternatives.

5.2 No-Action Alternative

This alternative was dismissed as it would not address the need to interconnect the proposed CREC to the existing electric transmission system.

5.3 Electrical Alternatives

5.3.1 Connection to Existing Transmission Lines

ISO-NE analyzed connecting CREC directly to the existing 341 Line or the existing 347 Line or both. These options were rejected by ISO-NE as they all presented unacceptable reliability issues and power transfer limitations. Ultimately, ISO-NE determined that a new 345 kV transmission line to the Sherman Road Switching Station would be the required solution for connecting CREC to the transmission system.

5.3.2 115 kV Alternative

TNEC evaluated installing one new overhead 115 kV transmission line from the CREC to the Sherman Road Switching Station as an alternative to the Project. This alternative would use a similar H-Frame structure and monopole structure configuration proposed as for the Project.

The Sherman Road Switching Station is a 345 kV facility, therefore this alternative would require adding a 115/345 kV transformer, which would take up additional space within the fenced in area and add to the cost of the Project. The use of the additional space is problematic because it limits TNEC's ability to fully utilize the station in the future due to site constraints associated with neighboring wetlands and high pressure gas pipelines located near the station. Additionally, this alternative would have similar environmental and other impacts on the ROW as the proposed Project. For these reasons TNEC rejected this alternative.

5.4 Overhead Route Alternatives

TNEC considered two overhead routing alternatives for the 3052 Line. These alternatives involve paralleling existing utility corridors.

5.4.1 Construct Overhead Transmission Line in Project ROW (Proposed Option)

As discussed in greater detail in Section 4.0 of this ER, the Project involves (i) the construction of a new 6.8-mile 345 kV transmission line in the existing TNEC ROW and the new CREC ROW; and (ii) improvements to the existing Sherman Road Switching Station. This alternative was found to be superior to others considered for a variety of reasons discussed in this section. Consequently, it has been advanced as the proposed alternative.

5.4.2 Overhead Transmission Line Adjacent to Algonquin Gas Transmission Pipeline ROW

TNEC also evaluated the use of an existing Algonquin Gas Transmission (AGT) pipeline ROW which runs from southwest to northeast as shown on Figure 5-1. TNEC considered constructing an overhead 345 kV transmission line adjacent to AGT ROW from the CREC to the Sherman Road Switching Station, utilizing H-Frame construction as an alternative to the Project. This alternative would require the same improvements to the Sherman Road Switching Station as the proposed alternative.

This routing alternative would parallel an existing ROW corridor and has the advantage of not having to relocate the existing 341 and 347 Lines to accommodate the new line. However, the AGT ROW is not currently wide enough to accommodate the 3052 Line and it is unlikely AGT would permit the construction of an overhead transmission line within its gas pipeline ROW. This option would require creating and clearing of forested wetlands and upland forest for a new approximately 150-foot-wide ROW and building new access roads along the AGT ROW that are located away from the existing high pressure gas pipelines. Thus, this alternative would require obtaining additional easement rights along the entire length of the AGT ROW. This land acquisition would add significantly to Project costs, would result in increased impacts to the natural and social environments from creating a new 6+ mile corridor, and would delay the Project schedule. In addition, installing electric and natural gas facilities within the same corridor can introduce constraints to both operations in regard to safe access, work space requirements and future replacement and/or expansion of facilities within the shared corridor.

After consideration of this alternative, TNEC determined that locating an overhead transmission line within or adjacent to the AGT ROW would result in additional costs and delays associated with the need to acquire additional land; increased environmental and other impacts; and operational and safety constraints from the collocation of a transmission line near a high pressure gas line. TNEC therefore concluded that use of the TNEC and CREC ROWs was its proposed alternative.

5.5 Overhead Configuration Alternatives

The Applicant considered three alternative configurations (combinations of transmission line structure types) for constructing the Project within the existing TNEC ROW:

- Install 3052 Line in the Project ROW utilizing a combination of H-frame and monopole construction (the proposed Project).
- Install 3052 Line in the Project ROW utilizing monopole construction.
- Install 3052 Line in the TNEC ROW utilizing double-circuit monopole construction.

TNEC assessed the impacts of each of these configurations on Project cost, reliability, visibility of the structures, wetlands, and the level of disturbance caused by construction. The following sections describe the advantages and disadvantages of each alternative.

5.5.1 Construction Using Combination of H-Frame Structures and Monopoles (the Proposed Project)

As proposed, the Project will use steel H-frame structures for the 3052 Line and monopole structures for the shifted 341 Line. This option was chosen as it is the most cost-effective and reliable overhead solution. Monopoles and H-frame structures are relatively comparable in terms of their allowable span lengths, and as such, both designs would utilize approximately the same number of structures along the transmission line route. Monopoles and H-frame structures are comparable in terms of their structural reliability and their electrical reliability and performance. The narrower configuration of the monopole permits the 341 Line to be shifted north in Segment 2 without having to rebuild the 347 Line which was recently constructed as part of IRP. By using the monopoles for only 1.6 miles, the Applicant is able to minimize the visual impact of the taller structures as well as to minimize the impact of the larger reinforced concrete caisson foundations required for each monopole.

5.5.2 Construction Using Monopole Structures

TNEC evaluated using monopole structures both for the entire length of the 3052 Line and for the shifted 347 Line. The structures in Segments 1 and 3 would be approximately 110 feet tall, approximately 22 feet taller than the proposed H-frame structures. The typical steel H-frame structure includes two poles that are each approximately 5.5 feet in diameter whereas the steel monopole structure has a single pole that is approximately 10 feet in diameter. Each monopole structure would require a reinforced concrete caisson foundation, which would result in greater areas of excavation and fill for the structure installations. In addition, the monopole structures would be more expensive than the proposed configuration.

Ultimately, this option was rejected because of the increased environmental impact from the larger footprint of the reinforced concrete caisson foundations, the visual impact from the taller structures, the additional cost of the structures, and because the 3052 Line could be built using H-frame structures in Segments 1 and 3.

5.5.3 Construction Using Double-Circuit Monopole Structures

As an alternative to constructing the Project using H-frame structures, TNEC also evaluated the use of double-circuit structures to carry the 3052 Line and the existing 347 Line. To achieve this configuration, the 3052 Line and the existing 347 Line would be constructed on a common single-shaft steel structure and the existing parallel 347 Line would be removed from its present location. TNEC determined that the double-circuit structure alternative had the following advantages and disadvantages relative to the proposed H-frame structure:

Advantages:

- The natural and social environmental impacts of the single circuit monopole configuration would be generally similar to those of the double-circuit monopole configuration.
- Use of a double-circuit structure could reduce tree removal requirements by approximately 10 to 15 feet in width, in portions of the ROW.
- Double-circuit structures and H-frame structures would be relatively comparable in terms of their allowable span lengths, and as such, both designs would utilize approximately the same number of structures along the transmission line route.
- Double-circuit structures and single-circuit H-frame structures would be comparable in terms of their structural reliability.

Disadvantages:

- Double-circuit structures would be inferior to single-circuit H-frame structures in terms of their electrical reliability and performance. Common mode failure of double-circuit structures could result in the loss of both lines. Double-circuit structures would increase the risk of a lightning strike or single transmission line fault causing both transmission lines to be interrupted simultaneously.
- Double-circuit monopoles would be larger in diameter to accommodate the weight of two circuits, and would not resemble the existing H-frame structures on the TNEC ROW.
- Typically, double-circuit structures would be approximately 135 feet in height (approximately 45 to 50 feet taller than the proposed single-circuit H-frame structures), and as such would be more visible.
- Each double-circuit structure would require a reinforced concrete caisson foundation, as opposed to the H-frame structures which would only require concrete foundations at points of line angle and dead-end locations. The additional foundations required for the double-circuit alternative would significantly increase the excavation, rock removal and soil disturbance required for installation, and would increase the potential for impacts (access roads, construction pads, support work pads) to environmental resources.
- The larger and heavier steel structures required for a double-circuit transmission line, together with the need to get concrete trucks safely along the access spur roads to each foundation location may increase the level of access road improvements required for the Project, and the impacts associated with those improvements.
- The use of double-circuit structures would increase the installed cost of the Project.
- Constructing a double-circuit transmission line would unnecessarily remove, retire and replace existing transmission line segments which are functioning adequately. This incremental cost would be borne by ratepayers and not Invenergy.
- If the 3052 Line and the existing 347 Line shared double-circuit structures (towers), the simultaneous loss of these lines would be treated as a double-circuit tower (DCT) contingency in transmission planning studies; this would lower official interface transfer capabilities.

After considering the relative advantages and disadvantages of utilizing double-circuit structures, TNEC concluded that utilizing single-circuit H-frame and monopole structures as proposed for the Project offered more advantages, provided greater reliability, created fewer impacts, and was a more cost-effective solution.

5.6 Underground Transmission Alternatives

TNEC developed and analyzed underground alternatives to compare with the proposed overhead transmission line configuration for the Project. Underground transmission lines typically have much higher installation costs than overhead transmission lines. Underground transmission cables, particularly long underground cables, have very different electrical characteristics than overhead transmission lines. This can lead to operational and power flow issues, and can require additional system reinforcements to address these issues. Construction techniques for underground transmission lines create different environmental impacts than overhead transmission line construction. Reliability issues associated with underground transmission lines are different than those associated with overhead transmission lines. In developing the underground alternative, TNEC addressed these differences between overhead and underground transmission lines. The following sections describe the underground alternatives considered and their advantages and disadvantages.

5.6.1 Underground Transmission Routes

TNEC considered the following three underground routes:

- Project ROW from the CREC to the Sherman Road Switching Station.
- AGT ROW from the CREC to the Sherman Road Switching Station.
- Public roadways from CREC to the Sherman Road Switching Station.

5.6.1.1 Project ROW

The advantages of installing an underground transmission line along the Project ROW include use of the existing TNEC utility corridor, fewer traffic impacts during construction than if a roadway route were used, and a somewhat shorter route in this particular case. These factors might lead to somewhat lower costs and lower traffic disruptions/ impacts than a public roadway underground route.

However, the TNEC ROW is ill-suited for an underground transmission line for a number of reasons. The ROW traverses multiple wetlands and wetland buffer zones, and crosses multiple waterbodies, including Dry Arm Brook (twice), Clear River, Mowry Brook (twice), Round Top Brook, Chockalog River, and several smaller streams. With overhead construction, it is frequently possible to span wetlands and other sensitive resource areas. This has been demonstrated on the TNEC ROW with the existing transmission lines, and is proposed for the new overhead transmission line. By contrast, with underground construction, it is necessary to either trench the entire route, or to use trenchless techniques such as horizontal directional drilling or pipe jacking. Trenchless installation techniques create additional design, construction, and economic issues, and have their own associated environmental issues. Underground transmission construction techniques have the potential to cause an increase in short and long term impacts to wetlands and other sensitive resources along the overhead ROW.

A substantial permanent access road would need to be constructed along the ROW for purposes of construction and maintenance of an underground transmission line, causing permanent impacts to the ROW, and potentially affecting wetlands, stream crossings, rare species habitat, and other sensitive resources.

In addition, there is significant visible rock along portions of the ROW, which would make constructing an underground transmission line difficult and costly.

Finally, TNEC does not own the majority of the overhead ROW in fee, but rather holds easements. These easements generally do not include the right to install underground lines. Acquisition of the underground rights from numerous parties would significantly increase the timeframe and cost of this routing alternative as well. These constraints and considerations led TNEC to dismiss the TNEC ROW as a potential route for an underground transmission line.

5.6.1.2 Existing Algonquin Gas Pipeline ROW

Similar to the TNEC ROW, the AGT ROW is ill-suited for an underground electric transmission line. The AGT ROW crosses multiple wetlands, wetland buffer zones, and water bodies. A substantial permanent access road would be required for construction and maintenance of an underground line, potentially causing permanent impacts to wetlands, rare species and other sensitive resources, as discussed in Section 5.7.1.1.

TNEC would need to acquire additional property rights from AGT or individual property owners along the corridor for this alternative. Obtaining new property rights would significantly increase the timeframe and cost of this routing alternative. The AGT ROW is 75 feet wide and has two existing natural gas transmission lines within the ROW. In some areas, the ROW may not be wide enough to accommodate an underground electric transmission line, which would trigger the need for acquisition of additional property rights. These constraints and considerations led TNEC to dismiss the existing AGT ROW as a potential route for an underground transmission line.

5.6.1.3 Existing Public Roadways

There are several advantages to installing an underground transmission line beneath the public roadway network, as compared to using the utility corridors. These relative advantages could include:

- Reduced impacts on the natural environment. By using the established roadway network, most construction would not directly impact wetlands or environmentally sensitive areas. Some construction could fall in areas where the roadway is within wetland buffer zones. In these cases, suitable environmental controls and BMPs would be employed to control sedimentation.
- There would likely be less rock removal with a roadway network route, since original road construction would have graded and removed a portion of the rock along the route. Roadway geometry generally is more suitable for underground transmission installation, since there would not be severe grade changes to contend with.
- Access for construction and ongoing maintenance is generally simpler within the roadway network.

- In general, rights for installation of underground facilities within the roadway network are obtained via a permit from a limited number of agencies (municipal Departments of Public Works, RIDOT, etc.).

There are some potential disadvantages to using the roadway network for an underground transmission line:

- During installation of the conduit and manhole system, there would be construction related impacts on vehicular traffic. There would also be some traffic impacts during cable installation and splicing, but these would be confined to manhole locations.
- The roadway network is relatively sparse in this portion of the state, and does not directly parallel the TNEC ROW. As a result, the roadway route is somewhat longer than the overhead ROW route.

5.6.1.4 Selection of Roadway Network as Preferred Underground Route

Overall, TNEC concluded that the roadway network presented fewer environmental and property acquisition issues, and had significant operational benefits as compared to installing an underground transmission line within an existing cross-country utility corridor. For these reasons, TNEC developed a "representative" roadway route between the CREC and the Sherman Road Switching Station using the existing public roadway network. The underground roadway route would start at the CREC and be installed in the proposed CREC access road to Wallum Lake Road (Route 100). The underground route would proceed southeast on Wallum Lake Road, east onto Laurel Hill Road, south onto Grove Street, northeast onto Centennial Street, east along Hill Road to its intersection with Sherman Farm Road (Route 98), and then proceed north along Sherman Farm Road to the Sherman Road Switching Station. The length of the underground roadway route is approximately 7.2 miles long. The representative roadway route is shown in Figure 5-1. This route was selected as a reasonably direct interconnection between the two endpoints and is not the result of exhaustive routing analysis. Other roadway routes would be approximately the same length, and would be expected to have similar construction and operational issues, and similar costs. The public roadway underground alternative was developed in further detail for comparison to the Project.

5.6.2 Underground Cable Design and Construction

A solid dielectric cross-linked polyethylene (XLPE) cable system was selected to develop a conceptual design and cost estimate for the public roadway underground alternative. An XLPE cable system would be expected to have high reliability, lower cable charging, and lower maintenance requirements compared to other available transmission cable technologies at 345 kV (such as high pressure fluid filled pipe type cable).

The overhead transmission capacity of the bundled 1,590 kcmil ACSR proposed for the Project is approximately 3,000 amps (A), or 1,790 Megavolt Ampere (MVA). The overhead conductor size selected somewhat exceeds the immediate rating need, but overhead conductors are also selected based on sag requirements, conductor strength requirements under ice and wind loadings, and other factors. The immediate ampacity need for the interconnection to CREC is approximately 2,000 amps.

For underground construction, the cable system would consist of a single-circuit, initially consisting of two sets of 5,000 kcmil enamel coated copper 345 kV XLPE insulated cables per phase. This would satisfy the 2,000 amp need for the CREC project. These cables would be installed in a ductline and manhole system that would have spare capacity for additional cables for maintenance or replacement purposes.

Preliminary cable ampacity calculations were performed for the alternative underground cable system. Ampacity calculations were executed using CYME International's Cable Ampacity Program 7.1 Revision 1 to model the cable system based on the following design criteria:

TABLE 5-1 CABLE SYSTEM DESIGN CRITERIA

Nominal Voltage	345 kV
Conductor	5,000 kcmil Copper (coated)
Cable System	Extruded Dielectric Cross Linked Polyethylene
Maximum Normal Operating Temperature	90 degrees Celsius (°C)
Installation Depth (top of duct bank):	
Minimum Depth	3 feet
Maximum Depth	8 feet
Earth Ambient Temperature	25°C (Assumed)
Native Soil Thermal Resistivity	90°C - centimeters per watt (cm/W) (Assumed)
Duct Bank Thermal Resistivity	60°C - cm/W
Load Factor	100%
Steady-State Ampacity Rating	2,000 A

Note: The final circuit rating would depend on detailed engineering and final configuration of the underground transmission line.

For the portions of the underground cable route within roadways, the duct bank for the cables would be installed using open-cut trench design. Open trenching involves cutting and removing the pavement, excavating a trench, installing the conduit system, and backfilling the trench. Precast manholes would be installed at pre-determined locations, typically every 2,000 to 2,500 feet along the route. For a 345 kV system, manhole dimensions would be approximately 30 feet long by 7 feet wide by 8 feet high. PVC conduit is assembled and placed in the trench to form a duct bank. Typically a 20-foot-wide construction working area is utilized on streets for a single trench.

The approximately 6.2-feet wide by 2.6-feet tall concrete encased duct bank would consist of nine 8-inch Schedule 40 PVC conduits for the 345 kV Power Cables, three 2-inch PVC conduits for Ground Continuity Conductors, and two 4-inch conduits for communication cables. There would be a minimum of 36 inches of cover from grade to the top of the duct bank, resulting in a 6.2 foot wide by 5.6 foot deep trench. The final duct bank size and layout may vary somewhat from this and would be determined during detailed design. Factors to be considered during detailed design include electrical requirements, heat dissipation, minimal burial depths, existing facility/utility locations and cable installation requirements.

The underground transmission line would also require the following:

- Three large manholes (one manhole per cable set), each approximately 30 feet long by 7 feet wide by 8 feet high at every splice location;
- The installation of multiple cable terminal positions at the switching stations to accommodate the cables. This would require significant area at the switching stations to connect the cable terminations; and,

- Installation of three Shunt Reactors at the terminal switching station due to significant MVARs generated by the cable system. This would require additional land at the switching station.

The underground alternative would also take several additional years to design, license and build.

5.6.3 Underground Alternative Cost

TNEC prepared a conceptual cost estimate for the existing roadway underground alternative. A breakdown of the costs is shown below in Table 5-2.

TABLE 5-2 ESTIMATED UNDERGROUND CONSTRUCTION COST

COMPONENTS	ESTIMATE
Underground Transmission Cable Costs	$148,000,000
Incremental Switching Station Modifications, Transition Stations and Shunt Reactors	$30,000,000
Switching Station Modifications (common with preferred overhead alternative)	$6,200,000
Total	$184,200,000

Note: These costs do not include property acquisition, if required.

5.6.4 Environmental and Other Considerations

For construction of the overhead transmission line in the TNEC ROW, TNEC would use construction techniques that minimize impacts on the natural environment. Disturbed areas would be allowed to re-vegetate with low growing plant species, similar to existing vegetation within the cleared portions of the ROW.

In the case of the underground alternative along existing roadways, the majority of the construction would occur within existing roadways. Assuming an on-road route, most of the environmental impacts would be to the manmade environment, and would primarily occur during the construction of the line. These would include temporary impacts on traffic during conduit and cable installation. The majority of the installation of an underground transmission system would be performed utilizing cut and cover techniques, where the roadway is excavated, the conduit and manhole system is installed, the trench is backfilled, and roadway is repaved. For much of the route, the roadway is only two lanes wide. Lane closures with alternating traffic patterns would be required during construction. There would also be temporary noise impacts to the homes and businesses located along the roadway route from construction equipment and vehicles.

The underground roadway route would cross a number of streams and small rivers, where the streams are culverted or where the roadway is in a bridge over the waterways. Wetlands and waterways would be crossed by installing the cables on bridges (if available and suitable), by cut and cover over or under culverted streams, or by trenchless techniques such as Horizontal Directional Drilling. Where the underground route would pass through buffer areas adjacent to wetlands, proper construction techniques and BMPs, such as the use of hay bales or other sedimentation barriers, would be employed to protect these areas.

In addition to the impacts summarized above, an underground line will also require the following equipment installed above ground at the terminal switching station: shunt reactors, circuit breakers and associated switches, multiple cable terminations, and surge arresters. The additional equipment potentially increases the environmental impact of an underground project as additional space within the switching stations will be needed to connect the underground line to the switching station.

5.6.5 Underground Operational Issues

In addition to the significantly higher costs and the schedule impacts summarized in Section 5.6.3, there are a number of system and operational issues associated with underground transmission lines. These include:

- Lengthy Outage Repair Times: When an overhead transmission line experiences an outage, it can typically be repaired within 24 to 48 hours. In the case of a failure of an underground transmission cable, repair times for a 345 kV XLPE circuit can be in the range of a month or more. The extended outage times for underground cables would limit the ability of CREC to generate power during this time period. Extended underground outage repair times can expose the remainder of the transmission system to emergency loadings for longer periods of time. There is also increased exposure to loss of another transmission element, with possible loss of load, during the extended underground outage.

- Cable Capacitance: Underground cables have significantly higher capacitance than overhead transmission lines, meaning that it takes reactive power (Megavolt Ampere Reactive [MVARs]) to “charge up” the cable before the cable can transmit real power (Megawatt [MWs]). This has several ramifications:

  - Part of the cable’s capacity is used up by the charging current, so larger conductors are needed to transmit an equivalent amount of power. These have been included in the system design described above.

  - Capacitance can create voltage control problems, meaning that the voltage can get too high when the transmission system is at light load. If the CREC interconnection were to be constructed underground, there would be approximately 140 MVAR of cable charging per cable, or 280 MVAR for the initially developed two cable system. The transmission system cannot absorb this much charging MVARs and it would be necessary to install additional equipment, in the form of shunt reactors, at one or both terminal switching stations.

  - Cable capacitance causes higher switching transient voltages on the system (voltage “spikes” during switching). This can damage other system components, may trigger the need to replace surge arresters throughout the area, and complicates future system expansions.

- Effect on Reclosing: Many faults on overhead lines are temporary in nature. Often it is possible to “reclose” (re-energize) an overhead line after a temporary fault, and return the line to service with only a brief interruption, measured in seconds. Faults on underground transmission cables are almost never temporary, and the cable must remain out of service until the problem is diagnosed and repairs can be completed.

- Ratings: It is often difficult to match overhead line ratings with underground cables. It is also much more difficult to upgrade ratings on underground lines should that become necessary in the future. The proposed design for the underground alternative makes some accommodation for this, but the issue remains.

5.6.6 Underground Dips

During siting of overhead transmission lines, questions are often raised regarding the possibility of installing short segments of underground transmission line at discrete locations along the route. This type of short underground segment is often referred to as a “dip.” TNEC developed an estimated cost for a “generic” one mile underground dip for the 3052 Line. This underground dip would utilize two sets of 5,000 kcmil cu 345 kV XLPE cable per line, installed in a ductline. For a generic dip, the route would follow the existing ROW alignment. See Figure 5-2 (trench cross section).

At each end of the dip, there would be a transition station. This would be a fenced switching station, approximately 125 feet by 125 feet at a minimum, and similar in appearance to an electrical substation. The transition station would terminate the overhead line, and would contain cable terminations, a control house, and accessory equipment. The cost of a one mile generic underground dip, utilizing similar assumptions as the underground alternative, is as follows:

TABLE 5-3 ESTIMATED GENERIC COSTS FOR A ONE-MILE DIP SEGMENT

SYSTEM COMPONENT	ESTIMATED COST (MILLIONS)
Underground Transmission Cable Costs	$18,000,000
Transition Stations	$10,000,000
Total	$28,000,000

The average overhead transmission line cost along the route is approximately $4.43 million per mile. For a one mile dip, the underground line represents more than a six-fold increase in costs over the overhead line. An underground dip would expose the entire line segment to the underground transmission operational issues discussed above. These include:

- Lengthy outage repair times for underground transmission cables.
- Effect on reclosing for temporary faults.
- Cable capacitance effects (less for dips).
- Ratings – potential for future bottlenecks.

Underground dips represent a large cost increase, may require additional property rights, and introduce operational disadvantages when compared to the proposed overhead line.

