Stantec

Environmental Impact Assessment Registration Document for 138 kV Reliability for Fredericton South

November 1, 2019

Prepared for:

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1.0 INTRODUCTION

This document is the registration document for the Environmental Impact Assessment (EIA) for the project titled 138 kV Reliability for Fredericton South, (the Project) being proposed by the New Brunswick Power Corporation (NB Power) (the proponent). The Project consists of the construction and operation of a new 138 kV transmission line near Fredericton, New Brunswick (Figure 1.1). This Project will be financed entirely by NB Power. No applications for grants or loans of capital funds from any other government agency will be submitted for this Project.

This document is submitted to the New Brunswick Department of Environment and Local Government (NBDELG) as part of the environmental impact assessment (EIA) registration under Section 5(2) of the *Environmental Impact Assessment Regulation* 87-83 of the *Clean Environment Act*.

1.1 ORGANIZATION OF THIS DOCUMENT

This document is organized into ten chapters, as follows:

- Chapter 1.0 provides introductory information regarding the Project, including Project scope, information on the proponent, the purpose of the Project, and the regulatory framework that is anticipated to apply to the Project.
- Chapter 2.0 provides a description of the Project, including location; siting considerations; components and infrastructure; how construction, operation, and decommissioning and abandonment will be achieved; mitigation of potential environmental effects through Project design; and anticipated workforce and schedule.
- Chapter 3.0 provides an overview of the environmental setting of the Project.
- Chapter 4.0 provides a description of the methods used to assess potential interactions between the Project and valued components (VCs)
- Chapter 5.0 contains a description of existing environmental conditions and information regarding the assessment of potential environmental effects as a result of interactions between the Project and the VCs, and mitigation for those interactions.
- Chapter 6.0 provides a summary of mitigation for the Project, through design and in response to potential interactions between the Project and valued components.
- Chapter 7.0 outlines public involvement activities conducted to date and planned for the Project.
- Chapter 8.0 describes the Aboriginal engagement activities conducted to date and planned for the Project.
- Chapter 9.0 includes closing remarks and a statement of limitations about use of this document.
- Chapter 10.0 lists the references cited in this report.

1.2 OVERVIEW OF THE PROJECT

NB Power is proposing to improve the reliability of its electrical transmission infrastructure near Fredericton, New Brunswick. The Project consists of the construction a new 16.1 km-long, 138 kV

transmission line that will be constructed within an existing transmission line easement between the Rainsford Substation in Fredericton and the Mactaquac Terminal near the Mactaquac Generating Station (MGS) in York County, New Brunswick (Figure 1.1). The Project will include 15.5 km of new right-of-way (RoW) that will be established along the southern edge of the existing RoW of Line 1135 such that 30 m of new RoW will require clearing. The remaining 0.56 km of the 16.1 km total RoW will occur within the existing RoW of Line 1135. The Project also incorporates infrastructure upgrades and/or modifications to several existing substations to improve the overall reliability of transmission infrastructure in the Fredericton area. The Project would include the following major components and infrastructure:

- A 16.1 km-long, 30 m-wide RoW within an existing NB Power easement for the new 138 kV transmission line including wood H-frame poles and angle structures
- Conducting wires and insulators
- Various substation and terminal circuits, tap off structures, breakers, switches, lightning arrestors, and transformers

1.3 PROPONENT INFORMATION

NB Power's responsibilities include the operation and maintenance of the high voltage electricity transmission system in New Brunswick and to serve as a common carrier, providing access to all parties wishing to use the transmission system for delivery of electricity within the province, for exports, or for wheeling through by other parties.

As such, the proponent for the proposed undertaking is as follows:

Name of Proponent	New Brunswick Power Corporation (NB Power)
President & Chief Executive Officer	Mr. Gaëtan Thomas
Mailing Address of Proponent	P.O. Box 2000, 515 King Street Fredericton, NB E3B 4X1
Contact Person for this EIA Registration	Mr. Matthew Gorman Corporate Environmental Services NB Power P.O. Box 2000, 515 King Street Fredericton, NB E3B 4X1
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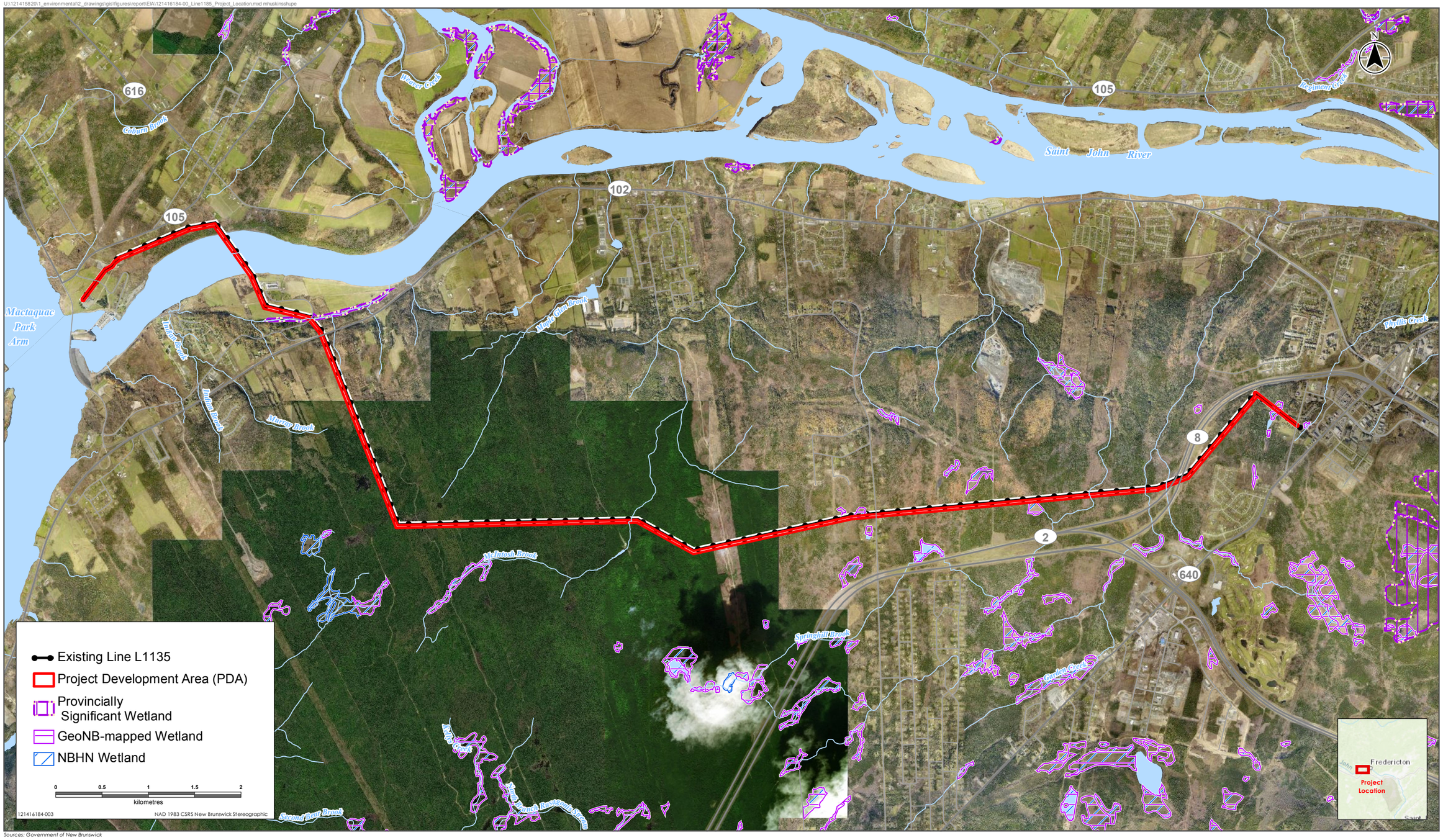

Sources: Government of New Brunswick

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Project Location

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121416184 - 138 KV RELIABILITY FOR FREDERICTON SOUTH

Figure 1.1

1.4 PURPOSE/RATIONALE/NEED FOR THE UNDERTAKING

NB Power's current Transmission and Distribution configuration leaves Fredericton South customers, including critical infrastructure and emergency services, vulnerable to infrequent interruptions that may take several hours or days to repair. Furthermore, current transmission capacity limits NB Power's ability to fully utilize the clean energy generation from the MGS under certain conditions. The Project will improve transmission capacity and provide two transmission lines into three key distribution substations allowing repairs to a transmission line to be completed with minimal interruption of electricity to customers.

1.5 REGULATORY FRAMEWORK

This section provides an overview of the anticipated major regulatory processes that could be applicable to the Project, including federal and provincial environmental assessment requirements and the roles of regulatory authorities.

1.5.1 Provincial

This section provides a brief description of the anticipated provincial environmental impact assessment, approval, and permitting processes that may apply to the Project.

1.5.1.1 New Brunswick Environmental Impact Assessment Regulation

The New Brunswick *Environmental Impact Assessment Regulation 87-83* under the *Clean Environment Act* (EIA Regulation) governs the EIA process in the province. The EIA Regulation requires that all undertakings listed in "Schedule A" of the Regulation (including their proposed construction, operation, modification, extension, abandonment, demolition, or rehabilitation) require registration and a "Determination Review" led by the NBDELG to review the Project's information and its potential environmental effects. At the conclusion of the Determination Review, the NBDELG's technical review committee (TRC) will make a recommendation to the New Brunswick Minister of Environment and Local Government as to whether a proposed undertaking can proceed, with or without conditions, or whether it requires a more formal Environmental Impact Assessment (referred to as a "Comprehensive Review").

The Project is an undertaking under the EIA Regulation, according to item (d) of Schedule A of the regulation, as follows:

> *"(d) all electrical transmission lines exceeding sixty-nine thousand volts in capacity or five kilometres in length."*

Based on the Project as currently conceived, a formal registration of the Project is therefore required under Section 5(1) of the EIA Regulation and will undergo, at minimum, a Determination Review, coordinated by NBDELG.

1.5.1.2 New Brunswick Species at Risk Act

Schedule A of the New Brunswick *Species at Risk Act* (NB *SARA*) lists species in New Brunswick that are classified as being *extirpated*, *endangered*, *threatened*, or of *special concern*. The NB *SARA*, by way of Section 28(2), prohibits the killing, harming harassing or taking of any species listed in Schedule A.

The Project will require a review of digitally accessible (i.e., office-based) data and a field assessment to determine the potential interaction with species listed under Schedule A of NB *SARA*, including their residences or critical habitat. If potential interactions with listed species are identified, the Project will implement measures to comply with the NB *SARA*.

1.5.1.3 New Brunswick Community Planning Act

The New Brunswick *Community Planning Act* governs the administration of regional development plans in the province and confers administrative power of planning authority and variance on regional service commissions. EIA registrations for undertakings occurring in areas with established regional development plans must include a letter from the planning authority indicating that the undertaking is in conformance with the regional plan (NBDELG 2012a).

NB Power is a Crown corporation of the Province of New Brunswick and derives its authority from the *Electricity Act*, S.N.B, 2013, c.7. As such, requirements of some provincial legislation such as the *Municipalities Act* and the *Community Planning Act* do not apply to NB Power because they do not expressly bind the Crown.

The Project is situated within the Regional Service Commission 11 (RSC 11) (GNB 2017a). RSC 11 will be informed of the Project and provided an opportunity to comment.