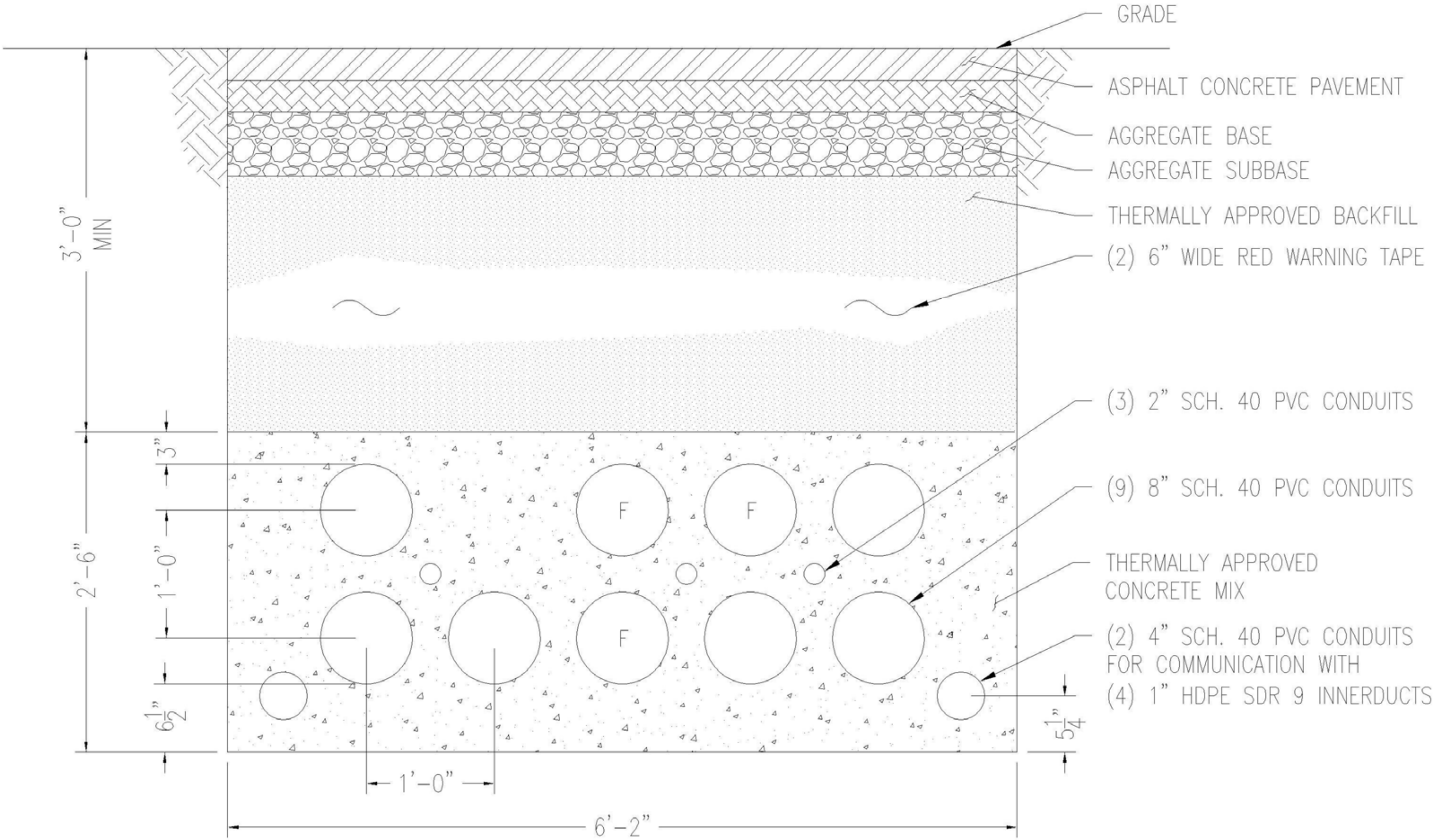

Figure 5-2 Underground Transmission Trench Detail

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5.6.7 Underground Alternative Conclusions

Both the overhead and underground alternatives would meet the identified needs of the Project and would be expected to have high levels of reliability. The underground alternative has significant operational issues, longer restoration times, and voltage control issues that make it technically inferior to the proposed Project. Generally, the underground alternatives on the public roadway network would have fewer environmental impacts than the preferred overhead alternative. There would, however, be greater temporary impacts to the public during construction of an underground alternative in the public roadways. In most instances, a cross-country underground alternative would have more environmental impacts than the preferred overhead alternative because of the need to excavate a continuous open trench along the ROW and the need to construct a continuous access route. The significantly higher cost and the operational issues make the underground alternative much less preferred than the Project as proposed.

5.7 Summary of Alternatives and Conclusions

In the development of the Project and selection of the preferred alternative, TNEC evaluated a variety of alternatives. Alternatives to the construction of the 345 kV transmission line included electrical alternatives, alternative overhead routes, and underground transmission alternatives.

Following an evaluation of the relative merits and disadvantages of the various alternatives, the overhead alternative as proposed is superior to other routing alternatives because it:

- Utilizes an existing ROW dedicated to existing overhead transmission lines, thus avoiding acquisition of new ROW and reducing environmental impacts.

- Meets the energy needs of the state and region by providing an interconnection for the proposed generation plant.

- Provides the lowest reasonable Project cost and is substantially less expensive than any of the other alternatives considered.

- Is designed to not cause unacceptable harm to the environment, and to enhance the socioeconomic fabric of the state by providing a reliable energy source.

6.0 DESCRIPTION OF AFFECTED NATURAL ENVIRONMENT

This section of the ER describes the existing natural environment that may be affected by the Project, both within and surrounding the Project ROW. As required by the EFSB Rules, a detailed description of all environmental characteristics within and immediately surrounding the Project is provided below. This section describes the specific natural features that have been evaluated for potential impacts. Information pertaining to existing site conditions has been obtained through available published resource information, the Rhode Island Geographic Information System (RIGIS) database, various state and local agencies, previous field investigations for TNEC's IRP[4], and recent field investigations of the Project area.

6.1 Study Area

A Study Area was established to assess the existing environment both within and immediately adjacent to the existing TNEC ROW and the proposed CREC ROW. This Study Area consists of a corridor measured 2,500 feet on either side of the 3052 Line. The boundaries of this corridor were determined to allow for a detailed desktop analysis of existing conditions within and adjacent to the Project ROW (Figure 6-1).

6.2 Geology

6.2.1 Bedrock Geology

The Study Area is mapped within the West Bay Area of the Esmond-Dedham Subterrane and is located approximately 1,600 feet to the east of the Hope Valley Shear Zone. The Hope Valley Shear Zone is a mapped Alleghanian strike-slip fault that marks the boundary between the Esmond-Dedham Subterrane and the Hope Valley Subterrane. A strike-slip fault is a fault on which the movement is parallel to the fault's strike. The Alleghanian orogeny or Appalachian orogeny is one of the geological mountain-forming events that formed the Appalachian Mountains. The Alleghanian orogeny occurred approximately 325 million to 260 million years ago over at least five deformation events.

The underlying bedrock beneath the Study Area is mapped as the Augen Granite Gneiss (Zeag) member of the Esmond Igneous Suite. This late Proterozoic formation consists mostly of augen granite gneiss, a pale to dark grey medium- to coarse-grained igneous unit characterized by large (>1 centimeter) lenticular feldspar porphyroclasts called augen. The formation also includes structurally conformable layers of amphibolite.

The Study Area is located within the Seaboard Lowland section of the New England physiographic province. The Study Area consists of two geologic areas: The Hope Valley Subterranne and the West Bay Area of the Esmond-Dedham Subterranne. The bedrock geology of the Study Area is undifferentiated rock and augen granite gneiss from the Blackstone and Harmony period laid during the late Proterozoic period or older group (Hermes et al. 1994). Refer to Figure 6-2.

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[4] USACE Section 404 Permit # NAE-2008-1671.

6.2.2 Surficial Geology

The present landscape of the Study Area, as with much of the northeastern United States, was formed during the Wisconsin glacial age approximately 10,000 years ago. The dynamic land forming processes that occurred during this geologic event produced the landforms and surficial geologic deposits within the Study Area.

The Study Area is comprised of predominantly glacial till, with pockets of glaciofluvial deposits known as outwash deposits and ice contact deposits interspersed throughout. Glacial till is material carried and directly deposited by glacial ice with little or no reworking by running water. Therefore, this material is not well sorted and the stones are not well rounded. Glacial till is non-stratified glacial drift consisting of clay, silt, sand, stones, and boulders transported and deposited by glacial ice. There are two forms of glacial till: lodgement till, which was deposited directly under the glacier as it moved or melted, and ablation till, which lay on top of the ice or was incorporated into the ice, and then deposited on the ground when the ice melted. Lodgement till tends to be more compact. In contrast, glaciofluvial deposits, often referred to as glacial outwash, were deposited by the abundant meltwater which flowed from the shrinking glacier. Glaciofluvial deposits are typically composed of well-rounded stones and sorted silt, sand and gravel deposited in recognizable layers by glacial meltwater.

Glaciofluvial deposits are common in low areas of the landscape, such as broad, level plains and valleys. Landforms associated with glaciofluvial deposits include outwash terraces, outwash fans or deltas, valley trains, eskers, kames, and kame terraces. Significant areas of glacial outwash are located in almost every town and city in the State. Some of these areas are capped with windblown deposits of silt, known as loess. The boundary between areas of till and outwash deposits is often characterized by an abrupt change in slope.

6.2.3 Geological Hazards

Geological hazards, such as earthquakes or fault zones, could have negative impacts on transmission line or substation facilities. Normal possible fault zones are evident to the east and south of the Study Area. Historically, seismic activity in the northeastern United States is the result of rebound in the earth’s crust depressed by ice loading during the Pleistocene glacial event. These events are non-tectonic and do not usually result in vertical movement along fault lines. This rebound may cause moderate to very strong ground shaking locally and some horizontal movement, but this potential can be regarded as minimal for the design life of the Project.

6.2.4 Sand and Gravel Mining

There are no sand and gravel mining operations within the Study Area corridor.

6.3 Soils

Detailed information concerning the physical properties, classification, agricultural suitability, and erodibility of soils in the vicinity of the Study Area are presented in this section. Descriptions of soil types identified within the Study Area were obtained from the Soil Survey of Rhode Island (Rector 1981) and Natural Resource Conservation Service (NRCS). The Soil Survey delineated map units that may consist of one or more soil series and/or miscellaneous non-soil areas that are closely and continuously associated on the landscape. In addition to the named series, map units include specific phase information that describes the texture and stoniness of the soil surface and the slope class. A total of 30 named soil series have been mapped within the Study Area. Table 6-1 lists the characteristics of the soil phases (lower taxonomic units than series) found within the Study Area. Study Area hydric soil status is depicted on Figure 6-3.

TABLE 6-1 CHARACTERISTICS OF SOIL PHASES WITHIN THE STUDY AREA

SOIL MAP UNIT SYMBOL	SOIL PHASE	DRAINAGE CLASS	PERCENT SLOPE	DEPTH TO BEDROCK (in.)
AfA	Agawam fine sandy loam	wd	0-3	>60
CaD	Canton & Charlton rock outcrop complex	wd	15-35	>60
CdB	Canton & Charlton fine sandy loam	wd	3-8	>60
CeC	Canton & Charlton fine sandy loam, very rocky	wd	3-15	>60
ChB	Canton & Charlton v. fine sandy loam	wd	3-8	>60
ChC	Canton & Charlton v. stony fine sandy loam	wd	8-15	>60
ChD	Canton & Charlton v. stony fine sandy loam	wd	15-25	>60
CkC	Canton & Charlton ex. Stony f.s. loam	wd	3-15	>60
CrC	Canton fine sandy loam, rocky	wd	3-15	>60
CrD	Canton fine sandy loam, rocky	wd	15-35	>60
CxC	Canton fine sandy loam, extremely bouldery	wd	3-15	>60
FeA	Freetown muck	vpd	0-1	>60
HkA	Hinckley gravelly sandy loam	ed	0-3	>60
HkC	Hinckley gravelly sandy loam	ed	rolling	>60
PaA	Paxton fine sandy loam	wd	0-3	>60
PaB	Paxton fine sandy loam	wd	3-8	>60
PbB	Paxton v. stony fine sandy loam	wd	0-8	>60
PbC	Paxton v. stony fine sandy loam	wd	8-15	>60
Pg	Pits, gravel	ed-swed	var.	>60
Re	Ridgebury fine sandy loam	pd	0-3	>60
Rf	Ridgebury, Whitman & Leicester ex. stony fine sandy loam	pd-vpd	NL	>60
Ss	Sudbury sandy loam	mwd	NL	>60
SuB	Sutton v. stony fine sandy loam	mwd	0-8	>60
SwA	Swansea muck	vpd	0-1	>60
UD	Udorthents- urban land complex	mwd-ed	var.	NL
Wa	Walpole sandy loam	vpd	0-3	>60
WhA	Woodbridge fine sandy loam	mwd	0-3	>60
WhB	Woodbridge fine sandy loam	mwd	3-8	>60
WoB	Woodbridge fine sandy loam, very stony	mwd	0-8	>60
WrB	Woodbridge fine sandy loam, extremely stony	mwd	0-8	>60

Notes:
in. – inches; ed – excessively drained; wd – well drained; mwd – moderately well drained; swed – somewhat excessively drained; pd – poorly drained; vpd – very poorly drained; 8-15 percent slope – highly erodible; NL – Not Listed.
Source: Rector 1981 and NRCS 2016a.

6.3.1 Soil Series

The soil series detailed in the following subsections have been identified within the Study Area. The classification follows that published in the Soil Survey of Rhode Island (Rector 1981) and online (http://websoilsurvey.nrcs.usda.gov).

Agawam Series

The Agawam series is classified as coarse-loamy over sandy-skeletal, mixed, mesic Typic Dystrochrepts. These well drained soils formed in glaciofluvial deposits derived mainly from schist, gneiss, and phyllite. The soils are on terraces and outwash plains.

Canton & Charlton Series

The Canton series is classified as coarse-loamy over sandy skeletal, mixed, mesic Typic Dystrochrepts. These well drained soils formed in glacial till derived mainly from schist and gneiss. The similar Charlton series is classified as coarse-loamy, mixed, mesic Typic Dystrochrepts. These soils were also formed in glacial till derived mainly from schist and gneiss. Charlton soils have a finer textured substratum than Canton soils. Because these series are similar, they are sometimes grouped and mapped together as an association.

Freetown Series

The Freetown series is classified as Dysic, mesic Typic Haplosaprists. These nearly level, very poorly drained soils are formed in depressions of outwash plains and glacial upland till plains.

Hinckley Series

The Hinckley series is classified as sandy-skeletal, mixed, mesic Typic Udorthents. These excessively drained soils are formed in glaciofluvial deposits derived mainly from schist and gneiss.

Paxton Series

The Paxton series is classified as well drained loamy soils formed in lodgment till. The soils are very deep to bedrock and moderately deep to a densic contact. They are nearly level to steep soils on hills, drumlins, till plains, and ground moraines.

Ridgebury, Whitman and Leicester Series

The Ridgebury, Whitman and Leicester series are commonly grouped together as one soil complex due to their similar properties. However, they are distinct series with individual classifications. The Ridgebury series is classified as coarse-loamy, mixed, mesic Aeric Fragiaquepts, the Whitman series is classified as coarse-loamy, mixed, mesic Humic Fragiaquepts and the Leicester series is classified as coarse-loamy, mixed, acid, mesic Aeric Haplaquepts. Ridgebury and Leicester soils are poorly drained and Whitman soils are very poorly drained. Whitman and Leicester have a dense till layer within one meter of the soil surface. These soils are formed in loamy glacial till derived mainly from schist, gneiss and granite. These soils are in depressions, drainage ways in glacial till uplands, and nearly level areas of glacial upland hills and drumlins.

Sudbury Series

The Sudbury series is classified as sandy, mixed, mesic Aquic Dystrochrepts. These moderately well drained soils are formed in glaciofluvial deposits derived mainly from schist and gneiss. These soils are on terraces and outwash plains.

Sutton Series

The Sutton series is classified as coarse-loamy, mixed, mesic Aquic Dystrochrepts. These moderately well drained soils are formed in glacial till derived mainly from schist, gneiss and granite. The soils are on side slopes and in depressions of upland hills. The soil surface ranges from non-stony to extremely stony.

Swansea Series

The Swansea series is classified as Sandy or sandy-skeletal, mixed, dysic, mesic Terric Haplosaprists. These very poorly drained organic soils are formed by organic material over sandy material. These soils are in depressions or on flat level areas on uplands and outwash plains.

Udorthents Series

The Udorthents series are moderately well drained to excessively drained soils that have been cut, filled, or eroded. The areas have had more than two feet of the upper part of the original soil removed or have more than two feet of fill on top of the original soil. Udorthents are extremely variable in texture. They are on glacial till plains and gravelly outwash terraces.

Walpole Series

The Walpole series is classified as sandy, mixed, mesic Aeric Haplaquepts. These poorly drained soils are formed in glaciofluvial deposits derived mainly from schist, gneiss, and granite. The soils are in depressions and drainage ways.

Woodbridge Series

The Woodbridge series is classified as coarse-loamy, mixed, mesic Typic Fragiochrepts. These moderately well drained soils are formed in glacial till derived mainly from schist, gneiss, and phyllite. The soils are on lower slopes and crests of upland hills and drumlins.

6.3.2 Prime Farmland Soils

Prime farmland, as defined by the United States Department of Agriculture (USDA), is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when it is treated and managed using acceptable farming methods. Rhode Island recognizes 34 prime farmland soils. The Study Area crosses seven prime farmland soil units as listed in Table 6-2.

TABLE 6-2 USDA PRIME FARMLAND SOILS WITHIN STUDY AREA

SOIL MAP UNIT SYMBOL	SOIL	PERCENT SLOPE
Afa	Agawam fine sandy loam	0-3
CdB	Canton & Charlton fine sandy loam	3-8
PaA	Paxton fine sandy loam	0-3
PaB	Paxton fine sandy loam	3-8
Ss	Sudbury fine sandy loam	NL
WhA	Woodbridge fine sandy loam	0-3
WhB	Woodbridge fine sandy loam	3-8

NL – Not Listed.
Source: NRCS 2016a.

Urbanized land and water are exempt from consideration as prime farmland. Within the Study Area, prime farmland soils exist on land occupied by residential, agricultural, commercial, and forestland and roads.

6.3.3 Farmland of Statewide Importance

Farmland of statewide importance is land that is designated by the Rhode Island Department of Administration Division of Planning to be of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. Generally, farmlands of statewide importance include those lands that do not meet the requirements to be considered prime farmland, but that economically produce high crop yields when treated and managed with modern farming methods. Some may produce as high a yield as prime farmland if conditions are favorable.

In order to extend the additional protection of state regulation to prime farmland, the state of Rhode Island has expanded its definition of farmland of statewide importance to include all prime farmland areas. Therefore, in Rhode Island, all USDA-designated prime farmland soils are also farmland of statewide importance.

Table 6-3 lists soil units designed as farmland soils of statewide importance that are found within the Study Area.

TABLE 6-3 FARMLAND SOILS OF STATEWIDE IMPORTANCE WITHIN THE STUDY AREA

SOIL MAP UNIT SYMBOL	NAME	PERCENT SLOPE
Afa	Agawam fine sandy loam	0-3
CdB	Canton & Charlton fine sandy loam	3-8
HkA	Hinckley gravelly sandy loam	0-3
HkC	Hinckley gravelly sandy loam, rolling	0-1
PaA	Paxton fine sandy loam	0-3
PaB	Paxton fine sandy loam	3-8
Re	Ridgebury fine sandy loam	0-1
Ss	Sudbury fine sandy loam	NL
Wa	Walpole sandy loam	0-1
WhA	Woodbridge fine sandy loam	0-3
WhB	Woodbridge fine sandy loam	3-8

NL – Not Listed.
Source: NRCS 2016a.
Special note: In Rhode Island, all soils that meet the “Prime Farmland” criteria are also included in the “Additional Farmland of Statewide Importance” category. The inclusion of these soils in the list of “Additional Farmland of Statewide Importance” by the USDA resulted from a May 1985 request by the RI Department of Administration’s Division of Planning seeking to have the Prime Farmlands afforded the additional protection given to Farmlands of Statewide Importance.

6.3.4 Erosive Soils

The erodibility of soils is dependent upon the slope of the land and the texture of the soil. Soils are given an erodibility factor (K), which is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values in Rhode Island range from 0.10 to 0.64 and vary throughout the depth of the soil profile with changes in soil texture. Very poorly drained soils and certain floodplain soils usually occupy areas with little or no slope. Therefore, these soils are not subject to erosion under normal conditions and are not given an erodibility factor. Soil map units described as strongly sloping or rolling may include areas with slopes greater than eight percent and soil map units with moderate erosion hazard are listed in Table 6-4.

TABLE 6-4 STUDY AREA POTENTIALLY HIGHLY ERODIBLE SOIL MAPPING UNITS

SOIL MAP UNIT SYMBOL	SOIL PHASE	PERCENT SLOPE	SURFACE K VALUES
CaD	Canton & Charlton Rock Outcrop	15-35	0.20
CdB	Canton & Charlton fine sandy loams	3-8	0.20
CeC	Canton & Charlton fine sandy loams v. rocky	3-8	0.20
ChB	Canton & Charlton v. stony fine sandy loams	3-8	0.20
ChC	Canton & Charlton v. stony fine sandy loams	3-8	0.20
ChD	Canton & Charlton v. stony fine sandy loams	8-15	0.20
CkC	Canton and Charlton extremely stony fine sandy loam	3-15	0.24
HkC	Hinckley gravelly sandy loam	rolling	0.17
PaB	Paxton fine sandy loam	3-8	0.24
PbB	Paxton v. stony fine sandy loam	0-8	0.20
PbC	Paxton v. stony fine sandy loam	3-15	0.20
SuB	Sutton v. stony fine sandy loam	0-8	0.20
UD	Udorthents-Urban land complex	0-15	0.24
WhB	Woodbridge fine sandy loam	3-8	0.24
WoB	Woodbridge v. stony fine sandy loam	0-8	0.20
WrB	Woodbridge extremely stony fine sandy loam	0-8	0.24

Source: Rector 1981 and NRCS 1993.

6.4 Surface Water

The Study Area is primarily drained by waterways in the Blackstone River drainage basin. The Blackstone River drainage basin is drained by waterways that generally flow to the east and southeast eventually flowing into Narragansett Bay. The far western portion of the Study Area is drained by waterways in the Five Mile River drainage basin. A drainage basin is the area that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel (Dunne and Leopold 1978), and is synonymous with watershed.

The Study Area is located within the Clear River sub-basin of the Lower Blackstone River watershed. The Clear River flows in a north to south direction across the TNEC ROW east of Wallum Lake Road (Route 100). Round Top Brook and Chockalog Brook also cross the TNEC ROW and are both included in the Clear River sub-basin of the Lower Blackstone River watershed. Round Top Pond is located approximately one mile to the northwest of the Study Area and Wilson Reservoir is located approximately one mile to the east of the Study Area. Tributaries of Dry Arm Brook run in a north/northeast direction to the northeast and east of the Project. Western portions of the Study Area fall within the Upper Five Mile River Watershed.

The major surface water resources and classifications within the Study Area and water resources crossed by the Project are listed in Table 6-5. The waters of the State of Rhode Island (meaning all surface water and groundwater of the State) are assigned a Use Classification which is defined by the most sensitive uses which it is intended to protect. Waters are classified according to specific physical, chemical, and biological criteria which establish parameters of minimum water quality necessary to support the water Use Classification. The water quality classification of the major surface waters within the Study Area are identified in the descriptions of the water courses that follow.

TABLE 6-5 MAJOR SURFACE WATER RESOURCES WITHIN THE STUDY AREA

WATER BODY NAME	TOWN	CLASSIFICATION/ USE	FISHERY DESIGNATION	WATER BODY CROSSED
Chockalog River and tributaries	Burrillville	A	Cold	Yes
Round Top Brook and tributaries	Burrillville	A	Warm	Yes
Big Round Top Pond	Burrillville	A	NA	No
Little Round Top Pond	Burrillville	A	NA	No
Unnamed tributaries to Wakefield Pond	Burrillville	B	NA	No
Tributaries to Wilson Reservoir	Burrillville	B	NA	Yes
Card Machine Brook	Burrillville	A	NA	No
Mowry Brook and tributaries	Burrillville	B	Cold	Yes
Clear River and tributaries	Burrillville	B1	Cold	Yes
Dry Arm Brook and tributaries	Burrillville	B	Warm	Yes
Round Pond	Burrillville	B	NA	No

Source: RIDEM 2011a.
Classification/Use:
- A Primary and secondary contact recreational activities and for fish and wildlife habitat. Suitable for compatible industrial processes and cooling, hydropower, aquaculture uses, navigation, and irrigation and other agricultural uses. These waters shall have excellent aesthetic value.
- B Fish and wildlife habitat and primary and secondary contact recreational activities. Suitable for compatible industrial processes and cooling, hydropower, aquaculture uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value.
- B1 Primary and secondary contact recreational activities and fish and wildlife habitat. Suitable for compatible industrial processes and cooling, hydropower, aquaculture uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharges. However, all Class B criteria must be met.
- NA No data found.

Pursuant to the requirements of Section 305(b) of the Federal Clean Water Act, water bodies that are determined to be not supporting their designated uses in whole or in part are considered impaired, and placed on the Clean Water Act, Section 303(d) List of Impaired Waters where they are prioritized and scheduled for restoration. The causes of impairment are those pollutants or other stressors that contribute to the actual chemical contaminants, physical parameters, and biological parameters. Sources of impairment are not determined until a total maximum daily load (TMDL) assessment is conducted on a water body. There are no impaired water resources within the Project Study Area.

6.5 Groundwater Resources

The RIDEM classifies all of the state’s groundwater resources and establishes groundwater quality standards for each class. The four classes are designated GAA, GA, GB, and GC. Groundwater classified GAA and GA is to be protected to maintain drinking water quality, whereas groundwater classified GB and GC is known or presumed to be unsuitable for drinking water use without treatment. The presence and availability of groundwater resources is a direct function of the geologic deposits in the vicinity of the Project.