1.5.1.4 New Brunswick Heritage Conservation Act

Heritage resources in New Brunswick are regulated under the New Brunswick *Heritage Conservation Act*. The Act defines requirements relating to known heritage resources in the province and its municipalities, protection for heritage resources, permitting requirements for those doing research on and/or encountering these resources (Archaeological Field Research Permit or AFRP), and penalties for violations of the Act. The regulatory management of heritage resources falls under the New Brunswick Department of Tourism, Heritage and Culture (NBDTHC), and is administered by its Heritage Branch (for built heritage resources and palaeontological resources) and its Archaeological Services Branch (for archaeological resources). The NBDTHC also manages and maintains provincial heritage databases, coordinates the administration of provincial legislation including archaeological permitting, and participates in environmental assessment reviews and land use policy and planning.

1.5.1.5 Other Potential Provincial Permit Requirements

Table 1.1 contains a representative list of other provincial permits, approvals, and authorizations that may be applicable to the Project. Note this is not necessarily an all-inclusive list.

Table 1.1 Other Potential Provincial Permit Requirements

Project Component	Permit, Approval, or Authorization	Issuing Provincial Agency
Right-of-Way (RoW)	(Archaeological) Site Alteration Permit	New Brunswick Archaeological Services Branch, Department of Tourism, Heritage, and Culture
	Watercourse and Wetland Alteration Permit - *Clean Water Act*	New Brunswick Department of Environment and Local Government, Sustainable Development, Planning and Impact Evaluation Branch, Surface Water Protection Section
	Highway Usage Permit– *NB Highway Corporation Act*	New Brunswick Highway Corporation
	Access Permit	New Brunswick Department of Transportation and Infrastructure
	Work Permit	New Brunswick Department of Energy and Resource Development
	Crown Lands - License of Occupation	New Brunswick Department of Energy and Resource Development

1.5.2 Federal

This section provides a brief description of the anticipated federal environmental assessment, approval, and permitting processes that may apply to the Project.

1.5.2.1 Impact Assessment Act

The *Impact Assessment Act* (I*AA*) came into force on August 28, 2019 and defines the requirements for federal environmental assessments (EA) in Canada. *IAA* applies mainly to "designated projects", which are the physical activities listed under the *Physical Activities Regulations* under *IAA*, as well as physical activities carried out on federal land. The *Physical Activities Regulations* identify 61 "Physical Activities" that constitute Designated Projects requiring EA under *IAA*. Item 39 of the Schedule to the *Physical Activities Regulations* includes:

> *"**39** The construction, operation, decommissioning and abandonment of either of the following:*
>
> ***(a)** a new international electrical transmission line with a voltage of 345 kV or more that requires a total of 75 km or more of new right-of-way;*
>
> ***(b)** a new interprovincial power line designated by an order under section 261 of the* Canadian Energy Regulator Act.

Since the transmission line is neither international nor interprovincial, nor does the voltage and length of the new transmission line exceed these thresholds, the Project is not a Designated Project under *IAA*.

Further, as no component of the Project will be built on federally regulated or owned land, it is not expected that the proposed Project will require an environmental assessment under *IAA*.

1.5.2.2 Species at Risk Act

The federal *Species at Risk Act* (*SARA*), by way of Schedule 1, lists species in Canada that are classified as being *extirpated*, *endangered*, *threatened*, or of *special concern*. The species listed in Schedule 1 are afforded special measures to protect them and assist in their recovery. These special measures include, amongst other things, prohibitions against:

- Killing, harming, or harassment of these species
- Damage or destruction of their residences
- Destruction of any part of their critical habitat

The Project will require a review of digitally accessible (i.e., office-based) data and a field assessment to determine the potential for Project interaction with any *SARA* Schedule 1 listed species, including their residences or critical habitat. If potential interactions with listed species are identified, the Project will implement measures to comply with the *SARA*.

1.5.2.3 Fisheries Act

The federal *Fisheries Act* has recently been amended and come into force (August 28, 2019). The *Fisheries Act* defines the requirements for protecting fish and fish habitat in Canada. Specifically, the Act specifies that any activity that could result in the death of fish (by means other than fishing, Section 34.4) or the harmful alteration, disruption or destruction (HADD) of fish habitat requires an authorization to be issued, with appropriate offsetting for residual environmental effects of the activity.

Additionally, Section 36(3) of the *Fisheries Act* states that it is illegal to release deleterious substances into a fish-bearing watercourse or waterbody without an authorization. A deleterious substance is considered any substance that can degrade water quality such that it becomes harmful to fish or fish habitat.

1.5.2.4 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (*MBCA*), by way of *Migratory Birds Regulations* and *Migratory Birds Sanctuary Regulations*, defines the provisions by which an estimated 450 native species of migratory birds (including their nests and eggs) are protected in Canada. In the event that activities have the potential to interact with migratory birds in a manner that contravenes *MBCA* regulations, the Project will implement measures to comply with the *MBCA*.

1.6 PROPERTY OWNERSHIP

The proposed new 138 kV transmission line will be located primarily on private land. The transmission line RoW will cross 63 parcels of land, including 51 parcels of private land (including NB Power-owned land and one industrial freehold property) (representing 41.8 ha or 85.0% of the 49.2 ha RoW) and 12

parcels of Crown or otherwise public land (representing 7.4 ha or 15.0% of the RoW). The Project as planned will occur within existing NB Power easements; however, NB Power will negotiate additional options for easements with the private landowners, where applicable.

Upgrades and reconfigurations to existing substations will occur within their current footprints. No additional easements will be required.

1.7 PROJECT-RELATED DOCUMENTS

This EIA registration includes other relevant documents:

- Species at Risk (SAR) and species of conservation concern (SOCC) for the Project area provided by the Atlantic Canada Conservation Data Centre (AC CDC) included in Appendix B
- An information package related to the Project which will be provided to landowners, and will be included as part of the public consultation report, attached as Appendix F

Other than this EIA registration document and the appended information, there are no additional Project-related documents that are publicly available.