Groundwater resources within the Study Area are depicted on Figure 6-4. The majority of the groundwater resources in the Study Area, approximately 89 percent, are classified by the RIDEM as GA (RIDEM designates approximately 71 percent of groundwater Rhode Island as GA), and approximately 1.0 percent of the groundwater resources in the Study Area are classified as GAA. GAA groundwater resources are known or presumed to be suitable for drinking water use without treatment and are either a part of the state's major stratified drift aquifers that are capable of serving as a significant public supply source, or are a RIDEM delineated wellhead protection area. As shown on Figure 6-4, the area designated as GAA is located outside of the Project area at the southern edge of the Study Area. The balance of groundwater resources in the Study Area are located in Massachusetts and were not evaluated for the purposes of this description.

A portion of the Study Area is located within Burrillville Zone A-80 which is an Aquifer Overlay Zone and subject to the General Ordinances for the Town of Burrillville Aquifer Zoning in §30-202(c) which states Zone A-80 permitted uses to include single-family residential, multifamily,[5] recreation/open space, farming,[6] commercial,[5] and industrial.[5]

6.6 Vegetation

The Study Area contains a variety of vegetative cover typical of Southern New England (DeGraaf and Yamasaki 2001). These include oak/pine forest, old field, and managed lawn. This section of the report focuses on upland communities. Wetland communities are discussed in Section 6.7 of this report.

6.6.1 Oak/Pine Forest Community

Forested cover types within the Study Area are typically dominated by oaks (*Quercus* spp.) with or without a white pine (*Pinus strobus*) component. Although these woodlands may appear similar throughout the Study Area, differences in the structure and composition of species in these forests may occur between sites. Soil moisture holding capacity and slope aspect are important factors in determining the plant associations present at a particular site. Plant associations growing on hilltops and south facing slopes are likely to face moisture deficits during the summer. Sandy soils associated with glacial outwash deposits have lower moisture holding capacity in comparison with soils formed over deposits of glacial till. Forests established in these drier sites are often characterized by smaller and more widely spaced trees in comparison with more mesic sites.

Common associates of the hilltop oak/pine forests in the vicinity of the Project ROW include black (*Quercus velutina*), scarlet (*Q. coccinea*), and white oaks (*Q. alba*) as well as aspen (Populus sp.) and gray birch (*Betula populifolia*). The shrub/sapling understory includes such species as black cherry (*Prunus serotina*), lowbush blueberry (*Vaccinium angustifolium*) and greenbrier (*Smilax rotundifolia*). Sheep laurel (*Kalmia angustifolia*) and sweet fern (*Comptonia peregrina*) occasionally occur in openings between oak stands with canopy openings and on rocky slopes. Herbaceous species include bracken fern *(Pteridium aquilinum*), tree clubmoss (*Lycopodium obscurum*) and hayscented fern (*Dennstaedtia punctilobula*). These hilltop communities occur where excessively drained soils predominate, and on hilltops throughout the Study Area.

[5] Must be sewered per §30-202(c) of Town of Burrillville Aquifer Zoning Ordinance.
[6] Permitted by special use permit only per §30-202(c) of Town of Burrillville Aquifer Zoning Ordinance.

There is an increase in the diversity within plant communities on midslopes compared with dry hilltops. The increase in soil moisture produces this greater diversity in trees, shrubs and herbs. Midslope tree species in addition to oaks include black birch (*Betula lenta*), white ash (*Fraxinus americana*), American beech (*Fagus grandifolia*) and several species of hickory (*Carya* spp.). Shrubs include witch hazel (*Hamamelis virginiana*), sassafras (*Sassafras albidum*) and ironwood (*Carpinus caroliniana*). Greenbrier and poison ivy (*Toxicodendron radicans*) are also common in this community. Common groundcover species include tree clubmoss and wintergreen (*Gaultheria procumbens*). Midslope oak/pine communities occur on mesic mid-slope and lower slope positions and adjacent to forested wetlands on the uncleared portion of the ROW.

6.6.2 Old Field Community

Upland vegetation within the cleared portions of the ROW is typically representative of an old field successional community. Old field communities are established through the process of natural succession from cleared land to mature forest. Within the cleared ROW, periodic vegetation management has favored the establishment and persistence of grasses and herbs. Over time, pioneer woody plant species including gray birch, sumac (*Rhus* sp.) and eastern red cedar (*Juniperus virginiana*) have become established.

Within the cleared portions of the ROW, vegetation varies considerably. On dry hilltops, little bluestem (*Schizachyrium scoparium*), bluets (*Houstonia caerulea*), sweet fern (*Comptonia peregrina*) and eastern red cedar are common. On the mid-slope, greenbrier and blackberry (*Rubus* sp.) form dense, impenetrable thickets. Numerous herbs including goldenrod (Solidago sp.), sheep sorrel (*Rumex acetosella*), wild indigo (*Baptisia tinctoria*), and mullein (*Verbascum thapsus*) are also common.

6.6.3 Upland Low Shrub Land Community

The TNEC ROW has been managed to selectively remove trees so they do not interfere with the operation of the existing transmission lines. Low shrub lands dominate portions of the ROW where succession of old field has occurred and where ROW management has resulted in tree sapling removal. Sweet fern (*Comptonia peregrina*), bayberry (*Myrica pensylvanica*), and northern arrowwood (*Viburnum recognitum*) are shrub species that are commonly found within the ROW.

Forest vegetation abuts the area of managed ROW in many places along the corridor. This forested edge contains species of trees and the ROW contains saplings that require more sunlight, such as black cherry (*Prunus serotina*), grey birch (*Betula populifolia*) and eastern red cedar. Mature forest containing northern red oak and red maple (*Acer rubrum*) are also present along the corridor, and saplings of these species are occasionally found in the ROW.

6.6.4 Managed Lawn/Grass

Portions of the cleared ROW contain managed residential lawn. Typically these areas consist of a continuous grass cover which may include Kentucky bluegrass (*Poa pratensis*), red fescue (*Festuca rubra*), clover (*Trifolium* sp.), and plantains *(Plantago* sp.). Ornamental shrubs may also occur within these areas.

6.6.5 Agricultural Areas

Based on the existing land use mapping obtained from the RIGIS and field survey, the ROW crosses agricultural lands in Burrillville, including pasture land, nurseries and tree farms, and cropland (refer to Figure 6-5).

6.7 Wetlands

Wetlands are resources which have ecological functions and societal values. Wetlands are characterized by three criteria: (i) the presence of undrained hydric soil, (ii) a prevalence (>50 percent) of hydrophytic vegetation, and (iii) wetland hydrology, where soils are saturated near the surface or flooded by shallow water during at least a portion of the growing season.

Federal and State-regulated freshwater wetlands and/or streams were identified and delineated within the ROWs. Wetlands and streams within the TNEC ROW were delineated in 2006 through 2008 and assessed again in 2011[7]. A total of 81 freshwater wetlands were identified and delineated on the Project ROW. The wetland delineations completed for the IRP within the TNEC ROW have been approved by the RIDEM and USACE for the Project[8]. These wetland boundaries have again been confirmed by POWER in summer of 2016 as being accurate demarcations of the wetlands and watercourses found within the ROW. ESS conducted field delineations on the CREC ROW in the fall of 2014 and the spring of 2015[9].

Field methodology for the delineation of State-regulated resource areas within the ROW was based upon vegetative composition, presence of hydric soils, and evidence of wetland hydrology. The study methods included both on-site field investigations and off-site analysis to determine the wetland and watercourse resource areas on the Project ROWs. Wetlands outside the ROW within the Study Area were identified based on a desktop review of RIGIS wetlands data (RIGIS 1993). Figure 6-6 depicts wetland resources within the Study Area based on the results of this desktop analysis.

In accordance with the provisions of the Rhode Island Fresh Water Wetlands Act and Rules (Rules), State-regulated freshwater wetlands include swamps, marshes, bogs, forested or shrub wetlands, emergent plant communities and other areas dominated by wetland vegetation and showing wetland hydrology. Swamps are defined as wetlands dominated by woody species and are three acres in size, or greater. Marshes are at least one acre in size and contain standing or running water during the growing season. Marsh plant species include grasses (*Gramineae*), sedges (*Cyperaceae*), rushes (*Juncaceae*) and other non-woody species. Bogs are wetlands dominated by “bog” species such as blueberries and cranberries (*Vaccinium* sp.), leatherleaf (*Chamaedaphne calyculata*), and sedges (*Carex*) to name a few of the diverse plant species. Generally over 50 percent of the ground or water surface is covered with sphagnum moss (*Sphagnum*). Bogs have no minimum size criteria. Emergent wetland communities are areas similar to marshes in vegetation composition; however, they are less than one acre in size. Forested and shrub wetlands are similar to swamps, but do not meet the three-acre size criteria. The upland area within 50 feet of the edge of a swamp, marsh, or bog is regulated as

[7] Wetlands and watercourse delineations conducted in accordance with the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands and the Regional Supplement to the U.S. Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Interim Version 2009) and the Rhode Island Fresh Water Wetlands Act.
[8] Letter from RIDEM to Michael E. Feinblatt (ESS) dated March 22, 2016.
[9] Wetland and watercourse delineations were conducted in accordance with the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0, 2012) (Regional Supplement) and the Rhode Island Fresh Water Wetlands Act and Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act.

the 50-foot Perimeter Wetland under the Rules. Emergent wetland communities, forested wetlands, and shrub wetlands do not merit a 50-foot Perimeter Wetland according to the Rules.

The Rules also regulate activities in and around streams and open water bodies which include rivers, streams, ponds, Areas Subject to Storm Flowage (ASSF), Areas Subject to Flooding (ASF) and floodplains. A river is any perennial stream indicated by a blue line on a USGS topographic map. If a stream or river is less than 10 feet wide, the area within 100 feet of each bank is regulated as a 100-foot riverbank wetland. If the stream or river is greater than 10 feet wide, the area within 200 feet of each bank is regulated as a 200-foot riverbank wetland. A pond is an area of open standing or slow moving water present for six or more months during the year and at least one quarter of an acre in size. Ponds have a 50-foot perimeter wetland associated with their boundary. ASSF are defined as a body of flowing water as identified by a scoured channel or change in vegetative composition or density that conveys storm runoff into or out of a wetland. ASSF include drainage swales and channels that lead into, out of, pass through, or connect other freshwater wetlands or coastal wetlands, and that carry flows resulting from storm events, but may remain relatively dry at other times. ASF include, but are not limited to, floodplains, depressions or low lying areas flooded by rivers, streams, intermittent streams, or areas subject to storm flowage which collect, hold, or meter out storm and flood waters. ASSF and ASF are not assigned perimeter or riverbank wetlands.

6.7.1 Pond

The boundary of a pond is determined by the extent of water which is delineated and surveyed. Named ponds located within the Study Area are Big Round Top Pond, Little Round Top Pond, and Round Pond (refer to Figure 6-6) (RIGIS 2011). In addition, there are 24 unnamed ponds within the Study Area (RIGIS 2011).

6.7.2 Swamp

Swamps are defined as areas at least three acres in size, dominated by woody vegetation, where groundwater is at or near the surface for a significant part of the growing season. A 50-foot Perimeter Wetland is applied to both forested and shrub swamps. Shrub swamps are areas dominated by broad-leaved deciduous shrubs and often have an emergent herbaceous layer. Dominant species in shrub swamps include sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), swamp azalea (*Rhododendron viscosum*), and silky dogwood (*Cornus amomum*). Drier portions of shrub swamps are often densely overgrown with greenbrier (Smilax sp.) and blackberry (*Rubus allegheniensis*). Common species in the herbaceous layer include sensitive fern (*Onoclea sensibilis*), skunk cabbage (*Symplocarpus foetidus*) and cinnamon fern (*Osmundastrum cinnamomeum*). Shrub swamp generally occurs in areas where the wetland crosses the managed portion of the ROW.

Forested swamps mainly occur on the edges of the managed ROW where the shrub swamps are present, but where the tree cover is allowed to dominate. Vegetation in a forested swamp includes predominantly red maple (*Acer rubrum*), willow (*Salix* sp.), black gum (*Nyssa sylvatica*), alder (*Alnus* sp.), silky dogwood, sweet pepperbush, winterberry, swamp azalea, cinnamon fern, common reed (*Phragmites* sp.), and peat moss (*Sphagnum* spp.).

There are seven shrub swamps and 31 forested swamps within the Study Area (RIGIS 1993).

6.7.3 Marsh / Emergent Wetlands / Wet Meadows

Marshes are wetlands at least one acre in size where water is generally above the surface of the substrate and where the vegetation is dominated by emergent herbaceous species. Marshes are the dominant cover type in several large wetlands within the ROW. Marsh vegetation is typically dominated by broad-leaved cattail (*Typha latifolia*), tussock sedge (*Carex stricta*), and reed canary grass (*Phalaris arundinaceae*), with lesser amounts of common reed (*Phragmites australis*), sensitive fern, skunk cabbage, steeplebush (*Spiraea tomentosa*), marsh fern (*Thelypteris palustris*), and soft rush (*Juncus effusus*). There are no marshes mapped in the Study Area (RIGIS 1993).

Emergent wetlands and wet meadows within the Project ROW are characterized by cattail, bulrush (*Scirpus pungens*), woolgrass (*Scirpus cyperinus*), soft rush, sensitive fern, and reed canary grass. Within the Study Area there are 44 wetlands that are identified as emergent wetlands or wet meadows (less than one acre is size) (RIGIS 1993).

6.7.4 River / Perennial Stream

A River is typically a named body of water designated as a perennial stream by USGS (a blue line stream on a USGS topographic map). A perennial stream maintains flow year-round, and is also designated as a solid blue line on a USGS topographic map. A total of 14 perennial streams were identified on the Project ROW. The major watercourses crossed by the Project include a perennial tributary to Chockalog River, Tributary to Chockalog River, Round Top Brook, Mowry Brook, Clear River and Dry Arm Brook. In this Study Area there are 23 mapped rivers and perennial streams (USGS 2015).

6.7.5 Stream / Intermittent Stream

A stream is any flowing body of water or watercourse other than a river which flows during sufficient periods of the year to develop and maintain defined channels. Such watercourses carry groundwater discharge and/or surface water runoff. Such watercourses may not have flowing water during extended dry periods but may contain isolated pools or standing water.

Based on a desktop analysis of the ROW, there are seven mapped intermittent streams within the Study Area (USGS 2015). Smaller unnamed streams may also be encompassed within a particular wetland. A total of 28 intermittent streams were field identified on the Project ROW.

6.7.6 Shrub/ Forested Wetland

Shrub wetlands in the TNEC ROW are dominated by highbush blueberry, sweet pepperbush, arrowwood (*Viburnum dentatum*), maleberry (*Lyonia ligustrina*), meadowsweet (*Spiraea* sp.), steeplebush, and greenbrier with minor amounts of emergent plant community species such as skunk cabbage and cinnamon fern. There are 134 forested wetlands and 62 shrub wetlands (less than three acres in size) present within the Study Area (RIGIS 1993).

6.7.7 Floodplain

A floodplain is the land area adjacent to a river, stream or other body of flowing water which is, on average, likely to be covered with flood waters resulting from a 100-year frequency storm event as mapped by Federal Emergency Management Agency (FEMA) (RIGIS 2015). Floodplain areas within the Study Area include lands surrounding the Chockalog River, lands surrounding Big Round and Little Round Top Ponds and Round Top Brook, and lands surrounding the Clear River and the Dry Arm Brook. Other unnamed watercourses may also contain an estimated 100-year floodplain though they are not mapped.

6.7.8 Area Subject to Storm Flowage

ASSF are channel areas which carry storm, surface, groundwater discharge or drainage waters out of, into, and/or connect freshwater wetlands or coastal wetlands. ASSF are recognized by evidence of scouring and/or a marked change in vegetative density and/or composition. A total of 26 ASSFs were identified on the Project ROW.

6.7.9 Special Aquatic Site - Vernal Pools

A vernal pool is a type of special aquatic site that is generally defined as a contained basin that generally lacks a permanent above-ground outlet. It fills with water between late fall and spring from rising groundwater, or with the meltwater and runoff of winter and spring snow and rain (RIDEM 2016a). Many vernal pools are regulated by the RIDEM as special aquatic sites. A special aquatic site is defined in the RIDEM Freshwater Wetlands Rules and Regulations as a body of open standing water, either natural or artificial, which does not meet the definition of pond, but which is capable of supporting and providing habitat for aquatic life forms, as documented by the: 1) presence of standing water during most years, as documented on site or by aerial photographs; and 2) presence of habitat features necessary to support aquatic life forms of obligate wildlife species, or the presence of evidence of, or use by aquatic life forms of obligate wildlife species (excluding biting flies).

Most vernal pools contain water for a few months in the spring and early summer, and are dry by mid-summer. Because they lack a permanent water source and dry periodically, vernal pools lack a permanent fish population. Vernal pools provide breeding habitat for species, particularly amphibians, which depend upon pool drying and the absence of fish for breeding success and survival (obligate vernal pool species). Some wetlands and water bodies may provide breeding habitat for amphibians, but lack the specific criteria to meet the definition of a vernal pool (e.g., provide habitat to facultative vernal pool species only, or contain evidence of breeding obligate vernal pool species occurring together with fish populations); these wetlands and water bodies have been designated as "amphibian breeding habitats."

Field investigations for potential vernal pools and amphibian breeding habitats were initially performed in conjunction with the identification and evaluation of wetlands located along the TNEC ROW during the 2008 field surveys. All wetlands along the TNEC ROW with potentially suitable vernal pool/amphibian breeding habitat were again investigated during the spring of 2011 (coinciding with the amphibian breeding season) to confirm the presence/absence of such amphibian breeding activity. A total of 14 vernal pools were identified supporting obligate vernal pool species, including spotted salamanders (*Ambystoma maculatum*), wood frogs (Rana sylvatica), and fairy shrimp (*Eubranchipus* spp.) along the TNEC ROW. ESS conducted field delineations on the CREC ROW in the fall of 2014 and the spring of 2015. No vernal pools were identified during this fieldwork on the CREC ROW.

6.8 Wildlife

As previously described, the Project passes through a variety of aquatic and terrestrial habitats. The wildlife assemblages present within the Study Area vary according to habitat characteristics. An overall list of wildlife species expected to occur within the transmission line Study Area was compiled. This list encompasses the expected birds within the Study Area. It should be noted that individual species may not occur in one particular area as opposed to another, but may be found in the general area of the transmission line. A list of amphibians, reptiles, birds, and mammals expected to occur within a given habitat are provided in Table 6-6. This information is based on geographical distribution and habitat preferences as described in *New England Wildlife: Habitat, Natural History and Distribution* (DeGraaf and Yamasaki 2001).

6.8.1 Breeding Birds

An inventory of potential breeding birds in the Study Area was compiled based on a review of published data concerning breeding birds in Rhode Island and agency consultation. The *Atlas of Breeding Birds of Rhode Island* (Enser 1992) was the primary source consulted to determine which bird species are likely to breed in the Study Area. Bird species observed or expected to inhabit areas within the Study Area are listed in Table 6-6 below and potential breeding bird species (Enser 1992) have been noted within this table.

6.8.2 Fisheries

There are four Designated Trout Waters, which are waters annually stocked with trout (*Oncorhynchus* spp.) by the RIDEM, located within the Study Area: Little Round Top Pond, Big Round Top Pond, Round Top Brook and Clear River (RIDEM 2016b). In addition to trout, other common gamefish species expected to exist in the vicinity of the Project include largemouth bass (*Micropterus salmoides*), northern pike (*Esox lucius*), calico bass (*Pomoxis* sp.), and yellow perch (*Perca flavescens*). Additional fish species expected to exist in the Project vicinity include bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), white perch (*Morone americana*), chain pickerel (*Esox niger*), carp (*Cyprinus carpio*), brown bullhead (*Ameiurus nebulosus*), and a variety of minnows and other species.

TABLE 6-6 EXPECTED WILDLIFE SPECIES WITHIN THE STUDY AREA

	TERRESTRIAL HABITATS							AQUATIC HABITATS						
	SWAMP HARDWOODS	HEMLOCK	OAK/ PINE FOREST	SHRUB/ OLD FIELD	CULTIVATED FIELD	GRASS FIELD	MANAGED LAWN	SEDGE MEADOW	SHALLOW MARSH	SHRUB SWAMP	POND	STREAM	RIVER	RIPARIAN
Amphibians & Reptiles														
American Bullfrog									X	X	X	X	X	X
American Toad	X	X	X	X	X	X		X	X	X	X			X
Black Rat Snake	X		X	X		X								
Blue-spotted Salamander	X	X	X					X	X	X	X			X
Common Garter Snake	X	X	X	X		X		X	X	X	X	X		X
Common Musk Turtle				X		X		X	X	X	X	X	X	X
Common Snapping Turtle			X	X	X	X			X	X	X	X	X	X
Eastern Box Turtle	X		X	X		X		X	X	X				X
Eastern Hognose Snake	X		X	X	X	X			X					X
Eastern Milk Snake	X		X	X		X								
Eastern Smooth Green Snake	X		X	X		X		X	X	X				
Eastern Worm Snake		X	X	X	X									
Four-toed Salamander	X	X	X					X	X	X		X		
Fowler's Toad	X		X	X	X	X		X	X	X	X			X
Green Frog	X							X	X	X	X	X	X	X
Gray Treefrog	X		X					X	X	X	X			X
Marbled Salamander	X	X	X							X	X			X
Northern Black Racer	X		X	X		X			X	X				X
Northern Brown Snake	X	X	X	X	X	X		X	X	X				
Northern Dusky Salamander	X	X	X									X		X
Northern Redback Salamander	X	X	X						X					
Northern Redbelly Snake	X	X	X	X						X				
Northern Ringneck Snake	X	X	X											
Northern Spring Peeper	X	X	X					X	X	X	X			X
Northern Two-lined Salamander	X	X	X									X		X
Northern Water Snake								X	X	X	X	X	X	X
Pickerel Frog	X					X		X	X		X	X		X
Red-spotted Newt	X	X	X					X	X	X	X	X		X
Ribbon Snake	X		X					X	X	X	X	X		X

	TERRESTRIAL HABITATS							AQUATIC HABITATS						
	SWAMP HARDWOODS	HEMLOCK	OAK/ PINE FOREST	SHRUB/ OLD FIELD	CULTIVATED FIELD	GRASS FIELD	MANAGED LAWN	SEDGE MEADOW	SHALLOW MARSH	SHRUB SWAMP	POND	STREAM	RIVER	RIPARIAN
Spotted Salamander	X	X	X					X	X	X	X			X
Spotted Turtle	X	X	X	X	X	X		X	X	X	X			X
Wood Frog	X	X	X					X	X	X				X
Wood Turtle	X	X	X	X	X	X		X	X	X	X	X	X	X
Birds														
American Black Duck *	X							X	X	X	X	X	X	X
Acadian Flycatcher	X		X											X
American Crow *	X	X	X	X	X	X								
American Goldfinch *	X	X	X	X	X	X		X	X	X				X
American Kestrel	X		X	X	X	X		X	X					
American Redstart *	X	X	X											
American Robin *	X	X	X	X	X	X				X				X
American Tree Sparrow	X	X	X	X		X		X	X	X				X
American Woodcock	X		X	X	X			X		X				X
Baltimore Oriole *	X		X	X						X				X
Bank Swallow	X	X	X	X	X	X		X	X		X	X	X	
Barn Owl					X	X								
Barn Swallow *	X	X	X			X		X	X		X	X	X	X
Barred Owl *	X	X	X	X		X								
Belted Kingfisher											X	X	X	X
Black & White Warbler *	X	X	X											X
Black-billed Cuckoo *	X			X										
Black-capped Chickadee *	X	X	X	X						X				X
Black-throated Green Warbler *	X	X	X											
Blue-gray Gnatcatcher *	X		X	X						X				
Blue-headed Vireo *	X	X	X											
Blue Jay *	X	X	X	X		X								X
Blue-winged Warbler *	X		X	X		X				X				
Bobolink						X		X	X					
Broad-winged Hawk *	X	X	X			X								
Brown Creeper *	X	X	X											X
Brown Thrasher *	X		X	X										X
Brown-headed Cowbird *	X	X	X	X	X	X			X					X
Bufflehead												X	X	

	TERRESTRIAL HABITATS									AQUATIC HABITATS				
	SWAMP HARDWOODS	HEMLOCK	OAK/ PINE FOREST	SHRUB/ OLD FIELD	CULTIVATED FIELD	GRASS FIELD	MANAGED LAWN	SEDGE MEADOW	SHALLOW MARSH	SHRUB SWAMP	POND	STREAM	RIVER	RIPARIAN
Canada Goose *					X	X	X	X	X		X	X	X	X
Canada Warbler *	X	X	X							X				X
Carolina Wren	X		X	X										X
Cedar Waxwing *	X		X	X						X				X
Chestnut-sided Warbler *	X			X						X				
Chimney Swift *				X	X	X		X						
Chipping Sparrow *	X	X	X		X	X								
Common Nighthawk	X	X	X	X	X	X		X						X
Common Grackle *	X		X		X	X		X	X	X				X
Common Merganser	X	X	X								X	X	X	X
Common Redpoll *		X	X	X	X	X			X	X				
Common Yellowthroat *	X	X	X	X				X	X	X	X			X
Cooper’s Hawk	X	X	X	X		X								
Dark-eyed Junco	X	X	X			X								
Downy Woodpecker *	X	X	X	X										X
Eastern Bluebird *	X		X	X		X				X				X
Eastern Kingbird *	X		X	X				X	X	X			X	X
Eastern Meadowlark *					X	X					X			
Eastern Phoebe *	X	X	X	X		X				X				
Eastern Screech Owl	X	X	X	X		X		X	X					X
Eastern Towhee *	X		X	X										
Eastern Wood-Pewee *	X	X	X	X						X				X
European Starling *	X	X	X	X	X	X								X
Evening Grosbeak	X	X	X											X
Field Sparrow *	X		X	X	X	X								
Fish Crow									X		X	X	X	X
Fox Sparrow	X		X	X										X
Grasshopper Sparrow					X	X								
Golden-crowned Kinglet	X	X	X							X				X
Golden-winged Warbler	X		X	X										
Gray Catbird *	X		X	X		X				X				X
Great Black-backed Gull														
Great Blue Heron *	X		X					X	X	X	X	X	X	X
Great Crested Flycatcher *	X	X	X	X										
Great Horned Owl	X	X	X	X	X	X		X	X	X				X

	TERRESTRIAL HABITATS							AQUATIC HABITATS						
	SWAMP HARDWOODS	HEMLOCK	OAK/ PINE FOREST	SHRUB/ OLD FIELD	CULTIVATED FIELD	GRASS FIELD	MANAGED LAWN	SEDGE MEADOW	SHALLOW MARSH	SHRUB SWAMP	POND	STREAM	RIVER	RIPARIAN
Green Heron	X		X					X	X	X	X	X	X	X
Hairy Woodpecker *	X	X	X											X
Hermit Thrush *	X	X	X	X						X				
Herring Gull													X	
Hoary Redpoll	X	X		X	X	X			X	X				
Hooded Merganser	X	X	X								X	X	X	
Hooded Warbler	X		X	X						X				
Horned Lark					X	X								
House Wren *	X		X	X		X				X				X
House Finch *			X											
House Sparrow *					X	X								
Indigo Bunting *	X		X	X		X								X
Killdeer					X			X						X
Lapland Longspur					X	X								
Least Bittern									X					
Least Flycatcher *	X		X											X
Louisiana Waterthrush	X		X									X		X
Mallard *					X	X		X	X	X	X	X	X	X
Mourning Dove *	X	X	X	X	X	X								
Mute Swan					X	X		X	X	X	X	X	X	
Nashville Warbler	X	X	X							X				X
Northern Bobwhite			X	X	X	X								
Northern Cardinal *	X		X	X						X				X
Northern Flicker *	X	X	X	X	X	X								
Northern Goshawk	X	X	X	X		X								
Northern Mockingbird *	X		X	X						X				
Northern Rough-winged Swallow	X	X	X	X	X	X		X	X		X	X		X
Northern Saw-whet Owl	X	X	X											X
Northern Shrike	X	X	X	X		X		X	X					
Northern Waterthrush *	X	X	X							X				
Orchard Oriole	X		X											X
Ovenbird *	X	X	X											
Pine Grosbeak	X	X	X		X									
Pine Siskin	X	X	X	X		X				X				X
Pine Warbler *			X											

	TERRESTRIAL HABITATS							AQUATIC HABITATS						
	SWAMP HARDWOODS	HEMLOCK	OAK/ PINE FOREST	SHRUB/ OLD FIELD	CULTIVATED FIELD	GRASS FIELD	MANAGED LAWN	SEDGE MEADOW	SHALLOW MARSH	SHRUB SWAMP	POND	STREAM	RIVER	RIPARIAN
Prairie Warbler *			X	X										X
Purple Finch *	X	X	X	X										
Purple Martin	X	X		X	X	X		X	X		X	X	X	X
Red-bellied Woodpecker	X		X											X
Red-breasted Nuthatch			X											X
Red-eyed Vireo *	X	X	X											X
Red-shouldered Hawk *	X	X	X							X				X
Red-tailed Hawk *	X	X	X	X	X	X				X				
Rose-breasted Grosbeak *	X	X	X	X						X				X
Red-winged Blackbird *	X				X	X		X	X	X	X			X
Ring-necked Pheasant				X	X	X								
Rock Dove					X									
Rough-legged Hawk				X	X	X		X	X	X				
Ruby-crowned Kinglet		X	X											
Ruby-throated Hummingbird	X	X	X	X										
Ruffed Grouse *	X	X	X	X										
Rusty Blackbird	X													X
Savannah Sparrow					X	X		X	X					
Scarlet Tanager *	X	X	X											
Sharp-shinned Hawk	X	X	X										X	
Snow Bunting					X	X		X	X					
Solitary Sandpiper									X					
Song Sparrow *	X	X	X	X	X	X		X	X	X				X
Sora Rail								X	X	X	X			
Spotted Sandpiper						X					X	X	X	X
Swamp Sparrow	X							X	X	X	X			X
Tree Swallow *	X	X	X	X	X	X		X	X	X	X	X	X	X
Tufted Titmouse *	X		X	X						X				X
Turkey Vulture	X		X	X	X	X				X	X			
Veery *	X	X	X											
Virginia Rail									X					
Warbling Vireo *			X	X										X
Whip-poor-will *	X		X	X		X								

	TERRESTRIAL HABITATS							AQUATIC HABITATS						
	SWAMP HARDWOODS	HEMLOCK	OAK/ PINE FOREST	SHRUB/ OLD FIELD	CULTIVATED FIELD	GRASS FIELD	MANAGED LAWN	SEDGE MEADOW	SHALLOW MARSH	SHRUB SWAMP	POND	STREAM	RIVER	RIPARIAN
White-breasted Nuthatch *	X		X	X										
White-eyed Vireo	X		X	X						X				X
White-throated Sparrow *	X	X	X	X		X								
Wild Turkey	X	X	X	X	X	X								
Willow Flycatcher	X	X	X	X										
Wilson's (Common) Snipe				X				X	X	X				X
Winter Wren	X	X	X							X				X
Wood Duck *	X		X						X	X	X	X	X	X
Wood Thrush *	X	X	X											X
Worm-eating Warbler			X											
Yellow-bellied Sapsucker	X	X	X											X
Yellow-billed Cuckoo *	X		X	X						X				
Yellow-throated Vireo *	X		X											X
Yellow Warbler *	X		X	X						X				
Mammals														
Beaver	X		X						X	X	X	X	X	X
Big Brown Bat	X	X	X	X	X	X		X	X	X	X	X	X	X
Black Bear	X	X	X	X	X	X		X	X	X	X	X	X	X
Bobcat	X	X	X	X		X		X		X				
Coyote	X	X	X	X		X		X	X	X				X
Deer Mouse	X	X	X	X										
Eastern Chipmunk	X	X	X	X		X								
Eastern Cottontail	X		X	X		X		X	X	X				X
Eastern Mole	X		X	X	X	X								
Eastern Pipistrelle	X	X	X	X	X	X		X	X	X	X	X	X	X
Ermine	X	X	X	X	X	X			X	X				X
Fisher	X	X	X	X										
Gray Fox	X		X	X				X	X	X				X
Gray Squirrel	X		X											X
Hairy-tailed Mole	X	X	X	X		X								
Hoary Bat	X	X	X	X	X	X		X	X	X	X	X	X	X
House Mouse				X	X	X								
Little Brown Myotis	X	X	X	X	X	X		X	X	X	X	X	X	X

	TERRESTRIAL HABITATS										AQUATIC HABITATS			
	SWAMP HARDWOODS	HEMLOCK	OAK/ PINE FOREST	SHRUB/ OLD FIELD	CULTIVATED FIELD	GRASS FIELD	MANAGED LAWN	SEDGE MEADOW	SHALLOW MARSH	SHRUB SWAMP	POND	STREAM	RIVER	RIPARIAN
Long-tailed Weasel	X	X	X	X	X	X		X	X	X				X
Meadow Jumping Mouse	X	X	X	X		X		X	X	X				X
Meadow Vole	X	X	X	X		X		X	X	X				X
Masked Shrew	X	X	X	X		X		X	X	X				X
Mink	X	X	X					X	X	X	X	X	X	X
Muskrat								X	X	X	X	X	X	X
New England Cottontail	X		X	X		X		X	X	X				X
Northern Flying Squirrel		X	X											
Northern Myotis	X	X	X	X	X	X		X	X	X	X	X	X	X
Northern Short-tailed Shrew	X	X	X	X		X		X	X	X				X
Norway Rat				X	X	X								
Porcupine	X	X	X	X	X	X		X						
Raccoon	X	X	X	X	X	X		X	X	X				X
Red Bat	X	X	X	X	X	X		X	X	X	X	X	X	X
Southern Flying Squirrel	X		X											
Red Fox	X	X	X	X	X	X		X	X	X				X
Red Squirrel	X	X	X											
River Otter	X	X	X						X	X	X	X	X	X
Silver-haired Bat	X	X	X	X	X	X		X	X	X	X	X	X	X
Smoky Shrew	X	X	X							X				X
Snowshoe Hare	X	X	X	X					X					
Southern Bog Lemming	X		X	X		X		X	X					X
Southern Red-backed Vole	X	X	X	X	X	X								X
Star-nosed Mole	X							X	X	X	X	X	X	X
Striped Skunk	X	X	X	X	X	X		X	X	X				X
Virginia Opossum	X		X	X	X	X		X	X	X				X
Water Shrew	X	X	X					X	X	X	X	X	X	X
White-footed mouse	X	X	X	X		X		X		X				X
White-tailed Deer	X	X	X	X	X	X		X	X	X				X
Woodchuck	X	X	X	X	X	X								
Woodland Vole	X		X	X		X				X				

Legend:
X = Expected
Source: DeGraaf and Yamasaki 2001.
* = Potential Breeding Birds from *The Atlas of Breeding Birds in Rhode Island* (Enser 1992).

6.8.3 Rare and Endangered Species

Correspondence regarding federal and Rhode Island state listed species is included in Appendix B, Agency Correspondence.

6.8.3.1 Federal-listed Species: Current Correspondence for the Project Area

Current review of the United States Fish and Wildlife Service (USFWS) Endangered Species Consultation Procedure, available on the website *https://www.fws.gov/newengland/EndangeredSpec-Consultation_Project_Review.htm* indicates that one Federal-listed Species, the Northern long-eared bat (*Myotis septentrionalis*), documented in the Town of Burrillville, may occur in the Project location due to the unfragmented forested habitat. The Applicant's environmental consulting and engineering firm ESS conducted an acoustic bat survey under the Interim 4(d) Rule during late July-early August 2015 at the proposed CREC facility site as well as on the CREC ROW. ESS's report was reviewed by the USFWS and the Rhode Island Division of Fish and Wildlife (RIDFW); both agencies agreed with study results that Northern long-eared bats (NLEB) were not present in the survey area.[10, 11]

The Applicant requested input from the USFWS on any known federally rare, threatened or endangered species or their critical habitats within the Project area. In addition, the Applicant requested comments on the necessity for further consultation under Section 7 of the Endangered Species Act, including confirmation on the status of the NLEB in the Project area, and the need, if any, for supplemental field surveys along the existing TNEC ROW.[12] In response, the USFWS instructed the Applicant to fill out the online Information for Planning and Conservation (IPaC) Form (USFWS 2017) which streamlines the USFWS environmental review process.[13] The online IPaC Form was submitted and results indicated the only threatened or endangered species in the Project area was the NLEB. In addition, another online data form was submitted to obtain recommended conservation measures for the Project area. However, computer-generated results indicated there were no species in the Project area with conservation measure recommendations available online. A final form was completed, the NLEB 4(d) Rule Streamlined Consultation Form, which will be submitted to the USACE with the Section 404 wetlands application (Appendix B).

The USFWS also instructed the Applicant to contact Charles Brown (RIDFW) for guidance on whether there have been updated studies on NLEBs in Burrillville through RIDFW research. The response from RIDFW (Appendix B) indicated that while no known maternity roost trees or hibernacula have been found within the Project area, the RIDFW suggested that performing surveys in the areas designated for tree removal would be prudent, and if surveys were not to be performed, then to consider limiting tree clearing outside the maternity season (June-July).[14]

The Applicant is proposing to adhere to the time of year restrictions and avoid tree clearing during the June-July timeframe in order to avoid potential impacts to maternity roost trees. A summary description and habitat requirements for the NLEB are provided below.

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[10] von Oettingen, Susi, Email to Matt Robertson. 18 December 2015.
[11] Brown, Charles. Email to Matt Robertson. 16 March 2016.
[12] Whoriskey, Erin. Letter to Susi von Oettingen. 19 July 2016.
[13] From personal communication by S. von Oettingen, August 25, 2016.
[14] Brown, Charles. Email to Meaghan Lamothe. 31 August 2016.

A USFWS IPaC review was also completed for the recently federally-listed rusty patched bumble bee (*Bombus affinis*). Prior to the mid- to late 1990s, the rusty patched bumble bee was widely distributed across areas of 31 states/provinces including Rhode Island. Since 2000, the rusty patched bumble bee has been reported from 13 states/provinces. The rusty patched bumble bee has not been reported as being in Rhode Island since 2000, and Rhode Island is no longer considered the current range of the rusty patched bumble bee. The Final Rule on the USFWS listing does not go into effect until February 10, 2017 and another IPaC review will be run at that time to confirm these conclusions.

6.8.3.2 Federal-Listed Animal Species Description and Habitat Requirements

Northern long-eared bat: The NLEB is a medium-sized bat in the *Vespertilionidae* Family with distinguishing long ears (USFWS 2015). Their body lengths range from 3.0 to 3.7 inches with a wingspan of 9 to 10 inches. Fur color ranges from medium to dark brown on the back and tawny to pale-brown on the underside. The NLEB has both a winter and summer habitat. During winter, these bats hibernate in caves and mines, known as hibernacula. These habitats have high humidity, constant temperatures, and no air currents. During the summer, NLEBs prefer forests where the bats roost in colonies or singly in cavities of both live and dead trees, as well as underneath tree bark. Females give birth to a single pup each season with the estimated maximum lifespan of the NLEB being up to 18.5 years. NLEBs feed at dusk and eat a variety of insects such as flies, leafhoppers, caddisflies, beetles, and moths. The greatest threat to the NLEB is white-nose syndrome, which is spreading from the Northeast to the Midwest and Southeast United States (USFWS 2015). The NLEB is federally listed as a threatened species under the Endangered Species Act.

6.8.3.3 State-listed Species: Current Correspondence for the Project Area

An inquiry email was sent to the Rhode Island Natural History Survey (RINHS) asking which member of the four-member consortium managing the natural heritage and natural communities data in Rhode Island should be contacted to review the Project area for the presence of rare species.[15] The RINHS instructed the Applicant to compare online natural heritage data available from the RIGIS website (RIGIS 2016) with the Project footprint (refer to Appendix B).[16] Dr. David Gregg, RINHS Executive Director, further advised the Applicant to contact the RIDEM Division of Planning and Development Office for additional information on the listed species if natural heritage data crossed the Project.

Because of the overlap between natural heritage data and the Project area, the Applicant contacted the RIDEM to determine the presence of any known state-listed species.[17] According to the RIGIS natural heritage database, the following species occur within the Project ROW: rock harlequin or pale corydalis (*Capnoides sempervirens = Corydalis sempervirens*), dewdrop (*Rubus dalibarda = Dalibarda repens*), Northern beech fern (*Phegopteris connectilis*), and hobblebush (*Viburnum lantanoides*). A single specimen of American yew (*Taxus canadensis*) is located on the edge of the Project area outside of the TNEC ROW.

Summary descriptions and habitat requirements for each of the rare plant species mapped in the vicinity of the Project are provided below.

[15] Lamothe, Meaghan. Email to David Gregg. 08 June 2016.
[16] Gregg, David. Email to Meaghan Lamothe. 08 June 2016.
[17] Whoriskey, Erin. Email to Paul Jordan. 19 July 2016.

6.8.3.4 State-Listed Plant Species Descriptions and Habitat Requirements

Rock Harlequin or Pale Corydalis: Rock harlequin is an annual or biennial wildflower in the Poppy Family (*Papaveraceae*) that grows in dry woods or rocky places. Blooming time for rock harlequin is spring to fall and its flowers are in short racemes. The flowers are rose to pink-purple in color with a yellow tip. The leaves of this species are alternate and finely divided. This species grows erect, usually branched and to approximately 6 to 24 inches high. Rock harlequin is a state-listed Species of Concern.

Dewdrop: Dewdrop is a perennial wildflower in the Rose Family (*Rosaceae*) that grows in rich, wet, woods. This species blooms in the summer with white, erect five-petaled flowers that are barely taller than the leaves. The dewdrop has heart-shaped, dark green basal leaves. Dewdrop is State Endangered.

Northern Beech Fern: Northern or long beech fern is a perennial species in the Marsh Fern Family (*Thelypteridaceae*). This fern grows in rich, moist woodlands. The fronds of the long beech fern are 6 to 10 inches long and are shaped like arrowheads with the lowest pair of leaflets pointing downward at a diagonal. A distinguishing characteristic of the Northern beech fern are the wings on the rachis that connects all but the two lowest pinnae on the frond. The upper pinnae become more fused, creating a long-tapering front tip. Northern beech fern is a State Threatened species.

Hobblebush: Hobblebush, also called moosewood or witch-hobble, is a perennial shrub in the Moschatel Family (*Adoxaceae*) with pendulous branches that take root when they touch the ground. Hobblebush can grow 6 to 12 feet high. This plant grows in moist acidic woods, stream banks, and swamps. The shrub flowers in May-June with large clusters of white to pink flowers. The leaves are cardioid or heart-shaped, and serrate. The bark is gray-brown and warty and the fruit is a drupe which is red, turning to black when ripened. Hobblebush is a State-listed Species of Concern in Rhode Island.

American Yew: The American yew is a low, straggling evergreen shrub or ground cover in the Yew Family (*Taxaceae*). This shrub grows to three to six feet tall with a spreading appearance. The flat, narrow needles are dark green above and pale green below. The fruits of the American yew are bright red and berry-like. American yew is a state-listed Species of Concern.

6.8.3.5 State-listed Species: Current Studies for the Project Area

Biological surveys had previously been completed for state-listed species for the IRP in 2011. Populations of pale corydalis were found and documented on the TNEC ROW.

Biological surveys were completed for the identified state-listed plant species to document their presence and extent on the Project ROW. Surveys were conducted by POWER, on behalf of the Applicant, in August of 2016. Field surveys of state-listed plant species (hobblebush, Northern beech fern, dewdrop, and additional populations of pale corydalis) were performed during the 2016 field season. Populations of hobblebush, and Northern beech fern, were identified on the TNEC ROW. The surveys were conducted within both Eastern hemlock open and closed canopy forests in both wetlands and uplands, as well as in open upland grassy meadows and shrub-dominated habitats on the TNEC ROW.

The Applicant will coordinate with the RIDEM and RINHS to report the findings of the biological surveys and to determine appropriate avoidance/protection measures that should be implemented during construction. Due to the sensitivity of locational information on rare species, information regarding the exact locations of hobblebush and Northern beech fern obtained from the 2016 surveys is not released in this document. Results of the 2016 rare species surveys will be provided to the RIDEM with the freshwater wetlands application.

6.9 Air Quality

The National Ambient Air Quality Standards (NAAQS) have been established by the USEPA for the criteria pollutants for the protection of public health and welfare. The criteria pollutants are nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). The NAAQS consist of primary and secondary standards. The primary standards are intended to protect human health, including the most sensitive of the population, with a margin of safety. The secondary standards are intended to protect the public welfare from known or anticipated adverse effects associated with the presence of air pollutants, such as damage to property, soils, or vegetation.

Areas that have demonstrated compliance with a NAAQS via collected ambient air monitoring data are designated as being in attainment with the NAAQS, or unclassifiable if insufficient data has been collected for an attainment designation by the USEPA. Areas for which the collected ambient air monitoring data shows an exceedance of a NAAQS are designated as nonattainment, and must implement emission reduction measures in a State Implementation Plan to achieve compliance.

RIDEM has adopted the NAAQS and has established Acceptable Ambient Levels for various air toxic compounds. The State of Rhode Island is currently designated as being in moderate nonattainment with the 1997 8-hour ozone NAAQS. Rhode Island is also included in the Ozone Transport Region. RIDEM has submitted a State Implementation Plan and revisions to address attainment of the NAAQS including the interstate transport of pollutants. Rhode Island is designated as attainment/unclassifiable for the remaining criteria pollutants.

7.0 DESCRIPTION OF AFFECTED SOCIAL ENVIRONMENT

Per EFSB Rules, this section provides a detailed description of all environmental characteristics of the proposed site including the physical and social environment on and off site.

7.1 Population Trends

The population of Burrillville (the Project Town) is shown in Table 7-1.

TABLE 7-1 BURRILLVILLE POPULATION TRENDS, 1990-2000, 2000-2010

AREA	1990	2000	2010	CHANGE			
				1990-2000		2000-2010	
				ABSOLUTE	PERCENT	ABSOLUTE	PERCENT
Burrillville	16,230	15,796	15,955	(434)	(2.7%)	159	1.0%
State of Rhode Island	1,003,464	1,048,319	1,052,567	44,855	4.5%	4,248	0.4%
Percent of State	1.6%	1.5%	1.5%				

Source: United States Bureau of the Census 1990, 2000, 2010.
Notes: * ( ) Negative

According to the Rhode Island Statewide Planning projections, the population of Burrillville will decrease slightly between 2010 and 2040; while the overall population in the state of Rhode Island will increase slightly between 2010 and 2040 (refer to Table 7-2).

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TABLE 7-2 PROJECT TOWN POPULATION PROJECTIONS, 2010-2040

AREA	2010	2015	2020	2025	2030	2035	2040	CHANGE IN POPULATION			
								2010-2025		2025-2040	
								ABSOLUTE	PERCENT	ABSOLUTE	PERCENT
Burrillville	15,955	15,757	15,713	15,813	15,860	15,818	15,675	(-142)	(0.1)%	(-138)	(0.1)%
State of Rhode Island	1,052,567	1,046,327	1,049,177	1,061,796	1,070,677	1,073,799	1,070,104	9,229	0.1%	7,308	0.1%
Percent of State Population	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%				

Source: Rhode Island Statewide Planning Program 2013.
Notes:
[1] Population projections based on the Rhode Island Statewide Planning.
( ) Negative

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7.2 Employment Overview and Labor Force

According to the Rhode Island Commerce Corporation, Rhode Island's economy centers on a number of large and growing industry sectors including health care, financial services, marine products, defense and manufacturing. Located in the midst of the Northeast "knowledge corridor," Rhode Island is also a center of higher education, with such institutions as Brown University, the University of Rhode Island, Providence College, Rhode Island College, Roger Williams University, Johnson & Wales University, and Bryant University. In addition, the U.S. Navy has long had a significant presence in the Newport area, home to the Naval Undersea Warfare Center and the U.S. Naval War College. Rhode Island's well-developed tourism industry and its range of scenic and cultural attractions draw visitors from all over the world. Labor force and employment estimates are presented in Table 7-3.

TABLE 7-3 LABOR FORCE AND EMPLOYMENT ESTIMATES, 2013 - 2016

	BURRILLVILLE	STATE OF RHODE ISLAND
2016		
Labor Force	8,877	551,967
Employment	8,394	520,881
Unemployment	482	31,086
Unemployment rate	5.4%	5.6%
2015		
Labor Force	8,923	554,558
Employment	8,389	521,434
Unemployment	534	33,124
Unemployment rate	6.0%	6.0%
2014		
Labor Force	8,952	555,955
Employment	8,383	513,217
Unemployment	569	42,738
Unemployment rate	6.4%	7.7%
2013		
Labor Force	8,926	557,256
Employment	8,105	505,686
Unemployment	821	51,570
Unemployment rate	9.2%	9.3%

Source: Rhode Island Department of Labor and Training 2016.
Notes: Estimation of monthly labor force and employment estimates. 2016 is estimated from the months of January – July.

Rhode Island's workforce is known for its high productivity and diverse set of skills. The state's long tradition in metal, electronics, plastic and other manufacturing is complemented by an expanding workforce in financial and business services, life sciences and information technology.

7.3 Land Use

This section describes existing and projected future land use within the Study Area. The scope of this discussion will address those features which might be affected by the Project. As depicted in Figure 6-5, the dominant land uses within the Study Area include forest, residential, recreation and agriculture. Most residential development in the Study Area is low-density, and northern Rhode Island remains mostly rural.

Starting from the CREC, the CREC ROW heads northwest through forest to join the TNEC ROW between Buck Hill Road and Staghead Drive. From the TNEC ROW to the Sherman Road Switching Station, the TNEC ROW heads east-north-east through forests, low-density residential areas and agricultural areas of Burrillville.

The existing TNEC ROW has been used for transmission purposes since the 1960s. It contains two existing 345 kV overhead transmission lines and is crossed by two natural gas pipelines and a fiber optic line. The two existing overhead transmission lines are:

> 347 Line: This 345 kV transmission line occupies the TNEC ROW from the junction of the CREC ROW to the Sherman Road Switching Station. Portions of the 347 Line will be reconfigured as part of this Project.
>
> 341 Line: This 345 kV transmission line occupies the TNEC ROW from the junction of the CREC ROW to the Sherman Road Switching Station. Portions of the 341 Line will be reconfigured as part of this Project.

There is an AGT pipeline crossing planned between Structures 3052-004 and 3052-005 on the CREC ROW, where two pipelines are sited within a 75-foot-wide easement. A 24-inch pipeline, which was commissioned in 1952, is located on the north side of the easement. A 30-inch pipeline, commissioned in 1956, occupies the south side of the easement.