2.0 PROJECT DESCRIPTION

This chapter provides information on environmental planning and management, location, siting considerations, and specific components and infrastructure of the Project as it is currently conceived. A description of Project's construction and operation and maintenance activities, mitigation by design, and the anticipated workforce and schedule are also included.

2.1 ENVIRONMENTAL PLANNING AND MANAGEMENT

NB Power is a responsible and established proponent with almost 100 years of experience in the planning, design, construction, operation, distribution, and management of electrical power generation and transmission in New Brunswick. Currently, NB Power maintains and operates 6,849 km of transmissions lines that are supported by 48 industrial substations and 49 terminals (NB Power 2019).

NB Power, through the Transmission System Operator, owns and maintains the New Brunswick transmission grid as the hub of the Maritimes Area, and is one of only 16 Reliability Coordinators in North America with the authority and means to prevent or mitigate emergency situations in order to maintain system reliability (NERC 2017). The management of the Maritimes Area electrical grid incorporates 15 interconnections in New Brunswick with Québec, Nova Scotia, PEI, and New England, including northern Maine.

NB Power will carefully plan and manage all aspects of this Project from initial design to development to site reclamation. Examples of the methods and tools that NB Power will use to avoid, mitigate, and otherwise manage potentially adverse environmental effects include the following, with reference to the document section where more detail is provided:

- Review of the major regulatory processes that may apply to the Project (Section 1.5)
- Identification of potential sources of emissions and wastes related to the Project (Section 2.9)
- Consideration of potential accidents, malfunctions, and unplanned events (Section 2.10)
- Assessment of potential interactions between the Project and the environment which incorporates experience gained from public, regulator, and First Nations engagement on four recently (2017-2018) approved transmission line EIAs (Chapter 5.0)
- Summary of proposed mitigation (Chapter 6.0)
- Development of a Project-Specific Environmental Management Plan (PSEMP) that follows from the Environmental Protection Plan for New Brunswick Power Corporation Transmission Facilities (NB Power 2012). The PSEMP provides the framework for the management and monitoring of environmental and socio-economic mitigation measures that satisfy corporate and regulatory requirements, best management practices, as well as input from stakeholders and First Nations. The PSEMP defines roles and responsibilities for employees and contractors and includes plans and procedures to address situations that may occur during construction. The PSEMP will be submitted to the TRC for review following receipt of an approval, and prior to the initiation of construction

2.2 PROJECT LOCATION

The Project will be located in central New Brunswick, in York County near the city of Fredericton. The Project Development Area (PDA) of the new transmission line (refer to Section 4.3) will be approximately 16.1 km in length, with a 30 m wide RoW (Figure 1.1). The 30 m RoW, shown in Figure 1.1 as the PDA, will begin at the 6137 Rainsford Substation and run west for approximately 0.56 km within the existing 60 m RoW for Line 1135. The new transmission line will then turn south and run parallel and immediately south of the existing Line 1135 for approximately 15.5 km to the 4125 Mactaquac Terminal. This 15.5 km section of new transmission line will occupy an additional 30 m of RoW immediately south of the existing 30 m-wide RoW currently occupied by Line 1135. As the new RoW is within an existing NB Power easement, NB Power will not require any additional easements for this Project (see Section 2.4.5 for an explanation of “easement” versus “RoW”).

The upgrades and reconfiguration of existing substations and terminals will occur within their existing footprints and are not part of the Project PDA. The location of substations and terminals that will be modified in support of this Project are shown in Figure 2.1.

2.3 SITING CONSIDERATIONS

NB Power determined that the most environmentally, socially, and economically feasible route for the Project was to use the existing RoW for the existing transmission Line 1135 and widen it by approximately 30 m to accommodate the new line. This proposed route reduced the amount of new RoW that would transect undeveloped greenfield areas, and limited, to the extent practicable, interactions with contiguous forested and residential properties. The proposed route allows for the shortest distance to supply the Rainsford Substation from the new 138 kV transmission Line (Figure 1.1).

NB Power also incorporated industry-recognized engineering and design principles with particular attention to the type and number of structures in order to reduce the overall environmental footprint. Terrain constraints such as accessibility, slope, and crossing windows were also considered when selecting the route.

The practices used in selecting the proposed route have negated the need for a route alternatives analysis. A summary of selected environmental attributes of the proposed route follows in Table 2.1.

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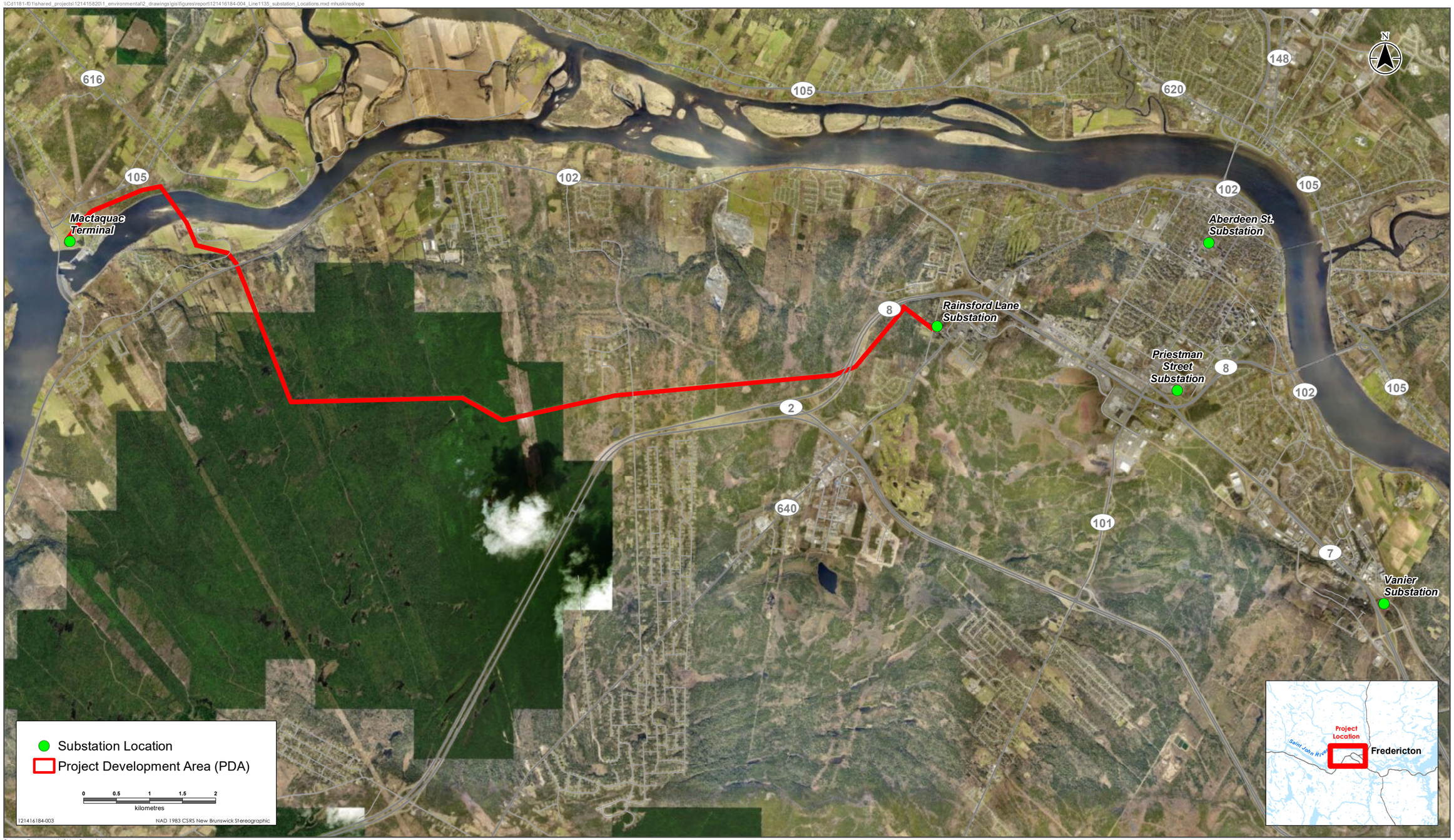

Sources: Government of New Brunswick

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Substation Locations

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121415820 - TWINNING OF LINE L1135 MACTAQUAC TO RAINSFORD LANE

Figure 2.1

Table 2.1 Summary of Environmental Attributes for the Proposed Route

Constraint/Attribute	Quantity
Total length of PDA	16.1 km
Number of properties crossed	63
Amount of private land crossed	41.8 ha
Amount of Crown/public land crossed	7.4 ha
Number of First Nations communities crossed	0
Amount of agricultural land crossed	4.5 ha
Amount of forest crossed	23.5 ha
Number of confirmed watercourse crossings	12 (including the Saint John River)
Number of Environmentally Significant Areas crossed	1
GeoNB-mapped wetland area affected	0.6 ha
Number of roads crossed	6
Number of protected wellfields	0
Number of pits / mines / quarries	0.7 ha
Known occurrence of rare species (no. of individuals)	9
Amount of elevated archaeological potential crossed[1]	10.3 ha
1 Archaeological Services, a branch of the New Brunswick Department of Tourism, Heritage, and Culture	

2.4 DESCRIPTION OF PROJECT COMPONENTS FOR TRANSMISSION LINE

A high-voltage transmission line consists of a series of structures which support conductor wires that carry electricity. Various structure types and configurations exist to support the conductors such as wood pole H-frame, dead-ends, and strain configuration structures. During the initial planning stages of the transmission line, an economic evaluation was carried out to determine the structure type. Factors considered include material cost, cost of structure assembly and erection, structure heights and strength, hardware cost, and available RoW. Environmental and social factors, such as weather, climate change, and property boundaries, are also considered.

2.4.1 Structure Type

Standard structure types to be used for this Project include 2-pole wood H-frames, 3-pole wood dead-end structures, and 3-pole wood strain configuration structures. The latter two structures are required where angle changes along the route occur (Figure 2.2). These structure types will be approximately 15 m to 20 m in height and consist of wooden poles treated with chromated copper arsenate (CCA) for durability. The use of CCA pressure-treated wood, currently authorized for use in Canada (HCPMRG 2011), protects the wood against fungi and insects, and provides extra protection against moisture content changes (Environment Canada 1999). Untreated wooden poles from hemlock, tamarack, and cedar were

not considered for this Project as they are more susceptible to decay from wood rot or damage from wood boring insects which would lead to structural weakening and possibly pole failure. CCA-treated poles have greater wood stability and resistance to splitting, which substantially extends the service life of the wood (i.e., from less than 10 years to 40 years) and increases its durability. In addition, this type of treatment provides resistance to electrical currents and facilitates the climbing of poles by line maintenance staff (Environment Canada 1999). CCA-treated poles are widely available and have the lowest cost. They are a proven product, derived from a renewable resource, are readily available and locally produced. Alternative pole materials (e.g., pre-cast concrete, corrosive-resistant steel, and plastic lumber) have proven to be cost prohibitive and were not considered for this Project.