A fiber optic line owned by AT&T crosses on the Project ROW immediately west of Sherman Farm Road (Route 98) in Burrillville.

7.3.1 Residential

Low- or medium-density residential land comprises approximately six percent of the land use within the Study Area. These residential areas are clustered along the roadways that cross through the Study Area, predominantly around residential streets surrounding Round Pond, along Buck Hill Road, East Wallum Lake Road, Hill Road, Stone Barn Road, Collins Taft Road and Sherman Farm Road.

7.3.2 Agricultural

Approximately two percent of the land use within the Study Area is considered agricultural land (pasture, crop land or idle agricultural land uses). The Project ROW crosses several properties in active agricultural use such as crop lands and pastures.

7.3.3 Business

Business land use (commercial/ industrial or mixed commercial/ industrial) comprises approximately one percent of the Study Area. This land use type is associated with the Ocean State Power Plant located along Sherman Farm Road.

7.3.4 Institutions

There are no institutions within the Study Area.

7.3.5 Open Space and Recreation

Several areas of open space, including recreational areas, are present within the Study Area (see Figure 7-1), as listed below.

7.3.5.1 Local and Non-Government Organization Conservation Lands

The ROW passes through the following local and non-governmental conservation lands:

Wallum Lake Rod and Gun Club: The Wallum Lake Rod and Gun Club is located off Brook Street in the town of Burrillville. The property contains indoor and outdoor facilities including: archery, skeet, trap, rifle and pistol ranges, an indoor pistol range, banquet hall and an outdoor pavilion. The Wallum Lake Rod and Gun Club has prepared a Conservation Management Plan for their property that they implement with participation from the NRCS.

Crestwood Development: This property is open space associated with a residential area located near Town Farm Road in Burrillville.

Within the 5,000-foot-wide Study Area but not crossed by the ROW, additional local and non-governmental organization conservation lands include:

Buck Hill Association: This 3.8-acre property is associated with the Buck Hill Association/ Round Pond/ Staghead Drive and is privately-owned.

Clear River Parcel: This approximately 20-acre property was conveyed by TNEC to the Burrillville Land Trust as part of the mitigation for the IRP.

7.3.5.2 Government Conservation Lands

The ROW crosses the following federal and state conservation lands:

Blackstone River Valley National Heritage Corridor: The Blackstone River Valley National Heritage Corridor is a National Heritage Corridor dedicated to the history of the early American Industrial Revolution, including mill towns stretching across 24 cities and towns (400,000 acres in total) along the river's course in Worcester County, Massachusetts and Providence County, Rhode Island. The town of Burrillville is included in this National Corridor. The National Corridor was designated by an Act of Congress on November 10, 1986 to preserve and interpret for present and future generations the unique and significant value of the Blackstone Valley.

Blackstone Valley National Historic Park: The Blackstone Valley National Historic Park is within the National Heritage Corridor. The final boundaries of the park have not been established, but are likely to include several historic districts and landmarks within the Corridor as well as the Blackstone River and its tributaries (Clear River is a tributary of the Blackstone River).

Round Top Fishing Area and Wildlife Management Area: The Round Top Fishing Area and Wildlife Management Area is managed by RIDEM and consists of the land surrounding Big

Round Top Pond and Little Round Top Pond. This property provides hunting, fishing and boating access to the public.

Within the Study Area but not crossed by the ROW, the Rhode Island state conservation lands are:

Buck Hill Management Area: This 2,049-acre management area is comprised of mostly forestland, wetlands and agricultural lands protecting an approximately 31-acre wildlife marsh. The property provides open space, hunting, bird watching, wildlife viewing and hiking to the public.

George Washington Management Area: This 3,489-acre management area on the shores of the Bowdish Reservoir provides hiking, camping, picnicking, fishing, bird watching, and swimming to the public. The management area is comprised mostly of forestland and wetlands.

Other areas of open space in the Study Area include lands associated with farmlands, wetlands, streams, and rivers, and the Pascoag Fire District.

7.3.6 Future Land Use

In order to assess future land use, an analysis of current zoning was undertaken. Typically, towns and cities manage future growth through zoning regulations, which provide a degree of control over development within the community. The majority of the Study Area is zoned agricultural or residential. Specifically, the route crosses medium to low density rural residential land (land zoned as F-5). There are areas of agricultural and open pasture land throughout the Study Area (Figure 7-1).

Currently, forested land that is residentially zoned within the Study Area in Burrillville can be used for future residential development in accordance with the town zoning ordinances. The town ordinances include restrictions and/or prohibitions on development within zoned conservation areas.

The Town of Burrillville Comprehensive Plan (December 14, 2011) notes that utilities should make every effort to minimize adverse impacts of power transmission facilities to the environment as well as allow for a minimum vegetated buffer between transmission facilities and adjacent properties with special concern given to high energy electromagnetic fields. The Project involves replacement and/or expansion of electric transmission facilities on the existing TNEC ROW. The CREC ROW is currently zoned as F5- Farming/ Residential where power generation is a permitted use with a Special Use Permit.

7.4 Visual Resources

The visual quality of a landscape is defined by the perceived value of its existing pattern of landform (topography), vegetation, land use, and water features.

The Project ROW extends approximately 6.8 miles in the Town of Burrillville, Rhode Island. The study area for the visual assessment was defined as the area within a one mile radius of the centerline of the ROW, consistent with established visual assessment methodology. The topography in the study area varies from level plains to gently rolling terrain with elevations ranging from 357 to 776 feet above mean sea level. Land use is a mix of undeveloped forestland (the predominating land cover type), occasional agricultural fields, and rural residential areas. A relatively small area of industrial development exists in association with the electric and gas transmission lines within the visual study area.

Forest vegetation is primarily an oak-hickory community, intermixed with beech-maple-red oak forest and white pine/oak forest. Mature forest vegetation typically occurs in large blocks that provide a sense of enclosure and screening along roadways and around residential areas. There are several lakes, ponds, rivers, and small streams within the visual study area, including Round Pond, Wakefield Pond, Wilson Reservoir, Chockalog River, and Clear River which are typically obscured from direct view by surrounding forest vegetation.

There is one nationally significant resource area – the Blackstone River Valley National Heritage Corridor – within the visual study area. The visual study area also includes 77 resources/sites that could be considered visually sensitive from a statewide, regional, or local perspective. Resources of statewide significance include historic structures listed in the State/National Register of Historic Places, state forest land, state wildlife management areas, state-designated scenic areas and state bike routes and trails. Regionally and locally significant resources include local parks and recreational facilities (trails, bike paths, golf courses and water resources), designated open space (e.g., conservation lands), cemeteries, and areas of intensive land use (e.g., villages and major transportation corridors). Specific visually sensitive resources of these types that occur within the visual study area are described the Visual Impact Assessment Report included as Appendix C.

7.5 Noise

Environmental sound levels are quantified using a variety of parameters and metrics. This section introduces general concepts and terminology related to acoustics and environmental noise.

Sound energy is physically characterized by amplitude and frequency. Sound amplitude is measured in decibels (dB) as the logarithmic ratio of a sound pressure to a reference sound pressure which corresponds to the typical threshold of human hearing. Generally, the average listener considers a 1.0 dB change in a constant broadband noise “imperceptible” and a 3.0 dB change “just barely perceptible”. Similarly, a 5.0 dB change is generally considered “clearly noticeable” and a 10 dB change is generally considered a doubling (or halving) of the apparent loudness. Frequency is measured in hertz (Hz), which is the number of cycles per second. The typical human ear can hear frequencies ranging from approximately 20 Hz to 20,000 Hz. Typically the human ear is most sensitive to sounds in the middle frequencies (1,000 Hz to 8,000 Hz) and is less sensitive to sounds in the low and high frequencies. As such, the A-weighted scale was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighted scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies. Any sound level to which the A-weighted scale has been applied is expressed in A-weighted decibels, dBA. For reference, the A-weighted sound pressure levels associated with some common noise sources are shown in Table 7-4.

TABLE 7-4 TYPICAL SOUND PRESSURE LEVELS ASSOCIATED WITH COMMON NOISE SOURCES

SOUND PRESSURE LEVEL (dBA)	SUBJECTIVE EVALUATION	ENVIRONMENT	
		OUTDOOR	INDOOR
140	Deafening	Jet aircraft takeoff at 75 feet	
130	Threshold of pain	Jet aircraft takeoff at 300 feet	
120	Threshold of feeling	Elevated train	Rock band concert
110	Extremely loud	Jet flyover at 1,000 feet	Inside propeller plane
100	Very loud	Motorcycle at 25 feet, auto horn at 10 feet, crowd noise at football game	
90	Very loud	Propeller plane flyover at 1,000 feet, noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately loud	Diesel truck (40 mph) at 50 feet	Inside auto at high speed, garbage disposal, dishwasher
70	Loud	B-757 cabin during flight	Close conversation, vacuum cleaner, electric typewriter
60	Moderate	Air-conditioner condenser at 15 feet, near highway traffic	General office
50	Quiet		Private office
40	Quiet	Farm field with light breeze, birdcalls, soft stereo music in residence	Bedroom, average residence (without television and stereo)
30	Very quiet	Quiet residential neighborhood	
20	Very quiet	Rustling leaves	Quiet theater, whisper
10	Just audible		Human breathing
0	Threshold of hearing		

Source: Adapted from Architectural Acoustics, M. David Egan 1988 and Architectural Graphic Standards, Ramsey and Sleeper 1994, as referenced in the Environmental Noise Assessment prepared for the Southern Rhode Island Transmission Project by Black & Veatch Corporation.

For the most part, the Study Area is characterized by rural and suburban environments, with some commercial land uses. Ambient sound levels are influenced by diverse factors such as vehicular traffic, commercial and industrial activities, and outdoor activities typical of both rural and developed environments. Noise receptors include residences, schools, daycare facilities and designated recreational areas.

7.6 Cultural and Historic Resources

7.6.1 Desktop Review

Gray & Pape reviewed the site files of the RIHPHC, which include reports and site forms from previous archaeological projects in the area of Burrillville, as well as the site files of the Massachusetts Historical Commission for the neighboring towns of Douglas and Uxbridge. The review included examination of mapping of all recorded Native American and historic period archaeological sites, and mapping of all recorded Native American burial locations within an approximately one-mile radius of the proposed project. Gray & Pape reviewed State and National Registers of Historic Places; conducted a literature survey of archaeological studies, historic sources, maps and photographs from the nineteenth and twentieth centuries; studied geological and USDA soil maps; reviewed nineteenth through twenty-first century topographic maps; reviewed existing conditions and proposed layout plans provided by ESS; and reviewed LiDAR data covering the proposed Project area.

7.6.2 Archaeological Resources

Three previously-recorded archaeological sites were identified within or immediately adjacent to, the TNEC ROW (see Table 7-5). The Mallard site, RI-1661, lies between Structures 108 and 107 on the 341 Line, and was identified during a reconnaissance survey in 1987 (King et al. 1987). Site RI-1660, the Humming Bird site, lies just to the southeast of RI-1661, along the southern edge of the corridor, between proposed Structures 23 and 24 on the 3052 Line. Both sites consist of primarily quartz waste flakes from the Native American production of stone tools, although the Mallard site also contains a Small Stemmed projectile point, a hunting tool that dates usually between 4,500-3,000 years ago. The third site in the ROW is the Sherman/Arnold Barn site, RI-1684, which consists of a large three-sided stone foundation with an open side facing Collins Taft Road. The structure is a bank barn, built into the side of the slope downwards towards the road, measuring approximately 20 by 36 feet, with a back wall height of 7.5 feet. A number of nearby houses are indicated on historic maps of the nineteenth century, with which the barn remains may be associated. Public Archaeology Laboratory (PAL) tested the site in 2012 (Leveillee et al. 2012), and recommended avoidance of impacts to the site.

TABLE 7-5 ARCHAEOLOGICAL SITES IDENTIFIED WITHIN THE TNEC ROW

SITE NO.	SITE NAME	SITE DATA	SITE DATES	REFERENCES
RI-1660	Hummingbird	8 pcs quartz	Unknown	King et al. 1987[1]
RI-1661	Mallard	Quartz Small Stemmed point, quartzite biface, quartzite flake, 13 quartz debitage	4500-3000 BP	King et al. 1987[1]
RI-1684	Sherman/Arnold Barn	Bank barn foundation	Nineteenth century	Leveillee and Lance 2008[2]
None	Possible outbuilding	Square depression	Unknown historic	Leveillee et al. 2012[3]
None	Structure 80 Findspot	Quartz flakes on ground surface and in one test pit	Unknown pre-Contact	Leveillee et al. 2012
None	Buffam/Esten/ Sherman Cellar Hole	Cellar hole, well, artifacts	Nineteenth century	Leveillee et al. 2012
None	Structure 88 Findspot	5 quartz flakes	Unknown pre-Contact	Leveillee et al. 2012
None	Quarried granite slabs	3 quarried slabs	Unknown historic	Leveillee et al. 2012
None	Structure 92 site	8 quartzite flakes and stemmed point	Late Archaic?	Leveillee et al. 2012
None	Gaswell/Phillips Foundation	Stone lined cellar hole	Nineteenth century	Leveillee et al. 2012

SITE NO.	SITE NAME	SITE DATA	SITE DATES	REFERENCES
None	Schoolhouse Well	Stone lined square well, possibly associated with Burrillville School #8 or nearby house	Nineteenth century	Leveillee et al. 2012
None	Structure 108 Findspot	Two quartzite flakes	Unknown pre-Contact	Leveillee et al. 2012

In addition to the three recorded archaeological sites within the TNEC ROW, another nine locations were identified during previous surveys within or adjacent to the TNEC ROW, that despite including features and/or artifacts, were not recorded as archaeological sites (Table 7-6). These include four Native American sites and five historic period sites. Five of these nine sites lie along the south edge of the TNEC ROW, in proximity to the proposed 3052 Line.

Another 12 recorded sites lie within approximately one mile of the TNEC ROW, in Burrillville, Uxbridge, and Douglas, but are not close enough to the proposed 3052 Line to be of direct concern.

During the previous archaeological survey for the 341 Line (Leveillee et al. 2012), consultation in the field was conducted with Native American tribal representatives, in order to collect data on areas of interest or concern within the TNEC ROW. Areas of concern included places and landscape features that tribal representatives requested not be impacted by construction and that should be preserved in place. Areas of concern that lie near or along the proposed 3052 Line were identified in nine locations.

A large number of stone walls also cross the TNEC ROW between Sherman Road and the 3052 Line divergence. It is advised that TNEC follow Best Practices recommendations in avoiding impacts to stone walls as much as is practical. If impacts to stone walls are anticipated, existing conditions of stone walls will be documented.

Areas within the proposed CREC ROW were tested by Gray & Pape for archaeological resources in 2015, following investigation of an earlier alignment. The previous alignment included a nineteenth to early twentieth century cabin site (RI HPHC 2758). The CREC alignment was subsequently shifted 1) to avoid the resource and 2) comply with transmission line engineering standards. No archaeological sites were identified along the revised/ proposed CREC ROW alignment. However, at that time, specific structure locations and the proposed route of the CREC ROW access road had not yet been fully designed. It is possible that unidentified archaeological sites may exist within the untested portions of the CREC ROW. Such sites (if they exist) will be identified by additional testing at impact areas along the proposed ROW. Additional cultural resource surveys along the CREC and TNEC ROWs will be completed by Gray & Pape.

The Applicant reached out to the Blackstone Valley Heritage Corridor, Inc. as part of its consultation process.

7.6.3 Summary of Previous Studies Conducted in the Project Area

PAL had also conducted Phase I(a/b) reconnaissance and Phase I(c) archaeological testing in 2009 as part of the Interstate Reliability Project, which was constructed in the same existing TNEC ROW. The Phase I (a/b) reconnaissance archaeological survey included archival research and a project site walkover to assess the potential for pre-contact, contact, and post-contact period cultural resources to be present within the existing ROWs. As a result of the reconnaissance, the ROWs were stratified into zones of high, moderate, and low archaeological sensitivity, relative to the probability that potentially significant cultural resources could be expected to be located within those zones. Zones of high and moderate archaeological sensitivity were identified in sections of the ROWs that have not been substantially disturbed and are situated in attractive environmental settings (elevated terrain, well-drained soils, within 500 meters of a source of water) and/or are within or proximate to identified cultural resources. Poorly drained areas (wetlands) and sections of the existing ROWs substantially disturbed due to land use activities such as sand and gravel mining were identified as zones of low sensitivity. The Phase I(c) archaeological survey consisted of testing the areas of high and moderate sensitivity.

As a permitted undertaking under USACE review, the cultural resource surveys also included consultation with the Narragansett Indian Tribal Historic Preservation Office and the Wampanoag Tribe of Gay Head Historic Preservation Office. PAL was accompanied during field work by these Native American representatives who identified landscape features and locations as “Areas of Interest” or “Areas of Concern.”

PAL completed an identification survey of the IRP ROWs in November 2009. The Phase I(c) survey of the 341 Line ROW resulted in the identification or verification of 17 newly identified and previously recorded archaeological sites and historic features. Of these, six were pre-contact archaeological sites and find spots, 11 consisted of post-contact sites and/or structural features. The 341 Line ROW survey also resulted in the identification of 21 features or groupings of features designated Native American areas of concern and/or interest, and 41 stone walls.

Following the identification surveys of the 341 Line ROWs in November 2009, PAL conducted archaeological site evaluations (Phase II) in May and June 2010. Archaeological site evaluations were conducted on six archaeological sites that were considered potentially significant. PAL also conducted an identification survey consisting of a Phase I(a/b) reconnaissance and a Phase I(c) archaeological testing at the Sherman Road Switching Station in March and April of 2012.

7.7 Transportation

The Study Area is served by a limited network of state and local roads and highways. The major north/south routes in the area include Route 102 and Route 100.

In addition to multiple local roadway crossings, the Project ROW crosses the following state highways: Route 98 (Sherman Farm Road); Route 96 (Round Top Road); and Route 100 (Wallum Lake Road). Construction access to the Project ROW may be from any of the local or state roadways described above. Access permits for use of state highways will be obtained from the RIDOT or the Town of Burrillville, if required, prior to construction.

7.8 Electric and Magnetic Fields

EMF is a term used to describe electric and magnetic fields that are created by the voltage (electric field) and the current (magnetic field) on electric conductors. TNEC, like all North American electric utilities, supplies electricity at 60 Hz. Therefore, the electric utility system and the equipment and conductors connected to it, produce 60-Hz (power-frequency) EMF. These fields can be either measured using instruments or calculated using an electromagnetic model.

Power-frequency EMFs are present wherever electricity is used. This includes utility transmission lines, distribution lines, and substations. It also includes electrical wiring in homes, offices, and schools. Appliances and machinery that use electricity will also generate electric and magnetic fields.

Electric fields exist whenever voltages are present on transmission conductors, and are not dependent on the magnitude of current flow. The magnitude of the electric field is primarily a function of the configuration and operating voltage of the line and decreases with the distance from the source. The electric field may be shielded (i.e., the strength may be reduced) by any conducting surface, such as trees, fences, walls, buildings, and most types of structures. The strength of an electric field is measured in volts per meter (V/m) or kilovolts per meter (kV/m), where 1 kV = 1,000 V.

Magnetic fields are present whenever current flows in a conductor, and are not dependent on the voltage present on the conductor. The magnetic field strength is a function of both the current flow on the conductor and the configuration of the transmission line. The strength of magnetic fields also decreases with distance from the source. Since the flow of electricity or load on a transmission line varies with time of day based on the need for electric power in the region, the magnetic field associated with electric transmission lines also varies throughout the day and with seasonal changes in electric demand. Unlike electric fields, however, most common materials have little shielding effect on magnetic fields.

Magnetic fields are measured in units called Gauss. For the low levels normally encountered during daily activities, the field strength is expressed in a much smaller unit, the milliGauss (mG), which is one thousandth of a Gauss. Table 7-6 lists common household devices and typical magnetic field levels measured at the distances indicated from the source.

TABLE 7-6 COMMON SOURCES OF MAGNETIC FIELDS

SOURCES*	DISTANCE FROM SOURCE	
	6 INCHES (mG)	24 INCHES (mG)
Microwave Ovens	100-300	1-30
Dishwashers	10-100	2-7
Refrigerators	Ambient - 40	Ambient – 10
Fluorescent Lights	20-100	Ambient – 8
Copy Machines	4-200	1-13
Drills	100-200	3-6
Power Saws	50-1,000	1-40

Note: * Different makes and models of appliances, tools, or fixtures will produce different levels of magnetic fields. These are generally-accepted ranges.
Source: Public Service Commission of Wisconsin 2013.

Table 7-7 is provided to illustrate guidelines suggested by various national and international health organizations for exposure to both electric and magnetic fields. The EMF guidelines identified in Table 7-7 were developed by the identified organizations to be protective against adverse health effects from EMF. They should not be viewed as representing EMF levels that have been proven as safe versus levels that are un-safe; the values shown are simply guidelines based on current knowledge.

TABLE 7-7 60-Hz EMF GUIDELINES ESTABLISHED BY HEALTH AND SAFETY ORGANIZATIONS

ORGANIZATION	MAGNETIC FIELD	ELECTRIC FIELD
American Conference of Governmental and Industrial Hygienists (ACGIH) (occupational)	10,000 mG[a] 1,000 mG[b]	25 kV/m[a] 1 kV/m[b]
International Commission on Non-Ionizing Radiation Protection (ICNIRP) (general public, continuous exposure)	2,000 mG	4.2 kV/m
Non-Ionizing Radiation Committee of the American Industrial Hygiene Assoc. endorsed (in 2003) ICNIRP's occupational EMF levels for workers	4,170 mG	8.3 kV/m
International Committee on Electromagnetic Safety	9,040 mG	5.0 kV/m
U.K., National Radiological Protection Board [now Health Protection Agency]	2,000 mG	4.2 kV/m
Australian Radiation Protection and Nuclear Safety Agency, Draft Standard, Dec. 2006[c]	3,000 mG	4.2 kV/m

Notes:
[a] ACGIH guidelines for the general worker.
[b] ACGIH guideline for workers with cardiac pacemakers.
[c] http://www.arpansa.gov.au/pubs/comment/dr_elfstd.pdf; and http://www.arpansa.gov.au/News/events/elf.cfm

Exponent modeled the edge of ROW levels of electric and magnetic fields under existing and proposed conditions for the three segments of the ROW. The results are presented in Section 8.16.

8.0 IMPACT ANALYSIS

This chapter presents an analysis of the potential impacts of the Project on the existing natural and social environments within the Study Area. As with any construction project, potential adverse impacts can be associated with the construction, operation or maintenance of an electric transmission line. These impacts have been minimized by the careful location of structures, facilities, and access roads, and by the adoption of numerous mitigation practices.

Potential impacts to the natural and social environments associated with the Project can be categorized based on construction-related (temporary) impacts and siting and operational-related (permanent) impacts. Examples of potential temporary construction-related impacts include traffic impacts, temporary use of areas to stage construction equipment and supplies, and short-term construction noise associated with the operation of heavy equipment. Examples of permanent impacts include fill, new structures, vegetation removal, on-going vegetation management, and facility maintenance.

The Project will be constructed in a manner that minimizes the potential for adverse environmental impacts. A monitoring program will be conducted by the Applicant to verify that the Project is constructed in compliance with all relevant licenses and permits and all applicable federal, state and local laws and regulations. Design and construction mitigation measures will be implemented so that construction-related environmental impacts are minimized.

8.1 Geology

The Project will have negligible impact on the bedrock and surficial geologic resources of the Project ROW. The Project ROW consists of ablation till with pockets of lodgment till and organic deposits associated with wetland areas. Glacial outwash deposits make up the majority of the soils in the vicinity of the watercourses and open water bodies along the Project ROW. Organic deposits and sections of urban land are scattered throughout the Project ROW.

The development of the Project will have negligible impact on topography and geology. Soil resources may be affected by the creation or expansion of access roads and construction work pads along the Project ROW, as well as by the earth-disturbing activities required to install the transmission line structures. Impacts on soil resources will be short-term, lasting only for the duration of the construction period, until re-vegetation or other forms of site stabilization are achieved.

In general, the construction of the Project will result in minor changes in topography, localized at structure locations or along access roads. For example, grading, which will change elevations, will only be performed to create level areas for the safe installation of structures, and to improve existing access roads or to create new access roads along the Project ROW in order to provide safe passage for construction equipment. Changes in the grades adjacent to proposed structure locations will be required for the construction of work pads, where fill may be imported to provide a safe and level work area around each structure location or where earth grading may be required. Work pads will remain after construction is completed unless constructed of temporary swamp pads. Grading will not be required along the Project ROW where the terrain is flat and open, or where no access road improvements are needed.

Where grading and earth disturbing activities are required, temporary soil erosion and sediment control measures will be installed to minimize the potential for soil erosion and sedimentation off the ROW or into watercourses or wetlands. Temporary soil erosion controls (e.g., silt fence, straw bales, filter socks, mulching, and temporary reseeding) will be deployed as necessary after vegetation removal or grading, or at other times during construction, in areas of land disturbance. The need for and extent of temporary and permanent soil erosion and sediment controls such as water bars, diversion channels, etc., will be a function of considerations such as slope/steepness, degree of vegetation removal, soil erodibility factor, soil moisture regime, proximity of cleared areas to natural resources, time of year, extreme weather conditions, and schedule of future construction activities.