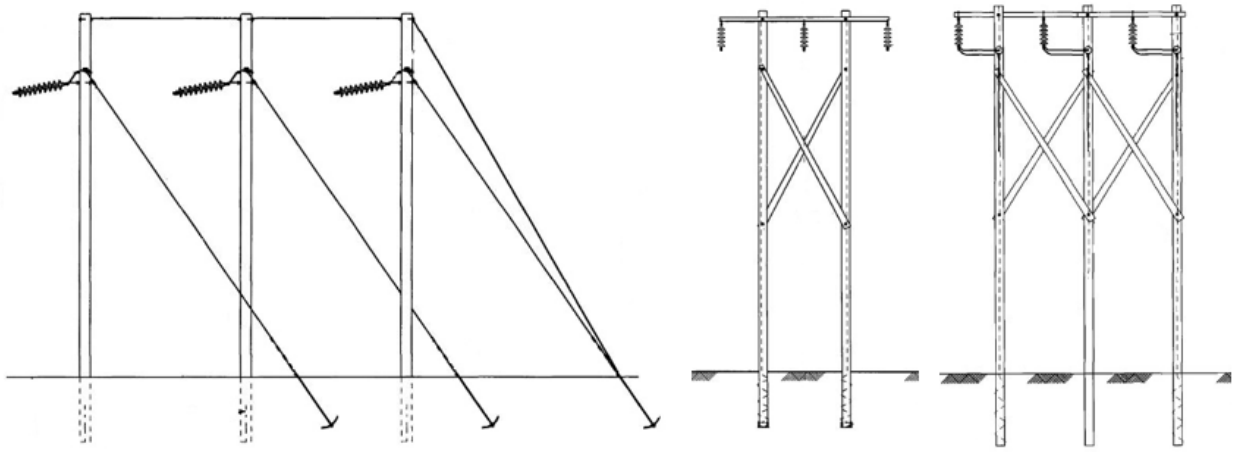

Figure 2.2 Example of structures proposed for new 138 kV transmission line. Left: 3 pole angle structure. Middle: Suspension structure with steel cross-arm, x-brace. Right: Dead-end tangent structure. Images provided by NB Power.

Structures are used to support the high-voltage conductors and to provide minimum clearance to ground, to objects under the transmission line, and at road crossings. The distance between structures (span) and their height is determined by the topography of the area and the clearance requirements and are designed to withstand known weather conditions and other related constraints. The average height from ground to insulator of the wooden H-frame structure will be approximately 16 m. The span between structures will be approximately 145 m on average. Three conductor wires will be strung to the insulators, with a spacing of approximately 3.8 m between them. Angle structures (e.g., dead-end structures) will be anchored with six to seven guy wires where the line turns and terminates. Poles will be reinforced with a cross arm and cross braces. Based on preliminary line design analysis, it is expected that approximately 103 structures will be required for the construction of the new 138 kV transmission line.

Final structure and pole locations will be determined based on geotechnical field surveys and LiDAR terrain analysis. This will reflect detailed engineering analysis with respect to span, length, local soil conditions, topographic and geologic features, and proximity to existing infrastructure.

Subject to detailed engineering analysis, structure, and pole placement to avoid known constraints or sensitive environmental conditions has been identified as a mitigation measure to reduce environmental effects, where practicable.

2.4.2 Guy Wires and Anchors

Although specific information regarding anchor requirements for guy wires at angle structures and strain configuration structures has yet to be determined, cross plate anchors, rock anchors, or log anchors may be used depending on structure location.

Rock anchors will be required in areas where bedrock is present and screw type anchors are not feasible. Wedge style anchors and grouted rock anchors are typical rock anchor configurations. Grouted rock anchors are best suited for areas of fractured bedrock and will most likely be used. Bedrock is drilled to a specific depth and the grouted rock anchor is installed and backfilled with grout to the surface, preventing the anchor from pulling back through the bedrock while under tension.

Log anchors may be used as required. Log anchors will be installed in soft areas (e.g., wetlands) or at structure locations under high tension. Log anchors consist of a 1.2 to 1.8 m section of pole that is typically buried lengthwise approximately 2.4 m under the ground surface. Tension cables are attached to anchor rods through logs and structures; the excavation is then backfilled and the soil compacted.

2.4.3 Conductors and Insulators

There are several types of conductors available for use, which depend on a number of factors that are typically considered during preliminary design. A 795 MCM 26/7 Aluminum Conductor Steel-Reinforced (ACSR) conductor will be used for the transmission line itself. This ACSR wire design, which has been an industry standard since the early 1900's, provides optimal strength without sacrificing ampacity (Southwire© 2019). The 795 MCM ACSR is composed of 26 strands of aluminum alloy wire surrounding a core of seven galvanized steel strands. The outside diameter of the wire is approximately 28 mm and is suspended from the cross arms by insulator strings.

2.4.4 Counterpoise and Overhead Ground Wire

Lightning strikes on transmission lines pose a significant risk to the stability of the electrical network. In order to mitigate impact to the proposed transmission line, two 9 mm diameter steel cables, called overhead ground wire (OHGW), will be strung above the conductor for the whole length of the line. The OHGW are to protect the transmission line and substation apparatus from the high current and voltage surges present in lightning. In the event the line suffers a direct or indirect strike, these wires provide a path for the high current and voltage to safely discharge down through the structures and into the ground.

Counterpoise and pole bearing plates will be on all structures to improve ground capacities. Counterpoise is composed of No. 5 galvanized steel wire running the full length of the pole, spun multiple times around the overburdened portion of the pole and stapled to the butt where a bearing plate isn't present.

2.4.5 Easement and Width of Right-of-Way (RoW)

An easement is defined as a non-possessory, registered interest right acquired by one person on the land of another, permitting partial use of the other's land for a specific purpose, such as a RoW across it. For transmission line projects, an easement includes the right to build and erect certain towers and/or other supports, and/or trench for underground wires or cables. It also includes the stringing, placing, and maintaining from one tower or support to the other towers or supports, all necessary wires, cables, supporting cables, anchors and ground rods, and/or wires or cables in underground trenches, all works being for the purpose of conducting and transmitting electric power or signals to, on, or across related lands and premises. The "easement" allows for the construction and operation of a transmission line on part of a property while ownership of the entire parcel of land remains with the original owner. For this Project, no new easement will be required as there is already 30 m of easement on the south side of the existing 30-metre-wide transmission line RoW currently occupied by Line 1135.