Any excess rock generated from excavation/construction activities may be left at approved locations along the Project ROW (with the landowner’s permission). Excess rock or boulders may also be placed across or along the Project ROW to provide barriers to unauthorized on-ROW all-terrain vehicular (ATV) traffic. Excess rock generated from upland areas will not be deposited in wetlands or watercourses.

Bedrock may be encountered along sections of the Project ROW during drilling activities and excavation for structure foundations. If bedrock is encountered at or below the surface and it is sufficiently stable and unfractured, the pole structures may be anchored directly to the bedrock which will serve as the footing for the structures. If the bedrock is inadequate as a pole footing, it will be drilled to the required depth and a concrete footing will be poured, or the pole set and backfilled with clean granular material.

The majority of the transmission line structures will be direct embedded structures. All angle and dead-end structures will require concrete foundations with anchor bolts. Rock encountered during excavation generally can be removed by means of rock drilling. Potential temporary effects from rock removal may include dust and vibration/noise from rock drilling.

8.2 Soils

Construction activities which expose unprotected soils have the potential to increase natural soil erosion and sedimentation rates. Soil compaction and decreased infiltration rates may result from equipment operations. Standard construction techniques and BMPs will be employed to minimize any short- or long-term impacts due to construction activity. These include the installation of straw bales, siltation fencing, water bars, diversion channels, the reestablishment of vegetation and dust control measures. These devices will be inspected by the Applicant’s environmental monitor frequently during construction and repaired or replaced if necessary. The Applicant will develop and implement a Soil Erosion and Sediment Control Plan (SESC Plan), which will detail BMPs and inspection protocols.

Excess soil from excavation at pole structures in uplands will be spread around the poles and stabilized to prevent migration to wetland areas. Excess material and rocks excavated from pole structure locations in wetlands will be disposed of at upland sites. Any excess rock not otherwise used along the Project ROW will be disposed of off-site at an appropriate location, pursuant to regulatory requirements. Topsoil will then be spread over the excess excavated subsoil material to promote rapid revegetation.

Highly erodible soils are encountered within the Study Area. On all slopes greater than eight percent which are above sensitive areas, impacted soils will be stabilized with straw or chipped brush mulch to prevent the migration of sediments.

Soil erosion and sediment control measures will be selected to minimize the potential for soil erosion and sedimentation in areas where soils are impacted. TNEC will adhere to its ROW Access, Maintenance, and Construction Best Management Practices (EG-303), and the project-specific SESC Plan will be prepared in compliance with the Rhode Island Soil Erosion and Sediment Control Handbook, the Rhode Island Stormwater Design and Installation Standards Manual, and the Wetland BMP Manual: Techniques for Avoidance and Mitigation.

Typically, temporary soil erosion controls will be installed based on the specifications in the SESC Plan. Temporary soil erosion controls may be placed in the following types of areas, in accordance with site-specific field determinations:

- Across or along portions of cleared ROW, at intervals dictated by slope, amount of vegetative cover remaining, and down-slope environmental resources.
- Along access ways within the transmission line ROW.
- Across areas of impacted soils on slopes leading to streams and wetlands.
- Around portions of construction work sites that must unavoidably be located in wetlands.

The temporary soil erosion controls will be maintained, as necessary, throughout the period of active construction until restoration has been deemed successful, as determined by standard criteria for storm water pollution control/prevention and soil erosion control. In addition to silt fence or straw bales, temporary soil erosion controls may include the use of mulch, jute netting (or equivalent), soil erosion control blankets, reseeding to establish a temporary vegetative cover, temporary or permanent diversion berms (if warranted), and/or other equivalent structural or vegetative measures. After the completion of construction activities in any area, permanent stabilization measures (e.g., seeding and/or mulching) will be performed as necessary.

During the course of periodic post-construction inspections, the Applicant will determine the appropriate time frame for removing these temporary soil erosion controls. This determination will be made based on the effectiveness of restoration measures, such as percent re-vegetative cover achieved, in accordance with applicable permit and certificate requirements.

8.3 Surface Water Resources

Any impact of the Project upon surface waters will be minor and temporary. Construction activities temporarily increase risks for soil erosion and sedimentation that may temporarily degrade existing water quality; however, appropriate BMPs will be implemented and maintained to effectively control sediment. In addition, construction equipment will not cross rivers and streams along the construction corridor without the use of temporary swamp mat bridges. Emphasis has been placed on using existing gravel roadways within the Project ROW and seeking access points that avoid crossing wetlands and surface waters to the extent possible.

There are a number of surface water features within the Study Area. Temporary swamp mats will be used to access structure locations within or adjacent to surface water features as conditions warrant. Access to most structure locations adjacent to these watercourses will be provided without impacting the channels either by using alternate upland access on the Project ROW or by spanning the areas using temporary swamp mats during construction. Sedimentation and turbidity within these watercourses will be minimized through the implementation of BMPs prior to construction activities.

Potential impacts to surface waters if sediment transport is not controlled include temporary increased turbidity and sedimentation (locally and downstream) and subsequent alterations of benthic substrates, decreases in primary production and dissolved oxygen concentrations, releases of toxic substances and/or nutrients from sediments, and destruction of benthic invertebrates. Soil erosion and sediment controls are intended to effectively minimize the potential for this situation to occur. The implementation and maintenance of stringent soil erosion and sediment control BMPs will limit the levels of Project related sedimentation and will minimize adverse impacts to surface waters.

All 16 of the watercourses located within the TNEC ROW are spanned by existing transmission lines, and certain of the smaller stream crossings along the TNEC ROW also are traversed by existing utility access roads. Because the development of the Project will not create an entirely new corridor across the majority of these watercourses and typically will not involve in-stream activities, the Project may have limited and short-term impacts on streams and water quality. Refer to Table 8-1 below.

TABLE 8-1 NAMED WATERCOURSES SPANNED BY THE PROJECT

WATERCOURSE	TRANSMISSION LINE SPAN – EXISTING OR PROPOSED
Dry Arm Brook	Existing (TNEC ROW) and Proposed (CREC ROW)
Clear River	Existing
Mowry Brook	Existing
Round Top Brook	Existing
Chockalog River	Existing
Tributary to Chockalog River	Existing

The Applicant proposes to avoid direct construction work in watercourses to the extent feasible and to limit the potential for impacts associated with soil erosion, sedimentation, or spills into streams and rivers from nearby upland construction activities. In general, the proposed transmission lines will span watercourses, although temporary and possibly permanent access will be required (i.e., use of existing access roads or creation of new access roads) across the smaller stream crossings along the Project ROW.

Vegetation removal will be minimized along streams. Only the minimum amount of vegetation necessary for the construction and safe operation of the transmission facilities (including the provision of access) will be removed. Vegetation removal near streams will be performed selectively, to preserve desirable streamside vegetation for habitat enhancement, shading, bank stabilization, and soil erosion and sediment control.

Potential impacts on watercourses may occur from vegetation removal within riparian zones/buffers (as necessary to allow safe construction or to maintain appropriate clearance from conductors) and the movement of construction equipment across watercourses involving the use of temporary equipment bridges or permanent access roads. Access across wetland areas and streams, where upland access is not available, will be accomplished by the temporary placement of swamp mats. Temporary timber mats, or other similar bridging techniques, will be installed to cross streams so not to impede or interrupt natural flow. Such temporary swamp mat access roads will be removed following completion of construction and, if necessary, areas will be restored to re-establish pre-existing topography and hydrology.

Crossings of smaller streams by construction equipment will be minimized to the extent possible. Existing access roads, which already cross these watercourses along the ROW, will be utilized whenever possible. In general, culverted access roads have historically been installed across the smaller existing watercourses along the TNEC ROW. Prior to construction, integrity inspections of the culverts will be conducted, and culvert structures deemed to either be in disrepair or unable to support the weights of the anticipated construction vehicles will be replaced at the same location and designed to maintain the stream flows. New culverts may be required where no culvert currently exists. These new culverted crossings will be designed and installed in accordance with USACE and RIDEM guidelines.

8.3.1 Water Quality

The primary potential impact to water quality from any major construction project is the increase in turbidity of surface waters in the vicinity of construction resulting from soil erosion and sedimentation from the impacted site. A second potential impact is the spillage of petroleum, hydraulic fluid, or other products near waterways. Impacts to previously undisturbed areas on the ROW will be minimized through the use of existing roadways. Further, equipment (with exceptions for equipment that is not readily mobile) will not be refueled or maintained near wetland or surface water resources. The contractors will respond to an inadvertent release or spill of oil or other hazardous materials in accordance with Rhode Island State requirements. Pre-construction environmental training of contractors will reinforce this obligation. Therefore, it is anticipated that any adverse impacts to water resources resulting from construction of the Project will be negligible.

The removal of vegetation prior to construction may result in increased soil erosion potential so that slightly higher than normal sediment yields may be delivered to area streams and wetlands during a heavy rainfall. However, these short-term impacts should be minor as a result of the relatively small area of ground disturbance, the use of selective vegetation removal within 25 feet of the streams, the implementation of soil erosion control measures and the short duration of construction activities. In addition, a detailed SESC Plan will be designed and implemented which will confine sediment within the immediate construction area and minimize impacts to downstream areas.

8.3.2 Hydrology

Some minor, temporary impacts to surface drainage can be expected during construction of the transmission lines. These impacts will be associated with access road improvements and installation of the pole structures. Following construction, temporarily disturbed areas will be restored to pre-construction conditions, to the extent practicable. Features that are to permanently remain on the Project ROW (i.e., construction work pads and access roads) will be stabilized.

The hydrology of surface waters will not be significantly affected during or after construction since temporary wooden mat bridges will be constructed across stream channels to allow for the passage of construction equipment without disturbing the stream or its channel substrate. These bridges will be removed following construction. A slightly higher rate of storm water runoff may result from the removal of vegetation which may otherwise slow down the runoff and increase infiltration. These impacts will be short-term because vegetative cover will quickly reestablish in the area following construction.

8.3.3 Floodplain

Portions of the Project are within the 100-year floodplain, which represents the extent of flooding that may result during a storm event having a one percent chance of occurring per year. As defined in the Rhode Island Freshwater Wetland Regulations, all rivers, streams and intermittent streams have 100-year floodplains associated with them, although they may not be mapped by FEMA.

One new structure will be located within the FEMA-designated floodplain associated with Round Top Brook for the construction of the 3052 Line. The removal and replacement of existing structures is not expected to result in any significant displacement of flood waters.

Any temporary fill placed within documented floodplains for temporary access roads or work pads will be removed following the completion of construction.

8.4 Groundwater Resources

Potential impacts to groundwater resources within the Project ROW as a result of construction activity on the transmission line facilities will be negligible. Equipment used for the construction of the transmission line will be properly inspected, maintained and operated to reduce the chances of spill occurrences of petroleum products. Pumps used for dewatering activities will be placed and operated within secondary containment devices. Refueling equipment will be required to carry spill containment and prevention devices (i.e., absorbent pads, clean up rags, five gallon containers, absorbent material) and fueling of equipment will occur in upland areas where practicable. In addition, maintenance equipment and replacement parts for construction equipment will be on hand to repair failures and stop a spill in the event of equipment malfunction. Following construction, the normal operation and maintenance of the transmission line facilities will have no impact on groundwater resources.

8.5 Vegetation

The objective of the TNEC's well-established vegetation management program is to maintain safe access to its transmission facilities and to promote the growth of vegetative communities along its ROWs that are compatible with transmission line operation and in accordance with federal and state standards. TNEC has conducted Integrated Vegetation Management within its ROWs as a matter of good utility practice since the late 1980s. TNEC's vegetation management program is designed to allow the safe operation of transmission lines by preventing the growth of incompatible vegetation that may interfere with the transmission facilities or access along its ROW. As a result, the vegetation within the maintained portions of the TNEC ROW typically consists of low-growing shrubs, herbaceous species, and other low-growing species. Portions of the ROW that are not proximate to an existing line may support taller vegetation, as long as it will not conflict with the construction or operation of the lines.

To stabilize impacted sites after the installation of the transmission facilities, the Applicant will stabilize, seed and mulch impacted areas with appropriate grass-type mixes and straw mulch. Vegetative species compatible with the use of the ROW for transmission line purposes are expected to regenerate naturally, over time. The Applicant will promote the re-growth of desirable species by implementing vegetative maintenance practices to control tall-growing trees and undesirable invasive species that conflict with line clearances, thereby enabling native plants to dominate.

A danger tree is a tree, located either on or off the ROW, which may contact electric lines if it failed or were cut. Hazard trees are danger trees that are structurally weak, broken, damaged, decaying or infested and that could contact the structures or conductors, or violate the conductor clearance zones, if they were to fail and fall towards the ROW. During and following the new transmission line construction, danger trees that have been determined to present a potential hazard to the integrity of the lines will be marked and pruned or removed. Hazard trees will also be pruned or removed at this time.

8.6 Wetlands

Construction of the Project will result in temporary, permanent, and secondary impacts to wetland resources. The following section describes the impacts associated with construction of the Project including vegetation removal, excavation for pole structures and access road construction.

Table 8-2 summarizes the potential impacts of the Project on wetlands based on preliminary design data. As summarized below, forested wetland vegetation and upland “buffer” vegetation will have to be removed to clear widths of 150 feet of the CREC ROW, 55 feet on the 1.6 mile section of the TNEC ROW, and 85 feet along the 4.4 mile section of TNEC ROW. Such forested wetlands will be converted to and maintained as scrub-shrub and emergent wetland cover types.

TABLE 8-2 SUMMARY OF POTENTIAL IMPACTS ON WETLANDS, WATERCOURSES AND FLOODPLAIN

IMPACT CATEGORY	APPROXIMATE IMPACT (ACRES)
Forested Wetland Clearing	10.000
Permanent Wetland Impacts from Structure Installation	0.005
Temporary Wetland Impacts from Swamp Mats	8.500
Temporary Impacts to Watercourses from Swamp Mats	0.300
Permanent Impacts to Watercourses from Culverts	0.006
Permanent Impacts to 100-year Floodplain from Structure Installation	0.002

Along the TNEC ROW, the proposed transmission line will be constructed and operated in existing ROW, where the wetlands have historically been affected by vegetation maintenance programs. Specifically, pursuant to the TNEC vegetation management practices, these wetlands are maintained in scrub-shrub and emergent wetland cover types. The development of the proposed transmission line in the maintained TNEC ROW will result in incremental, long-term impacts on wetlands associated with the Project. Clearing of trees and other vegetation for the CREC ROW will introduce a new 0.8 mile section of open corridor that will be maintained similar to the practices implemented on the TNEC ROW.

To minimize or avoid adverse impacts to wetlands throughout the Project ROW, the Applicant has attempted to locate new transmission structures in upland areas wherever practical and to limit the access roads required across wetlands if there are practical upland alternative access roads available. In general, where a new structure must be located in a wetland, a temporary work pad will be used for construction support. In some wetland areas, field conditions (such as thickness of organics, depth of water or steep slopes, etc.) may require the use of multiple layers of swamp mats placed on stringers. The temporary matting used for the work pads in wetlands will be removed after the completion of structure installation.

Because it is not possible to locate all structures outside of wetlands, the Project will result in a minor amount of permanent wetland fill associated with the structure foundations. Such fill will displace wetland soils and vegetation and thus will constitute a long-term adverse effect. In addition, existing permanent access roads will have to remain in certain wetlands. Compensatory wetland mitigation options for the Project may include wetlands restoration and/or enhancement (on- or off-ROW), wetlands preservation, and/or placement of conservation restrictions to preserve open spaces.

8.6.1 Vegetation Removal and Vegetation Management in Wetlands

Vegetation removal will occur within the wetland and state regulated buffer areas in order to facilitate construction and maintenance of the proposed transmission lines. Appropriate soil erosion and sediment control measures will minimize impacts to wetlands from adjacent impacted areas.

Within the footprint of the new transmission lines, forested wetland vegetation will be have to be removed in order to construct and safely operate the new overhead transmission facilities. As a result, forested wetlands along the expanded Project ROW will be converted to shrub-scrub or emergent marsh wetland types. This will not create a loss of overall wetland habitat, but rather a change in habitat type, from forested wetland to shrub-scrub wetland or emergent marsh. Where possible, dead standing snags and slash piles will be left in place to provide for wildlife habitat.

8.6.2 Vegetation Removal and Vegetation Management Adjacent to Cultural and Historic Resources

Vegetation removal within and adjacent to cultural resources will be carried out using methods to avoid impacts to the resource. Wherever practicable, roads for removing trees will be routed around these areas. Trees will be felled using mechanized tree shears that can cut and lift the trees away from the resource. In addition, to protect these resources from tree forwarding/skidding impacts, some trees may be cut four to six feet above the ground and left to act as “bollards” or “bumpers” to fence off and preserve these features in place. Some stone walls will have to be breached for vegetation clearing access routes. The stone walls will be restored after vegetation removal and construction is complete.

8.6.3 Access Roads

Following the delineation of wetland boundaries within the Project ROW, thorough constructability field reviews were conducted to determine access to pole structures which will minimize impacts to wetland areas. Access road locations have been chosen to avoid wetlands, to cross wetlands at previously impacted locations or to traverse the edge of the wetland where possible. Temporary crossings using swamp mats will be used where existing access road crossings do not exist.

In certain areas where no upland alternatives are available, existing access roads through wetlands along the Project ROW will have to be improved or new access routes through wetlands will have to be developed in order to reach structure sites. Access through wetlands will consist primarily of temporary swamp mats, which will be used only for construction and then removed from the wetlands. In some perimeter wetland or upland areas, gravel type roads (approximately 20 feet wide) will be required to provide safe access for construction and for the operation and maintenance of the transmission facilities. Permanent impacts will result where such access roads must remain in place in wetlands to provide access for operation and maintenance activities.

8.6.4 Structures

Under the current design of the proposed transmission line, engineering and safety requirements necessitate the placement of five poles within state and federally regulated wetland areas and a two-pole structure within state-regulated 100-year non-wetland floodplain. The only fill needed for structures is backfill required around the pole embedment. This will amount to approximately four cubic yards of crushed rock per structure. To mitigate this impact, the Applicant will assess the need to provide incremental floodplain compensation, in consultation with RIDEM.

The Applicant has and will continue to make design modifications, if practical, to avoid the installation of structures in wetlands. However, in certain areas, the location of structures in wetlands will be unavoidable. The installation of structures in wetlands will result in temporary impacts associated with the creation of temporary work pads for equipment, as well as permanent impacts associated with the displacement of wetlands located at the structure footings.

8.7 Wildlife

The removal of mature trees in forested areas within the Project ROW may affect wildlife species composition by favoring species that prefer shrub land, emergent, or open habitats to those that inhabit forested communities. The TNEC ROW will be cleared an additional approximately 55 feet in width for 1.6 miles and approximately 85 feet in width for 4.4 miles. Total tree clearing for the TNEC ROW will result in clearing approximately 51 acres of upland deciduous and coniferous forest and approximately eight acres of palustrine (mostly deciduous) forested wetland.

During construction, temporary displacement of wildlife may occur due to the presence of vegetation removal and construction equipment. However, the ability of the area to provide wildlife habitat will not be adversely affected following construction. A study conducted in the Northeast region from northern Connecticut into southern New Hampshire indicated an increase in early successional plant and wildlife usage of powerline corridors following removal of trees from ROWs (Wagner et al. 2014). Another study in western Massachusetts found transmission line corridors provided habitat for shrub land birds of high regional conservation priority (King et al. 2009). ROWs also serve as open corridors connecting non-contiguous natural areas (Temple 1996).

Wildlife currently using the forested edge of the TNEC ROW or the forest associated with the proposed clearing for the CREC ROW may be impacted by the construction of the Project. Larger, more mobile species such as large mammals may be temporarily displaced. Some avifauna will also be temporarily displaced, possibly impacting breeding and nesting activities depending on the time of year. Some smaller and less mobile animals such as small mammals and herpetofauna may be affected during the vegetation removal and transmission line construction. Impacts will be localized to the immediate area of construction around structure locations and along access roads. Following construction, wildlife will be expected to return and re-colonize the ROW.

Within the TNEC ROW, impacts on vegetation communities and wildlife assemblages will occur within and parallel to the existing ROW, which are maintained in shrub land or other open habitat types. In order to install and operate the proposed facilities, additional vegetation will have to be removed for construction and thereafter will be maintained as low-growth shrubs or grasses. For the most part, the vegetative communities that would be affected by the Project along and adjacent to the TNEC ROW are common to the region. In the areas where additional forested vegetation removal is required along the TNEC ROW and for the construction of the new CREC ROW, the Project may have long-term, but incremental and localized, impacts on vegetation and associated wildlife habitats.

The creation of additional shrub land habitat along the TNEC ROW and the creation of the shrub land section of the CREC ROW will represent a long-term positive effect on disturbance and shrub-dependent avian species, as well as species from other trophic levels such as bees and butterflies. The management and maintenance of ROW creates early successional habitats dominated by shrub vegetation and open areas with dense grasses and other herbaceous vegetation. Shrub land habitats within ROWs can provide wildlife habitat such as nesting for birds, browse for deer, and cover for small mammals (Ballard et al. 2004), and tend to offer habitats preferred by particular organisms for certain stages of their annual life-cycles (DeGraaf and Miller 1996). For example, in the northeastern United States, neotropical migrants are experiencing significant declines. Over 80 percent of these declining neo-tropicals use disturbance-dependent ecosystems such as shrub lands and forest edges (Confer and Pasco 2003). Studies conducted in the Northeast have shown that populations of most bird species associated with shrub land habitats have declined sharply. These shrub land species have been shown to make use of human-impacted habitats including utility ROWs (Hunter et al. 2001). These habitat types are declining and increasingly rare in the Northeast due to various factors (e.g., development, ecological succession, absence of fire) (DeGraaf and Miller 1996; King et al. 2009; Wagner et al. 2014). Additionally, most of the historic shrub land in the Northeast is irreversibly gone due to permanent human development; therefore, management for shrub habitat dependent species and for biodiversity cannot occur at these locations. Shrub land birds and other disturbance dependent species are now more dependent than ever on human activities to maintain the habitat required for their survival (King et al. 2009; Confer and Pascoe 2003; Confer et al. 2008). In this regard, transmission line ROW is considered a major source of shrub land habitat (Saucier 2003). In response to shrub land habitat loss and the decline in shrub land dependent species in the Northeast, the USFWS has recently approved the Great Thicket National Wildlife Refuge, which will be dedicated to managing shrub land wildlife habitat in the Northeast (USFWS 2016).

Site surveys have confirmed that no amphibian breeding habitats exist along the CREC ROW, and the ROW crosses one forested wetland and one swamp. In its entirety, the clearing required for the CREC ROW will be approximately 14.5 acres, including conversion of 0.5 acre of a forested wetland and 1.5 acres of a swamp to scrub-shrub and/or emergent wetland, with the remaining approximately 12.5 acres of clearing occurring in upland areas. Establishing the 0.8 mile of new CREC 150-foot-wide ROW may result in some habitat fragmentation by introducing edge effects to undisturbed forested habitat. Fragmentation effects on interior forest species could include an increase in predation by opportunistic predators due to a lack of protective cover, increased brood-parasitism on songbirds, causing interruption of migration routes and displacement of some interior forest species. Research on the effects of clearing uncleared portions of transmission line ROWs suggests that this practice improves habitat for some nesting bird species, and have shown a positive correlation between ROW width and species abundance (Confer and Pascoe 2003).

Vegetation removal will be performed using mechanized methods. Where removal of woody vegetation is required, vegetation will be cut flush with the ground surface to the extent possible. Where practical, trees will be felled parallel to the ROW to minimize the potential for off-ROW vegetation damage. Vegetation on the existing ROW is managed in accordance with the TNEC vegetation management program (National Grid 2013); accordingly, trees that could interfere with the operation of the transmission lines are routinely removed from the ROW and trees along the edges are periodically pruned or removed. The operation of the new transmission facilities will require the maintenance of the ROW as low-growth shrub land and open field habitats. Impacts to sensitive habitats of state-listed rare, threatened or endangered species will be minimized and where possible avoided through close coordination with the RINHP, RIDEM and the USFWS in the development of avoidance and mitigation criteria for the Federally-listed NLEB as well as the state-listed plant species discussed in Section 6.8.3. To avoid possible adverse impacts to or forced relocation of

NLEBs, the Applicant will implement appropriate time of year restrictions for clearing of the TNEC and CREC ROWs to avoid the maternity nesting season during June-July.

8.8 Air Quality

There are three potential sources of air quality impacts associated with the Project – dust, vehicle emission and SF_6 leakage – none of which are expected to be significant. During earth disturbing activities, the contractor will deploy dust mitigation measures as described in National Grid's EG-303. Exposed soils will be wetted and stabilized as necessary to suppress dust generation, and crushed stone aprons will be used at all access road entrances to public roadways. Consequently, fugitive dust emissions are anticipated to be low. Dust suppression methods will be used during drilling operations, as deemed necessary, to minimize impact. In addition, minimal quantities of earth will be moved or impacted during construction. Therefore, any impacts from fugitive dust particles will be of short duration and localized.

TNEC requires the use of ultra-low sulfur diesel fuel exclusively in its contractor's diesel-powered construction equipment. Vehicle idling is to be minimized during the construction phase of the Project, in compliance with the Rhode Island Diesel Engine Anti-Idling Program, Air Pollution Control Regulation No. 45, authorized pursuant to RIGLs § 31-16.1 and § 23-23-29. Vehicle idling for diesel and non-diesel powered vehicles is limited to five minutes except for powering auxiliary equipment, for heating/defrosting purposes in cold weather, and for cooling purposes in hot weather. The contractor is responsible for complying with the state regulatory requirements along with the National Grid Environmental Guidance (EG-802RI) Vehicle Idling – Rhode Island.

Due to the transitory nature of the construction, air quality in the Study Area will not be significantly affected by construction along the Project ROW. Emissions produced by the operation of construction machinery (nitrogen-oxides, sulfur oxides, CO, volatile organic compounds, and particulate matter) are short-term and not generally considered significant.

Three new circuit breakers will be installed at the Sherman Road Switching Station as part of the Project. The new circuit breakers, which will contain SF_6, will be installed and maintained by trained technical staff, and will be checked for integrity during routine inspections by TNEC personnel. TNEC's procurement specifications require that all circuit breakers that it purchases have an SF_6 leak rate of less than 0.5 percent per year.

TNEC entered into an SF_6 Emissions Reduction Partnership Memorandum of Understanding with the USEPA in December 2003. TNEC determines estimated SF_6 system emissions (SF_6 leakage) from its system based on a mass balance approach as required and specified in 40 Code of Federal Regulations (CFR) Part 98.303 (December 1, 2010) (USEPA Mandatory Greenhouse Gases Reporting, Electrical Transmission and Distribution Equipment Use).

There are no anticipated long-term impacts on air quality associated with the construction or operation of the Project.

8.9 Social and Economic

Based on the proposed location of the Project, the greatest potential for social impact is the interaction of construction and future maintenance activities on current and future land uses abutting the Project

ROW and the Sherman Road Switching Station. Some of the original transmission line assets within the Town of Burrillville have been in operation since the 1960s.

8.9.1 Social Impacts

The Project will not adversely impact the overall social and economic condition of the Project area. The Project does not require nor will it lead to long-term residential or business disruption. Temporary construction impacts, primarily related to construction traffic and equipment operation, are expected to be minor. As described in Section 4.0, the proposed transmission lines will be located entirely within a transmission line ROW either presently occupied by other transmission lines or within the CREC ROW. All upgrades at the Sherman Road Switching Station will occur within the existing station fence line.

8.9.2 Population

Project construction and operation will have no impact on the population.

8.9.3 Employment

The construction of the Project may have minor beneficial effects on the regional economy by creating jobs during the construction period. Project expenditures may also have a small spin-off impact as funds are re-circulated and spent within the local economy. By transmitting the electricity generated by the CREC, the Project will support the New England states' effort to stimulate additional growth and economic activity in the region.

It is estimated that construction of the new transmission line may employ approximately 50 skilled transmission line construction workers and approximately 12 substation construction workers for the duration of the Project construction.

8.9.4 Municipal Tax Revenue

The Project represents a capital investment of approximately $47.2 million in the Town of Burrillville. The conservative estimate of first year property tax revenues are approximately $800,000. Municipal tax revenue will commence after the facilities are placed in service, and are anticipated to continue at decreasing levels throughout the book-life of the facilities.

8.10 Land Use

The following section addresses the compatibility of the Project with various land uses along the proposed route. Because the Project will occupy areas dedicated to use for electrical facilities, it will not displace any existing residential uses, nor will it affect any future development proposals that meet local zoning requirements.

Land use impacts can be separated into short-term and long-term impacts. Short-term land use impacts may occur during the construction phase of the Project. Impacts associated with the construction phase of the Project will be temporary, and most present land uses within the existing ROW could resume following construction. The Applicant will provide notification of the intended construction plan and schedule to affected landowners and abutters so that the effect of any temporary disruptions may be minimized.

The construction activities are projected to extend for a period of approximately one year to include tree clearing and vegetation removal, installation of soil erosion controls, construction of access roads and work pads, installation of new transmission line structures, wire stringing and ROW restoration. The upgrades at the switching station will occur on a parallel schedule with the installation of the 3052 Line.

The construction of the new transmission line within the TNEC ROW will be consistent with the established land use and therefore will not present long-term land use impacts. Generally, existing land uses within and adjacent to the Project ROW will be allowed to continue following construction. The installation or construction of buildings, pools or other non-transmission related facilities is not allowed with the transmission line easement.

8.10.1 Residential

A number of residential areas are located in proximity to the Project ROW and Sherman Road Switching Station. In many locations, existing vegetation will continue to provide visual screening of the facilities from residences, although existing vegetative visual buffers may be reduced in width as a result of the proposed vegetation clearing required to install the new line.

8.10.2 Agriculture

The Project crosses a number of areas which are presently in agricultural use. Minimal impacts to agricultural uses will occur as a result of the Project, and these will be limited to footprints of the transmission line structures and access roads. Temporary displacement of some farming activities may occur during the active construction period along the ROW. The Applicant’s Stakeholder Relations team will work with these affected landowners to mitigate any perceived impact.

8.10.3 Business

The proposed route will not cross any business areas. Traffic management plans will be developed and implemented to minimize construction-phase disturbances on local traffic and nearby business operations. No displacement of business will result from the Project.

8.10.4 Institutions

There are no schools or other known institutions located within the Study Area.

8.10.5 Recreation

No existing recreational uses will be displaced long-term by the Project. Impacts to existing parks and recreational areas from the construction of the proposed electric transmission line will be minimal and short-term. Since the Project is located within the Project ROWs, potential long-term impacts will be avoided.

The majority of Project route follows the existing ROW across various recreational areas, the use of which may be temporarily affected during construction. The Applicant’s Stakeholder Relations team will provide regular construction updates to the public, including recreational users of local and state lands. In general, the impact of the Project on recreational uses will be short-term, lasting only for the duration of construction. The operations of the new transmission lines will not significantly alter the use of the recreational areas along the ROW.

The recreational facilities traversed by the Project route include the Big and Little Round Top Pond operated by the RIDEM, and the Wallum Lake Rod & Gun Club. The Applicant will provide notification to managers of these affected recreational areas prior to commencement of construction in the areas, and will work with these affected landowners to minimize construction-related impacts on their operations. The Applicant’s Stakeholder Relations team will be scheduling meetings with representatives of the Wallum Lake Rod & Gun Club to discuss the proposed construction schedule and ways to avoid and/or minimize potential construction-related disturbances to their operations during construction.

8.10.6 Consistency with Burrillville Comprehensive Plan

As documented in the Purpose and Need section of this report, the need for the Project is driven exclusively by the interconnection of the proposed CREC to the New England electric system. Studies prepared by ISO-NE demonstrate that the required connection is through a dedicated 345 kV transmission line to the existing Sherman Road Switching Station.

Because the Project will use existing TNEC ROW, new CREC ROW located on Spectra Energy property, and the area within the existing Sherman Road Switching Station yard, it will not significantly alter existing land use patterns and will not adversely impact future planned development on lands not currently encumbered with energy-related assets.

In accordance with the Comprehensive Plan, any adverse impacts will be minimized. However, partial vegetative clear-cutting is needed to accommodate proposed transmission lines. Regardless, this factor may not be deemed inconsistent nor detrimental, because clear-cutting will be entirely contained within said existing ROWs. Furthermore, it is anticipated that dedicated utility ROWs will be eventually improved for their intended purpose to serve those future land uses envisioned by both the Comprehensive Plan and Zoning Ordinance. The Comprehensive Plan clearly acknowledges presence of such features and how said presence can be used to promote development, as shown in Section VII, pages 17-18, stating:

Economic Development Strengths - “Burrillville has certain characteristics which should be considered advantages in promoting economic development, among others, as follows:” [Pages VII-17 - VII-18]

- “Presence of large utility companies, and electric, and associated distribution and transmission lines.”

The Clear River Energy Center power plant and the proposed transmission line improvements are therefore consistent with the Comprehensive Plan.

8.11 Visual Resources

A Visual Impact Assessment (VIA) (Appendix C) was conducted for the Project to analyze the potential visibility and visual impacts from the construction and installation of the transmission line and associated structures. The VIA procedures used are consistent with methodologies developed by various state and federal agencies, including the U.S. Department of the Interior, Bureau of Land Management (USDI BLM 1980), U.S. Department of Agriculture, National Forest Service (1974), the U.S. Department of Transportation, Federal Highway Administration (1981), and the New York State Department of Environmental Conservation (2000). The VIA used several evaluation techniques, including viewshed analysis, field verification of visibility, computer-assisted visual simulations, and the evaluation of the Project’s visual contrast and overall impact by a panel of landscape architects. This analysis assessed the potential effect of the Project on the aesthetic character and visually sensitive resources of the study area.

Viewshed analysis was conducted to determine the potential visibility of the existing and proposed transmission structures based on the screening effect of topography only. This is a “worst-case” analysis, in that the screening effect of vegetation is not considered. Heights of existing structures evaluated in this analysis ranged from 65.5 feet to 125 feet, while heights of the proposed transmission structures ranged from 68 feet to 130 feet. Two 1.0-mile radius topographic viewsheds were mapped, one to illustrate potential visibility of the proposed structures, and the other to illustrate potential visibility of the existing transmission structures already on the ROW. A vegetation viewshed was also prepared to illustrate the potential screening provided by forest vegetation. This analysis used 40 feet as the height of vegetation based on standard practice and is therefore conservative in that vegetation in many areas along the ROW is higher than the assumed 40-foot height.

Topographic viewshed analysis revealed that potential visibility of the Project increased only 0.5 percent – to approximately 87.2 percent of the visual study area – as compared to visibility of the existing transmission lines. This number reflects the fact that based on topography alone, a large portion of the study area already has potential views of the existing structures. The topographic viewshed of the existing lines covers 86.9 percent of the study area, disregarding screening provided by existing vegetation and man-made structures. When mapped forest vegetation is factored into the viewshed analysis, it significantly reduces the area where direct lines of sight toward the Project could potentially be available. This is a more accurate reflection of what the actual extent of Project visibility is likely to be. Within a 1.0-mile radius, the vegetation viewshed analysis indicates that only approximately 5.4 percent of the area could have potential views of some portion of the Project based on the availability of an unobstructed line of sight. This is a significant reduction in visibility when compared to the analysis factoring in topography only (potential visibility from 87.2 percent of the study area). When considering the screening effect of both topography and vegetation, areas of proposed structure visibility within the visual study area increase by 0.8 percent when compared to the vegetation/topographic viewshed of the existing transmission line.

Field verification was conducted to more accurately evaluate potential visibility of the proposed transmission facilities from ground-level vantage points. This fieldwork confirmed that the visibility of the existing transmission line is generally limited to areas at or adjacent to sites where the Project ROW crosses or closely parallels public roads. Residences generally have limited to no views of the existing transmission line due to the forest vegetation. In a few instances residential yards directly adjacent to the existing TNEC ROW offer glimpses of the transmission structures. Longer distance views are generally limited to views down the existing cleared TNEC ROW. Drivers generally will view the Project from locations where the proposed route crosses public roads. At these crossings, open views are generally restricted to the cleared ROW (i.e., under the line, looking down the cleared corridor). Open water views are screened by vegetation based on field review, and views from sensitive sites are generally screened or only available at road crossings.

Computer generated simulations were also prepared for representative locations to present the current and proposed appearance of the Project. Eight viewpoints were selected for simulations from the photo documentation conducted during the field visit. These locations provided representative views of the Project from a variety of views likely to be available (i.e., views on or directly adjacent to road crossings). Viewpoints were selected based on:

1. Providing an open view of the Project (as determined through field evaluation).
2. Illustrative of typical views from landscape similarity zones and sensitive resources where views of the Project will be available.
3. Illustrative of typical views of the proposed Project that will be available to representative viewer/user groups within the visual study area.
4. Illustrative of views of varying amounts of clearing, types and arrangements of proposed transmission structures, to depict a range of Project appearance following construction.

Before and after simulations prepared for each of the viewpoints were presented to a panel of registered landscape architects for evaluation of the effect of the proposed Project on visual conditions, in terms of its contrast with existing components of the landscape (land form, vegetation, land use, water and sky). The methodology utilized in this evaluation is a simplified version of the U.S. Department of the Interior, BLM contrast rating methodology (USDI BLM 1980).

The results indicate that the Project will not significantly alter the visual character and scenic quality of the existing views. Evaluation by a panel of landscape architects indicates that the proposed transmission lines’ overall contrast with the visual/aesthetic character of the area will generally be minimal. Some degree of contrast with the existing vegetation and sky was noted for several viewpoints due to the widened ROW and the new structures’ greater height, and more dominant visual presence. However, this effect was limited due to the proposed location of a large part of Project within an existing transmission line ROW with low baseline scenic quality. Also, the visual impact of the proposed Project will generally be restricted to sites where public roads cross the Project ROW and offer an unobstructed view. In all instances, views of the landscape from these road crossings already include the existing transmission lines. The H-frame design of many of the new structures is consistent with the design of the existing structures and limits the extent to which the new structures extend above the adjacent tree lines into the sky. The natural brown color of the self–weathering steel poles also generally blends well with the existing structures on the ROW and the background vegetation. As a result, mitigation of visual impacts does not appear warranted, but will be considered upon request.

8.12 Cultural and Historical Resources

The proposed Project will not affect any above-ground historic resources. Because the new transmission line will be added to an existing ROW, the feeling or character of nearby resources will not be altered in any significant manner. Construction of the CREC ROW will be in an undeveloped area without impact to any above-ground historic resources.

Ground disturbing construction activities may impact known, as well as previously unidentified, archaeological resources. The installation of new electrical transmission structures or the creation of new access roads or improvements could disturb archaeological deposits, including both Native

American and Historic Period sites. However, any impacts to archaeological sites can be mitigated by completion of an archaeological site identification survey prior to project construction.

8.13 Noise

The existing ambient noise levels will not be altered by the proposed transmission lines or switching station modifications. Like any construction project, temporary noise impacts will occur during the construction of the Project. Proper mufflers will be required to control noise levels generated by construction equipment.

Construction-related noise will be intermittent, and will last only for the duration of the construction period. It will result from the operation of construction equipment such as trucks, excavating equipment, drilling equipment, structure erection equipment (cranes), and wire stringing rigs. Overall, the development of the transmission facilities will result in sound levels that are typical of construction projects. The town of Burrillville has a local ordinance which regulates the emission of sound. The Project is exempted from the town noise ordinance (Burrillville Municipal Code, Article II Section 16-35(b)) as sound relative to allowed construction.

Construction-related noise may affect certain receptors including residences, schools, daycare facilities, and designated recreational areas. The extent of a noise impact to humans at a sensitive receptor is dependent upon a number of factors, including the change in noise level from the ambient; the duration and character of the noise; the presence of other, non-project sources of noise; people's attitudes concerning the Project; the number of people exposed to the noise; and the type of activity affected by the noise (e.g., sleep, recreation, conversation).

The impact of construction-generated noise also will depend on the location of the noise source, because sound attenuates with distance, and with the presence of vegetative buffers or other barriers.

While most transmission lines do not generate appreciable noise during normal operations, 345 kV transmission lines may be audible under certain weather conditions. Any operational noise associated with the proposed new transmission line will attenuate quickly with distance from the transmission line. Noise may increase somewhat during wet weather; however, these changes are typically negligible.

Modifications to the Sherman Road Switching Station proposed as part of this Project will not alter the current noise levels from this facility.

8.14 Transportation

During construction, personnel and construction equipment traveling to and from work sites may cause temporary and localized increases in traffic volumes. However, any such increases in traffic volume will be short-term. Further, the Applicant will employ local police to direct traffic at construction work sites along roads, as needed, and will erect appropriate traffic signs to indicate the presence of construction work zones. In addition, the Applicant will develop State and local access and traffic management plans for the construction contractor(s) as needed. The objective of these plans will be to define requirements for traffic controls and to provide for the safe ingress and egress to the ROW for construction equipment and other vehicles. Use of these measures will enable the Applicant and its contractors to complete construction safely and with minimal disruption to traffic.

Following construction, Project-related traffic activity will be minimal and will occur only when the ROW or transmission lines have to be inspected or maintained. As a result, the construction and operation of the transmission lines will have minimal impact on traffic on the surrounding area roadways.

The route of the Project crosses various local and state roads, and the transmission line conductors will span these roads and will not affect the long-term use of the transportation facilities.

8.15 Safety and Public Health

The TNEC switching station is locked and enclosed with chain link fence topped with barbed wire to prevent unauthorized entry. Following construction of the facilities, all transmission line structures and switching stations will be clearly marked with warning signs to alert the public to potential hazards if climbed or entered. Trespassing on the ROW will be discouraged by the use of existing gates and/or barriers at entrances from public roads.

Because the proposed facilities will be designed, built and maintained in accordance with the standards and codes as described in Section 4.4, the public health and safety will be protected.

8.16 Electric and Magnetic Fields

Exponent modeled the edge of ROW levels of electric and magnetic fields under existing and proposed conditions for the three segments of the ROW. As a preliminary to its analysis, Exponent performed phase optimization for the 3052 Line. The 341 and 347 Lines transfer power at times from West to East and at other times from East to West which resulted in the modeling of field levels for each of these two cases, for annual average and annual peak loads on the 341 and 347 Lines. Because the 3052 Line connects the CREC to the Sherman Road Switching Station, CREC was assumed to be operating at full load for the purposes of the modeling.

8.16.1 Phase Optimization

Where two or more transmission lines share a ROW, the level of EMF will depend on the specific arrangement of the conductors of each circuit. In many circumstances the field levels can be minimized by a careful arrangement of the phases in a phase-optimization analysis.[18] The analysis determined that the single phasing configuration of the 3052 Line which minimizes the highest edge of ROW magnetic field level in all sections and for both transfer cases is based upon the East-to-West transfer case and is A-B-C (from west to east). This phasing was applied when computing the EMF levels for the proposed configuration.

[18] Phase optimization is one of the ways to minimize EMF levels consistent with recommendations to apply low cost measures to minimize magnetic fields (see e.g., World Health Organization. Environmental Health Criteria 238: Extremely Low Frequency (ELF) Fields. Geneva, Switzerland: World Health Organization 2007).

8.16.2 Electric Fields

Calculations of the electric field at the edge of the ROW are summarized in Table 8-3 for the three segments of the ROW. As can be seen in Table 8-3 the edge of ROW electric-field level stays largely unchanged as a result of this project. The exception to this is the increase in the electric-field level on the northern ROW edge in XS-2 where the 341 Line is rebuilt closer to the ROW edge and the field level is calculated to be 1.3 kV/m). Similarly, in XS-1, the shorter distance from the structures to the ROW edge results in a higher electric field level (1.7 kV/m) at one ROW edge. At the edges of the ROW, all electric field levels are well below the Reference Levels recommended by ICES and ICNIRP.

TABLE 8-3 CALCULATED EDGE OF ROW ELECTRIC FIELD LEVELS (KV/M) WITH ALL LINES OPERATING AT MAXIMUM VOLTAGE

		LOCATION*	
SECTION	CONDITION	- ROW EDGE	+ ROW EDGE
XS-1	Existing	N/A	N/A
	Proposed	1.7	0.2
XS-2	Existing	1.2	0.4
	Proposed	1.3	1.3
XS-3	Existing	<0.1	0.4
	Proposed	0.1	0.4

Notes:
* "-Row Edge" is northeast edge in Segment 1, south edge in Segment 2, and southeast edge in Segment 3.
"+Row Edge" is southwest edge in Segment 1, north edge in Segment 2, and northwest in Segment 3

8.16.3 Magnetic Fields

Calculations of magnetic fields at the edges of the ROW in the three segments are summarized in Tables 8-4 through 8-7. As expected, the addition of the heavily-loaded 3052 Line to the ROW increases the magnetic-field level at the ROW edges. The edge of ROW magnetic-field level in XS-3 where the ROW is very wide, however, remains 12 mG or less under average loading conditions. The narrower ROW width in XS-2 results in a higher magnetic-field level, primarily on the southern ROW edge (69 mG) when the 3052 Line is located. Similarly, in XS-1, the shorter distance from the structures to the ROW edge results in a higher magnetic field level (84 mG) at one ROW edge. It is important to note, however, that even operating CREC at 1046 MVA capacity, the magnetic-field levels are all well below the Reference Levels recommended by ICES and ICNIRP.

TABLE 8-4 CALCULATED MAGNETIC-FIELD LEVELS (MG) AT AVERAGE ANNUAL LOADING OF THE 341 AND 347 LINES (CREC AT FULL CAPACITY) (EAST TO WEST TRANSFER)

SECTION	CONDITION	LOCATION*	
		- ROW EDGE	+ ROW EDGE
XS-1	Existing	N/A	N/A
	Proposed	84	17
XS-2	Existing	34	3.3
	Proposed	57	11
XS-3	Existing	2.5	3.3
	Proposed	9.2	4.5

Notes:
* "-Row Edge" is northeast edge in Segment 1, south edge in Segment 2, and southeast edge in Segment 3.
"+Row Edge" is southwest edge in Segment 1, north edge in Segment 2, and northwest edge in Segment 3.

TABLE 8-5 CALCULATED MAGNETIC-FIELD LEVELS (MG) AT AVERAGE ANNUAL LOADING OF THE 341 AND 347 LINES (CREC AT FULL CAPACITY) (WEST TO EAST TRANSFER)

SECTION	CONDITION	LOCATION*	
		- ROW EDGE	+ ROW EDGE
XS-1	Existing	N/A	N/A
	Proposed	84	17
XS-2	Existing	17	8.0
	Proposed	69	22
XS-3	Existing	0.7	8.0
	Proposed	12	6.2

Notes:
* "-Row Edge" is northeast edge in Segment 1, south edge in Segment 2 and southeast edge in Segment 3.
"+Row Edge" is southwest edge in Segment 1, north edge in Segment 2, and northwest edge in Segment 3.

TABLE 8-6 CALCULATED MAGNETIC-FIELD LEVELS (MG) AT ANNUAL PEAK LOADING OF THE 341 AND 347 LINES (CREC AT FULL CAPACITY) (EAST TO WEST TRANSFER)

SECTION	CONDITION	LOCATION*	
		- ROW EDGE	+ ROW EDGE
XS-1	Existing	N/A	N/A
	Proposed	84	17
XS-2	Existing	23	1.7
	Proposed	59	4.2
XS-3	Existing	2.0	1.7
	Proposed	9.7	1.7

Notes:
* "-Row Edge" is northeast edge in Segment 1, south edge in Segment 2, and southeast edge in Segment 3.
"+Row Edge" is southwest edge in Segment 1, north edge in Segment 2, and northwest edge in Segment 3.

TABLE 8-7 CALCULATED MAGNETIC-FIELD LEVELS (MG) AT ANNUAL PEAK LOADING OF THE 341 AND 347 LINES (CREC AT FULL CAPACITY) (WEST TO EAST TRANSFER)

SECTION	CONDITION	LOCATION*	
		- ROW EDGE	+ ROW EDGE
XS-1	Existing	N/A	N/A
	Proposed	84	17
XS-2	Existing	12	8.4
	Proposed	68	21
XS-3	Existing	0.4	8.4
	Proposed	12	6.0

Notes:
* "-Row Edge" is northeast edge in Segment 1, south edge in Segment 2, and southeast edge in Segment 3.
"+Row Edge" is southwest edge in Segment 1, north edge in Segment 2, and northwest edge in Segment 3.

9.0 MITIGATION MEASURES

The 3052 Line is aligned to avoid or minimize adverse environmental impacts to the extent practicable. Approximately six miles of the 3052 Line will be constructed within TNEC ROW and co-located with the two existing 345 kV 341 and 347 Lines. This ROW has long been dedicated as an energy corridor and also has the vegetation routinely managed by TNEC to be consistent with mandatory Federal Energy Regulatory Commission (FERC) vegetation standards for overhead transmission lines. Additional mitigation measures will be implemented to minimize Project impacts on the natural and social environments. Mitigation measures have been designed to reduce impacts associated with each phase of Project construction. Many of these measures are standard proven procedures that TNEC incorporates into all transmission line and substation construction projects. Others are site specific measures designed to meet the needs of this particular Project. These measures are described in the following sections.

9.1 Design Phase

In order to reduce the impacts associated with the construction and operation of the transmission line facilities, the Applicant has incorporated design measures to avoid and minimize the impacts of the Project. These measures, which include alignment of existing and proposed structure locations, structure design and configuration, selection of structure locations and the use of existing access roads where possible, have resulted in the avoidance and minimization of land use, wetland/water resource impacts, and soil disturbance to the greatest extent practicable. Land use impacts are minimized by locating the approximate six miles of proposed electric transmission lines within an existing managed ROW. The design and construction of the proposed electric transmission line incorporates measures which minimize impacts to wetlands and water resources and other natural features within the ROW.

To evaluate the location of the new structures, constructability field reviews of the Project ROW were conducted in August 2016 with TNEC, POWER, ESS, and Gray and Pape, Inc. These reviews were conducted to assess the constructability of the Project and to identify options for avoiding and/or minimizing impacts from construction. The constructability field reviews resulted in recommendations regarding shifting the locations of certain structures to avoid and/or reduce impacts to wetlands, watercourses, cultural resources, rare species habitats and other physical constraints (ledge, steep topography, existing structures, etc.) that were observed in the field. Where practicable, structure locations were adjusted and custom-shaped construction pads were designed to abut, but not permanently impact, wetlands and other resources. Forestry reviews were conducted from late August into early September 2016 to review vegetation clearing for the new transmission line along both the existing TNEC ROW and the CREC ROW. Proposed tree clearing routes were analyzed by TNEC and POWER to minimize impacts to wetlands, watercourses, rare species, cultural resources, and additional physical constraints.