The cleared width of the RoW is governed by a number of factors such as tree height, structure type, height of conductors, and sag of conductors, flashover distances, and safety factors for tree growth and conductor swing. To foster safe electrical clearances and prevent trees from falling onto the line or coming into contact with the conductors, the RoW is cleared of vegetation. The planned RoW width for the new 138 kV line will be 30 m. This is in addition to the existing 30 m of RoW for the adjacent Line 1135.

2.5 DESCRIPTION OF PROJECT COMPONENTS - MODIFICATIONS TO EXISTING TRANSMISSION LINES

Improving the reliability of electrical transmission to customers in the Fredericton South area also requires upgrades, modifications and/or reconfigurations to a number of existing transmission lines. A summary of proposed upgrades to substations and terminals is provided in Table 2.2 .Since these modifications do not require an expansion of the existing footprint, no further discussion is included.

Table 2.2 Proposed Upgrades to Existing Transmission Lines

Transmission Line	Description of Upgrade and/or Modification
1185	Reconfiguration (i.e., renumbering) of existing circuits and new configuration from Vanier Substation to Rainsford Substation from 1185-03 to 1185-02. Reconfiguration from Rainsford Substation to Mactaquac Terminal, and continuation from Structure 92 to Mactaquac terminal with new line for Line 1185.
1249	Tap off L1185 at Structure 47 to 1249-01 then onto 1249-02 at Priestman St. then onto Aberdeen Substation using existing Line 0033 circuit. Existing Line 0033 to upgrade capacitors and pole maintenance (if applicable) to be converted to 138 kV.

Table 2.2 Proposed Upgrades to Existing Transmission Lines

Transmission Line	Description of Upgrade and/or Modification
1174	Reconfiguration of existing circuits from Vanier Substation to Rainsford Substation from Structure 1 at Vanier Substation to Structure 84 at Rainsford Substation. New configuration starting from structure 1 at Vanier Substation 1174-04 (N/O) to Rainsford Substation 1174-02. New configuration from Mactaquac Terminal to Structure 92 will become Line 1174, and from Structure 92 to Rainsford Substation will also be designated Line 1174.
1248	Existing Line1185 section to be changed to Line 1248. Tap from Line 1174 to Line 1248 - 6124 Priestman Substation.
1104	Reconfiguration of existing circuits at Structure 01 at Marysville Terminal to Structure 23 Tap for Vanier Substation then onto various Taps ending at Coleson Cove Terminal. New configuration of Line 1104 circuit from Marysville Terminal to Vanier Substation to be changed to Line 1247. Separation of Line between Structures 22 and 23. L1104 will now start at 1174-04 and run to Coleson Cove L1104-B14 without further changes.
1247	Existing Line 1104 section to be changed to 1247 New configuration for new Line number 1247 to be assigned from Structure 01 Marysville Terminal to Structure 22, Line ending at 1185-03 Vanier Substation.
0033	Existing Line 0033 to be converted to 138KV. Various reconfigurations.

2.6 DESCRIPTION OF PROJECT COMPONENTS - SUBSTATION AND TERMINAL UPGRADES

High-voltage transmission substations and terminals consist of various components (e.g., support structures, transformers, breakers, switches, capacitor banks, controls, safety fencing). The Project will require upgrades and modifications to several existing substations and terminals to effectively and reliably manage the transmission of electricity to NB Power customers. No new substations or terminals are proposed for the Project. A summary of proposed upgrades to substations and terminals is provided in Table 2.3. Since these upgrades do not require an expansion of the existing footprint, no further discussion is included.

Table 2.3 Proposed Modifications to Substations and Terminals

Infrastructure	Location	Component[1]
Substation	Aberdeen 6100	Convert to 138 kV as part of existing transformer replacement project DT6100.
	Vanier 6118	Remove wood structures and connection from 1174 to switch 1174-05. Install foundations and steel for line switches 1174-03 and 1185-03. Install two new line switches (1174-05 and 1185-03) and associated leads.
	Rainsford 6137	Terminate the new line onto the dead-end structure on the south side of the substation. Install new line switch 1174-02 (including foundations and steel structure) along with floating dead-ends in the line. Relabeling existing line switches.
	Priestman 6124	Install foundations, steel structures and switches 1248-6124 and 1249-02. Install foundations, steel structure and tie switch 6124T1-T2. Install new dead-end structure and foundation for new switch 1249-01. Install new foundations and structures for current transformers (CTs) and install CTs.
	Doak Switching Station	Dismantle and removal of D33-01B. Removal of conductor related to reconfiguration of Line 1104 & Line 0033.
Terminal	Mactaquac 4125	Line 1185 Expansion Extension of terminal yard. Extension of Bus 1 & 2. Addition of four breakers and switches, line disconnect, potential transformers (PTs), lightning arrestors. Renumbering eight breakers and twelve switches. Annunciation upgrade for three bays. Reconfigure Teleprotection Circuits for L1174/L1104 Ch. 1&2 from Mactaquac and Marysville to Mactaquac and Coleson Cove. Run Fibre between Terminal and Telecom Buildings for new network infrastructure.
	Marysville 4198	Renumbering two breakers, five switches, and two jumpers. Annunciation upgrade for one Bay.
	Coleson Cove	Reconfigure Teleprotection Circuits for L1104/L1174 Ch. 1&2 from Marysville and Mactaquac to Coleson Cove and Mactaquac.

[1] Details on the renumbering of devices (e.g., breakers, switches, jumpers) are not provided as they do not constitute a change in infrastructure

2.7 PROJECT ACTIVITIES

The lifecycle of a newly designed transmission line involves initial construction, start-up and commissioning, ongoing operation and maintenance, and eventually decommissioning and abandonment. The activities associated with substation upgrades for this Project do not involve an expansion of their existing footprint, and are limited to modification to the existing components, ongoing operation and maintenance work, and eventually decommissioning and abandonment. The various activities around these phases as well as the various components of the Project are described separately below, but focus mainly on transmission line activities, as this is the only component of the Project that requires a new footprint.