Construction of the 3052 Line will result in the installation of approximately 57 new structures along the 3052 Line, one new structure in the proposed Clear River Switching Station, one new structure in the Sherman Road Switching Station, 14 new structures along the 341 Line, and one new structure and 15 relocated structures along the 347 Line. The constructability field reviews included a structure-by-structure evaluation to identify practicable options to avoid or minimize impacts on wetlands, watercourses, or vernal pools, as well as avoiding impacts to cultural features such as stone walls or stone features. These modifications are summarized as follows:

3052 Line Structure Shifts:

- 4 new structure locations were shifted to avoid wetlands
- 1 new structure location was shifted to avoid a wetland and riverbank buffer
- 1 new structure location was shifted to avoid perimeter wetland
- 1 new structure location was shifted to avoid a perimeter wetland and riverbank buffer
- 1 new structure location was shifted to avoid a cultural feature
- 3 new structure locations were shifted to avoid impacts to stone walls

341 Line Structure Shifts:

- 1 new structure location was shifted to avoid perimeter wetland

347 Line Structure Shifts:

- 2 structure locations were shifted to avoid wetlands

In all, a dozen structure locations were shifted to avoid impacts to wetlands, watercourses or vernal pools, as well as to avoid cultural features. Where possible, work pads and pull pads were reconfigured to avoid or minimize impacts to wetlands and watercourses. At these locations work areas were reduced in size or were shifted to avoid wetland and watercourse impacts.

The Applicant sought a Project alignment that will maximize the use of upland areas that do not contain sensitive environmental features for structure locations, construction pads and access roads. Further, construction BMPs will be implemented during and following construction to minimize impacts associated with the Project, and a compensatory wetland mitigation plan is being developed to address federal mitigation requirements.

The following sections detail the various measures implemented during the design phase of the Project to reduce impacts to the natural and social environment.

9.1.1 Mitigation of Natural Resource Impacts

The design of the transmission line facilities has been developed to reduce wetland impacts through avoidance, minimization, and mitigation compensation. Consequently, unavoidable wetland impacts associated with the construction of pole structures for the Project have been limited to approximately 0.005 acre of permanent wetland disturbance. Mitigation for these alterations of wetland will be provided in order to comply with federal wetland regulations, in accordance with the USACE, New England District Compensatory Mitigation Guidance.

The Applicant will develop a Wetland Invasive Species Control Plan (WISCP) which will outline all best management practices that will be implemented during construction to minimize the spread of wetland invasive species on the Project. Measures to be addressed in the WISCP will include:

- The requirement for the use swamp mats or equivalent (e.g., corduroy roads) in wetlands during construction operations and at wetland crossings along ROWs access roads to minimize spread of invasive species within a wetland from spreading invasive plant species by the construction equipment or vehicles;

- The cleaning of equipment or mats used in a wetlands containing invasive plant species prior to relocating to another work site; and

- The proper stockpiling of soils excavated from wetlands or riparian areas containing a predominance of target invasive plants.

The RIDEM requires compensation for any loss of 100-year flood storage. In accordance with these requirements, the Applicant will provide, as necessary, floodplain compensation for fills related to structure placement. Soil erosion and sediment controls will be installed along the perimeter of the excavation area to avoid sedimentation of the adjacent wetlands. Following excavation, the impacted area and contours will be restored, seeded and/or mulched.

Potential short-term and long-term impacts to wildlife will be mitigated. Wildlife impacts in the short-term will be mitigated by limiting ground disturbances to pole structure and access road locations, and restoring and/or stabilizing areas following construction. Vehicle and equipment traffic will be limited to established access roads as much as practical. Tree clearing will take place outside the June-July NLEB nesting season. Long-term mitigation efforts will include minimizing permanent wetland disturbance and maintaining wetland functions following construction. Plant species that are generally encouraged on the ROWs include low growing shrubs and herbaceous vegetation. These types of successional communities have various benefits to native flora and fauna. Mitigation for the effects of fragmentation from developing the 0.8 mile CREC ROW will be addressed in part through implementation of the USACE Compensatory Wetland Mitigation Guidance, which will include land preservation of wildlife habitats. It is also anticipated that some species displaced by the CREC ROW would be able to utilize the immediately adjacent undisturbed portions of the Spectra Energy property as well as the adjacent approximate 4,000 acre RIDEM George Washington Management Area.

9.1.1.1 Transmission Line Facilities

As stated above, Project-related wetland impacts were avoided and minimized to the maximum extent practicable through the Project design process. The result is a practical alternative with minimal wetland impacts.

9.1.1.2 Access Roads

The existing TNEC ROW includes a network of existing access roads. The Applicant proposes using the existing access roads along the TNEC ROW to the greatest extent possible, incorporating improvements to these roads and new access spurs to accommodate the construction vehicles and equipment required to construct the 3052 Line. On the CREC ROW there is a woods road, portions of which will be utilized for construction access, thus minimizing disturbance for the installation of a new access road. As further mitigation, most wetland and watercourse crossings will be accomplished using temporary mat/bridge crossings where no existing access road crossing exists. One new stream ford crossing is proposed on the CREC ROW where an existing gravel cart road exists.

9.1.2 Mitigation of Social Resource Impacts

In addition to avoiding and minimizing impacts to the natural environment within the Project ROW, several design practices have been incorporated to minimize or avoid impacts to the surrounding social environment. To minimize impacts to existing land uses and undisturbed areas, the Applicant will locate a majority of the Project adjacent to existing transmission lines within existing ROWs. The Applicant also proposes to locate new structures in-line with existing structures, where feasible, to minimize the potential for visual impact. Vegetation removal will be limited so that the maximum practical visual buffer between residences and the Project is maintained. The CREC ROW currently is entirely buffered by forestland; construction of the Project on the CREC ROW therefore, and is not anticipated to adversely impact adjacent residences from a visual perspective. Removal or alteration of stonewalls will be minimized to the extent practical.

To avoid, minimize, and mitigate potential effects to cultural and historical resources, impact locations will be tested for archaeological resources by following RIHPHC standards and guidelines for archaeological site identification. If evidence of sites is found, additional investigations will be conducted to determine site boundaries. This work will be done as part of the USACE's Section 106 consultation with the RIHPHC and Native American tribes. Recommendations will be made as to whether the sites should be avoided, or if not, whether additional survey will be needed to assess their eligibility for the National Register of Historic Places.

If one or more sites are found that are determined eligible for the National Register of Historic Places and cannot be avoided, then Section 106 consultation will continue to determine what mitigation strategies might be employed. Determination of eligibility for the National Register of Historic Places does not require that the resource be preserved, although that is preferable. The USACE and RIHPHC will guide and participate in that process, in consultation with Native American tribes that have entered the consultation process, and will culminate in a Memorandum of Agreement.

9.2 Construction Phase

The Applicant will implement several measures during construction which will minimize impacts to the environment. These include the use of existing access roads and work pad locations where possible, installation of soil erosion and sediment controls, supervision and inspection of construction activities within resource areas by an environmental monitor and working within defined limits of disturbance. The following section details various mitigation measures which will be implemented to minimize construction-related impacts.

9.2.1 Mitigation of Natural Resource Impacts

9.2.1.1 Wetlands and Watercourses

Throughout the planning and design process for the Project, where practicable wetland impacts have been minimized by aligning the new transmission line primarily along an existing ROW, utilizing existing access roads, and avoiding the placement and construction of structures and access roads in wetlands and watercourses. However, given the scale and landscape setting of the Project, certain wetland and watercourse resource impacts associated with the development of the Project cannot be avoided. In order to offset environmental impacts associated with the Project, appropriate compensatory mitigation (in collaborative consultation with local, state, and federal agencies) will be provided, as a component of the final Project design.

Because certain structures will unavoidably have to be located in wetlands, the Project will result in a minor amount of permanent wetland fill associated with the structure foundations. The amount of compensatory mitigation required will depend on the final Project design and the amount of wetland impacts. Compensatory wetland mitigation options for the Project may include wetlands restoration and/or enhancement (on- or off-ROW), wetlands preservation, and/or placement of conservation restrictions to preserve open spaces. Installation of a single transmission line structure within floodplain is anticipated to have de minimis impact on flood storage capacity and not result in an increase in flood stages in a meaningful way. The removal of existing structures and replacement with new structures is not expected to result in any significant displacement of flood waters. Engineering analyses are being completed to confirm these preliminary conclusions. If the impact within the floodplains is not determined to be negligible in comparison to the extent of the floodplains, compensatory flood storage volume will be designed to mitigate permanent impacts on 100-year floodplains.

Best management practices, as detailed in National Grid's Environmental Guidance document EG-303, will be employed to minimize disturbances to wetlands during construction of the Project. The boundaries of the wetlands and watercourses along the ROW will be clearly demarcated by a qualified wetland scientist prior to the commencement of work. When working in or traversing such wetlands, the Applicant will:

- Install, inspect, and maintain soil erosion and sediment controls and other applicable construction BMPs.
- Limit grading for access roads and structure foundations in wetlands to the amount necessary to provide a safe workspace.
- Install temporary swamp matting or geotextile and stone pads for access roads across wetlands or to establish safe and stable construction work areas/ pads within wetlands, where necessary. The type of stabilization measures to be used in wetlands will depend on soil saturation and depth of organic matter.
- Restore wetlands, after transmission facility construction, to pre-construction configurations and contours to the extent practicable.
- Comply with the conditions of federal and state permit conditions related to wetlands.
- Pile cut woody wetland vegetation so as to avoid blocking surface water flows within or otherwise to adversely affect the integrity of the wetland.
- Cut forested wetland vegetation without removing stumps unless it is determined that intact stumps pose a safety concern for the installation of structures, movement of equipment, or the safety of personnel.
- Avoid or minimize access through wetlands to the extent practical. Where access roads must be improved or developed, the roads will be designed, where practical, so as not to interfere with surface water flow or the functions of the wetland.
- Install temporary soil erosion controls around work sites in or near wetlands to minimize the potential for soil erosion and sedimentation.
- Refuel construction equipment (apart from equipment that cannot practically be moved) 100 feet or more from a wetland. If refueling must occur within a wetland, secondary containment will be used.
- Store petroleum products at least 100 feet from a wetland.

- Restore structure work sites in and temporary access ways through wetlands following the completion of line installation activities.
- The Applicant will implement the following mitigation measures to minimize the potential impacts of construction activities in or near watercourses:
  - Maintain ambient water flows (if water is present at the time of construction) and not constrain or interrupt the flow at any time during construction.
  - Minimize the installation of new culverts at currently day-lighted stream reaches to the greatest extent feasible.
  - Maintain existing riparian zone vegetation, to the extent feasible, along the banks of the watercourse.
  - Install controls to prevent or minimize turbidity and sediment loading into watercourses. These controls may include the use of crushed stone approach aprons onto mat bridges, stone check dams, water bars, diversion channels, soil erosion controls, turbidity curtains and floating booms.
  - Stream fords will be installed during low flow periods. Clean, washed stone will be used at stream ford crossings.
  - Install mat bridges or other bridging techniques to span watercourses, or use other stream crossing techniques, such as temporary or permanent culvert crossings. Avoid installing temporary bridging during peak flows, or when the waterway to be crossed is above bank-full width conditions; with the exception of emergency situations or other unforeseen circumstances.
  - The specific measures that will be implemented to protect amphibians will be in accordance with National Grid’s Environmental Guidance (EG-303) and further defined in consultation with the applicable regulatory agencies.

Compensatory wetland mitigation for the unavoidable impacts to wetlands, streams, and/or other aquatic resources as a result of the proposed Project is necessary in order to meet environmental criteria for activities to be permitted under the federal requirements (i.e., Sections 401 and 404 of the Clean Water Act – 33 United States Code [U.S.C.] § 1344 and 33 U.S.C. § 1251, respectively), and the April 10, 2008 Final Compensatory Rule (33 CFR Part 332). The USACE, New England District has developed a revision of the New England District Compensatory Mitigation Guidance, dated September 07, 2016, for use in reviewing all mitigation for unavoidable impacts (permanent, temporary and secondary impacts) to aquatic resources.

The Applicant will comply with all applicable wetland regulatory permit requirements and conditions, as well as the associated Project plans and specifications submitted in support of these permit applications. EG-303 describes typical BMPs for construction activities and includes guidance from the ROW Vegetation Management Policies and Procedures.

9.2.1.2 Surface Water and Groundwater Resources

For work along the Project ROW, the Applicant will require their contractors to adhere to BMPs regarding the storage and handling of oil and potentially hazardous materials during construction of the Project. Further, the Applicant will require their contractors to adhere to a standard emergency response plan or a Project-specific spill prevention, containment, response, and reporting plan. Equipment refueling and equipment/material storage will not be permitted within 100 feet of any wetland or waterbody, with the exception of equipment that cannot be feasibly moved from its working location (e.g., drilling equipment, dewatering pumps). Secondary containment will be used at these refueling locations. Contractor staging areas and contractor yards typically will be located at existing developed areas (parking lots, existing yards), where the storage of construction materials and equipment, including fuels and lubricants, will not conflict with protection of public surface water supplies or wetland resources.

Dewatering will be necessary during excavations for pole structures adjacent to or within wetland areas. Dewatering discharge water will be pumped into a straw bale or silt fence settling basin which will be located in approved areas outside wetland resource areas. Other dewatering options will include pumping into a temporary storage tank. The pump intake hose will be suspended above the bottom of the excavation throughout dewatering. The basin and all accumulated sediment will be removed following dewatering operations and the area will be seeded and mulched. Additionally, mud boxes will be used to temporarily store drilling muds (used during drilling operations for installing structures) until the drilling muds can be transported to an approved disposal location or spread in an approved upland area.

9.2.1.3 Rare, Threatened, and Endangered Species

The following state-listed rare plant species have been identified on or within the immediate vicinity of the ROW: rock harlequin, American yew, Northern beech fern, and hobblebush. In general, rock harlequins are adapted to the existing site conditions promoted by the on-going vegetation management practices implemented along the ROWs; in some cases, they have shown an affinity to disturbed areas, such as those found along the regularly maintained ROW. Periodic disturbances to the vegetative community associated with management and maintenance of the ROW can create early successional habitats that could promote the further establishment of rock harlequin on the ROWs. Tree clearing could have an impact on some state-listed plant species such as Northern beech fern and hobblebush, plants which grow in the forest understory. Opening the tree canopy may affect the current populations of Northern beech fern and hobblebush.

As a mitigation measure, the Applicant will conduct pre-construction reconnaissance sweeps/surveys to locate any populations of these plant species within the ROWs. Any identified plant locations will be marked for avoidance during construction. In consultation with the RIDEM and RINHS, the Applicant will determine if any other mitigative measures are recommended for rare plant communities, such as transplanting the affected plants to a protected location outside of the construction area.

Tree clearing will be limited to outside the NLEB nesting season which is June-July.

9.2.1.4 Soil Erosion and Sediment Control

Soil erosion and sediment control devices will be installed along the perimeter of identified wetland resource areas prior to the onset of soil disturbance activities to ensure that excess soil piles and other impacted soil areas are confined and do not result in downslope sedimentation of sensitive areas. Woody species with a mature height greater than 10 feet will be cleared within specified portions of the ROW. Low growing tree species, shrubs, and grasses will only be mowed along access roads and at pole locations. To avoid disturbing the root mat, tree stumps will be left in place except at structure locations and within the footprint of proposed access roads or construction work pads. Soil erosion controls will be inspected on a regular basis and maintained or replaced as necessary.

The soil erosion and sediment control measures selected will be appropriate to minimize the potential for soil erosion and sedimentation in areas where soils are impacted. The Applicant will adhere to EG-303, and will prepare a project-specific Stormwater/ Soil Erosion and Sediment Control Plan, in compliance with the Rhode Island Soil Erosion and Sediment Control Handbook, the Rhode Island Stormwater Design and Installation Standards Manual, and the Wetland BMP Manual: Techniques for Avoidance and Mitigation. Typically, temporary soil erosion controls will be installed based on the specifications in the Stormwater/ Soil Erosion and Sediment Control Plan.

9.2.1.5 Supervision and Monitoring

Throughout the entire construction process, the Applicant will retain the services of an environmental monitor. The primary responsibility of the monitor will be to oversee construction activities including the installation and maintenance of soil erosion and sediment controls on a routine basis to verify compliance with all federal, state, and local permit commitments. The environmental monitor will be a trained environmental scientist responsible for supervising construction activities relative to environmental issues. The environmental monitor will be experienced in soil erosion control techniques described in this report and will have an understanding of wetland resources to be protected.

During periods of prolonged precipitation, the monitor will inspect all locations to confirm that the environmental controls are functioning properly. In addition to retaining the services of an environmental monitor, the Applicant will require the contractor to designate an individual to be responsible for the daily inspection and upkeep of environmental controls. This person will also be responsible for providing direction to the other members of the construction crew regarding matters of wetland access and appropriate work methods. Additionally, all construction personnel will be briefed on project environmental compliance issues and obligations prior to the start of construction. Regular construction progress/environmental training meetings will provide the opportunity to reinforce the contractor’s awareness of these environmental issues.

9.2.2 Mitigation of Social Resource Impacts

The Applicant will minimize social resource impacts during construction by incorporating several standard mitigation measures. The use of an established transmission line ROW, rather than a new ROW, for a majority of the Project length confines the potential for disruption of existing land uses due to construction activities to an area already dedicated to transmission line uses. Construction generated noise will be limited by the use of mufflers and other feasible devices on all construction equipment. Dust will be controlled by wetting and stabilizing access road surfaces, as necessary, and by maintaining crushed stone aprons at the intersections of access roads with paved roads.

In order to mitigate impacts to social resources, the Applicant will designate an ombudsman for the Project who will be responsible for outreach during construction and who will provide a consistent point of contact for the public. By notifying landowners and abutters of planned construction activities before and during Project construction, the Applicant will minimize the potential for disturbance from construction, and be positioned to address any concerns expressed by local residents.

Some short-term impacts are unavoidable, even though they have been minimized. By carrying out the construction of the line in a timely fashion, the Applicant will keep these impacts to a minimum. The construction of the new lines in the existing ROW may cause some temporary disturbance to the abutting property owners.

The Applicant will prepare traffic management plans, as necessary, which will minimize impacts associated with Project construction traffic on local roadways.

If cultural or archaeological resources or properties are discovered during construction, the contractor will be directed to halt the task and the Applicant will consult with the USACE, RIHPHC and Tribal Historic Preservation Officer (THPOs). Removal or alteration of stonewalls will be minimized to the extent practical.

9.3 Post-Construction Phase

Following the completion of construction, the Applicant will implement the following standard and site specific mitigation measures to minimize the impact of the Project on the natural and social environment.

9.3.1 Mitigation of Natural Resource Impacts

Restoration efforts, including final grading and installation of permanent soil erosion control devices, and seeding of impacted areas, will be completed following construction. Construction debris will be removed from the Project site and disposed of in accordance with TNEC's policies and procedures. Pre-existing drainage patterns, ditches, roads, fences and stone walls will be restored to their former condition, where appropriate. Permanent slope breakers and soil erosion control devices will be installed in areas where the impacted soil has the potential to impact wetland resource areas.

Vegetation maintenance of the ROW will be accomplished with methods identical to those currently used in maintaining vegetation along the existing lines on the ROW. TNEC's ROW vegetation practices encourage the growth of low-growing shrubs and other vegetation which provides a degree of natural vegetation control. In addition to reducing the need to remove tall growing tree species from the ROW, the vegetation maintained on the ROW inhibits soil erosion.

TNEC's existing transmission line easements restrict certain activities within the ROWs. Easements typically prohibit the construction of buildings, pools, and other structures within the ROWs. In addition, TNEC routinely works with landowners to discourage unwarranted access onto and use of its ROWs by third party users of off-road vehicles such as ATVs and snowmobiles. Locked gates are installed along the ROW at many public access points to prevent unauthorized off-road vehicular use of the ROWs.

9.3.2 Mitigation of Social Resource Impacts

Where possible, and where it may be effective, TNEC will limit access to the ROW by installing permanent gates and barriers where access roads enter the ROW from public ways.

Where TNEC holds an easement rather than land ownership in fee, TNEC must receive landowner approval prior to installing barriers (such as fences, gates, and access control berms) to discourage such access onto the ROWs.

As appropriate, stone walls that are removed or breached by construction activities will be repaired or rebuilt. Rebuilt stone walls will be placed on the same alignment that existed prior to temporary removal, to the extent that it will not interfere with transmission line operation or maintenance.

10.0 PERMIT REQUIREMENTS

The Applicant anticipates the need to obtain permits under the following federal, state and local statutes and regulations, as applicable, prior to the construction of the Project.

10.1 Federal Permits

10.1.1 United States Army Corps of Engineers

The Project requires an USACE Department of Army Individual Permit under Section 404 of the Clean Water Act for the discharge of fill material to waters of the U.S., including wetlands, in connection with tree removal in wetlands, structure installation in wetlands, and the improvements to and construction of certain access roads in jurisdictional wetlands and watercourses. This Section 404 Application will be filed with the USACE in the near future.

The USACE review of the Project will involve joint coordination with other federal agencies including the USFWS, the USEPA, and the National Park Service (NPS). The USFWS requires documented consultation with regard to compliance with Section 7 of the Endangered Species Act of 1973. The USEPA may provide comments to the USACE application. The NPS may be involved with consultations due to the newly established Blackstone River Valley National Historical Park, whose final boundaries have yet to be fully defined (NPS 2016).

The Project will require consultation with the RIHPHC and the applicable THPOs in compliance with Section 106 of the National Historic Preservation Act. The applicable THPOs for this Project include: the Narragansett Tribe THPO and the Wampanoag Tribe of Gay Head (Aquinnah) THPO.

10.2 State Permits

10.2.1 EFSB License

The Project will require a license to construct a major energy facility from the EFSB pursuant to R.I.G.L. § 42-98-1 et seq.

10.2.2 RIDEM Freshwater Wetlands Permit

The Project will require a permit to alter freshwater wetlands from RIDEM pursuant to R.I.G.L. § 2-1-18 et seq. for alteration of freshwater wetlands in connection with the construction of certain structures and access roads. The RIDEM Freshwater Wetland Program has regulatory authority over proposed work activities that may affect freshwater wetlands, 50-foot perimeter wetlands associated with emergent marshes (1+ acres in size) and wooded swamps (3+ acres in size), and 100-foot and 200-foot riverbank wetlands associated with any flowing body of water. The Applicant will be submitting a Freshwater Wetlands Application to the RIDEM in the near future.

10.2.3 Water Quality Certification

In accordance with Rule 13 of the Rhode Island Water Quality Regulations, the Project will need a water quality certification from RIDEM under Section 401 of the Clean Water Act. It is expected that the water quality certification will be issued as part of the freshwater wetlands permit. The Applicant will be submitting a Clean Water Act Section 401 Water Quality Certification Application to the RIDEM in the near future.

10.2.4 RIPDES Stormwater Discharge Associated with Construction Activities

The Project will require a permit from RIDEM for approval of stormwater discharge associated with construction activities pursuant to Rule 31 of the RIPDES Regulations. It is expected that the Project will qualify for authorization under the General Permit and will be automatically authorized as part of the freshwater wetlands permit. The Applicant will be submitting a RIPDES Application, including a Soil Erosion and Sediment Control Plan, to the RIDEM in the near future.

10.2.5 RIDOT Permits

The Project will require highway utility permits from the RIDOT for the installation of wires across state highways and access from state highways during construction pursuant to R.I.G.L. Chapter 8 of Title 24. The Applicant will prepare, as necessary, traffic management plans for proposed work activities which will cross over state highways and may occur within the shoulders of the state highways.

10.3 Local Permits and Approvals

The Project may require local permits based upon the “Revised General Ordinances, Town of Burrillville, Rhode Island” (2015). Local permits (zoning, construction work hours, and soil erosion and sediment control) described below reference these ordinances.

10.3.1 Zoning

The Project will require a dimensional variance from the height restrictions of the zoning ordinance, Burrillville Zoning Ordinance, § 30-111 (Table III). Planning Board review is also required because the Project is under the jurisdiction of the Energy Facility Siting Board, Burrillville Zoning Ordinance, § 30-201(c)(8).

10.3.2 Construction Work Hours

Burrillville limits construction work hours. As part of the permitting for the Project, the Applicant will seek relief from these restrictions to allow construction during additional hours. Section 16-35(b) of the Burrillville General Ordinances limits the emission of sound relative to construction activities between 7:00 a.m. and 6:00 p.m. during normal Eastern Standard Time, between 7:00 a.m. and 8:30 p.m. during Daylight Savings Time, and prohibits it on Sundays.

10.3.3 Soil Erosion and Sediment Control

Burrillville has adopted local soil erosion and sediment control ordinances. The Town of Burrillville code requires that a Determination of Applicability must be filed with the Building Inspector for approval (Burrillville Ordinance Sections 12-61-73). The Ordinance exempts certain activities including the following: excavations for an improvement that: a) does not result in a total displacement of more than 50 cubic yards of material; b) has no slopes greater than 10 feet vertical in 100 feet horizontal or approximately 10 percent; and c) has all disturbed surface areas promptly and effectively protected to prevent soil erosion and sedimentation. The Applicant will consult with the Burrillville Building Inspector and incorporate the Town's requirements into the overall Project.

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