The potential for unplanned interactions to occur between activities associated with the Project and the environment are discussed further in Section 2.10.

2.7.1 Substation and Terminals

While the existing fenced areas of the substations and terminals associated with this Project will not change from current conditions, some preparatory work within the existing fenced-in footprint will be required to accommodate the upgrades. Site preparation for the substations and terminals may include the addition and levelling of clean fill in preparation for the installation of containment pads and concrete foundations to support steel structural components such as ground grids. Tie transformers, switches, lightning arrestors, motors, capacitors, poles and dead end structures, and associated protection and control equipment will be installed. As the modifications will occur within the existing fenced-in areas, there are no other site preparation activities required for the substations and terminals.

Throughout the operating life of the substations and terminals, estimated to be 50 years, routine inspections, maintenance, and replacement of components will occur. These activities will be conducted within the existing and fenced in footprint of the substation are typically of short duration. While decommissioning of these substations is not currently envisioned, substations will be decommissioned or rebuilt at the end of their useful service lives, in accordance with the applicable standards and regulations current at that time. In the event that a substation(s) is no longer required, NB Power will provide the necessary information to the appropriate regulatory agencies so that the regulatory requirements are met prior to commencement of decommissioning activities. As such, decommissioning and abandonment of the existing substations is not discussed further in this document.

NB Power is a mature company, with an established environmental protection plan (EPP) (NB Power 2012) that is reviewed periodically for new or revised practices that arise from EIA or other reviews. NB Power uses experienced planners, operators, and certified contractors to modify its terminals. The modifications to the substations and terminals associated with this Project will occur within enclosed, previously disturbed sites, using pre-assembled components. Thus, opportunities for environmental interactions during planned activities related to the construction, operation and maintenance, or eventual decommissioning and abandonment of the substations and terminals will be limited to sound quality and traffic control. As such, planned activities related to these upgrades will only be assessed in this EIA

registration document in regard to their potential affects on the atmospheric and socioeconomic environments (see Sections 5.1 and 5.6).

2.7.2 Transmission Line

2.7.2.1 Project Construction

The construction of a transmission line typically involves the following activities:

- Site preparation including vegetation clearing
- Access and staging
- Excavation, pole placement, structure assembly, and installation
- Stringing conductors
- Connection of transmission line and substation
- Inspection and energization
- Clean-up/revegetation

Both tracked and wheeled equipment and vehicles are used to perform these activities. The type of equipment and vehicles may include, and is not limited to, the following: crane, excavator, auger, dump trucks, dozer, tractor trailer and all-terrain vehicles. A brief description of the construction details is provided below.

2.7.2.2 Vegetation Clearing

Clearing involves the removal of vegetation from the RoW which may prohibit the construction and the safe operation of transmission lines. The extent of vegetation removal will vary depending on the type of structure selected for the design and on vegetation heights. Some areas may not require cutting such as fields and farmland. Vegetation will be largely removed by mechanical means, except within 30 m of a watercourse or wetland. In these areas, vegetation will be removed manually, using chain saws and other hand-held equipment, while leaving the under growth and duff layer undisturbed to prevent erosion.

Trees will be felled, de-limbed, mulched, and/or piled at the edge of the RoW according to clearing contract requirements. The remaining slash and debris will be windrowed a few metres from the edge of the RoW and compacted to a height no greater than 0.5 m. The windrows will be broken (left open) at all roads or access trails, along property lines, and along wetlands and watercourses. This provides access across the windrow for wildlife not capable of crossing the low vegetation pile. Felled trees from clearing the RoW may be used to build corduroy access where required and for erosion control. The windrows will be allowed to decompose naturally. Grubbing of the RoW or burning of vegetation will not be undertaken.

Timing of clearing is scheduled for fall 2020, to avoid the bird breeding season, which generally occurs from mid-April to late- August.

2.7.2.3 Access and Staging

Access is required to allow transportation of clearing and construction equipment, materials, and personnel to the RoW. Transmission lines may be located adjacent to, or intersect with, existing linear

corridors, which can provide access to or near the line. Access may be required along the RoW and deviate where watercourses and wetlands cannot be crossed with equipment. In all cases, maximum use is made of existing access roads.

As part of the design stage of the Project, NB Power will avoid locating structures next to watercourses and/or wetland habitat, and their 30 m buffers, where possible. Where these areas cannot be avoided, mitigation measures will be developed in consultation with the appropriate authorities. If access is not available on either side of a watercourse or wetland, temporary bridging, or corduroy (for wetlands only) will be used to cross these areas, allowing access for both wheeled and tracked vehicles. Where practical, only tracked vehicles (i.e., excavators, dump vehicles, small bulldozers, and terriva-bucket vehicles) will be used in or near watercourses and/or wetlands to reduce the potential for rutting.

Existing access roads may require improvements to provide construction vehicle and equipment access to the transmission line RoW. These improvements may include one or more of the following activities:

- Clearing brush overgrowth to widened sections of roads with the use of a mulching head
- Grading existing roadbeds and, where necessary, placing a few inches of gravel on the newly graded areas (e.g. crowning)
- Installing cross-drainage in certain areas to divert storm water runoff to the side of the roads
- Installing culverts, where required

Reconnaissance work and a review of aerial photographs suggests that all structure locations on the proposed RoW, with a few exceptions, can be accessed using a combination of existing roads, trails, and the RoW of existing Line 1135. These roads, trails, and existing RoW may require some minor improvements which will be identified following field studies. If new access roads are required they will be constructed in accordance with the PSEMP. Permission from landowners will be obtained to access existing roads and trails as required.

Prior to a tender being issued for construction of the new line, staging/storage areas for equipment and material will be identified

2.7.2.4 Excavation, Pole Placement, Structure Assembly, and Anchoring

Assembly of structures involves the transportation of construction materials to the RoW, excavation (i.e., for pole placement), and backfilling of excavated material. Excavation is commonly carried out by mechanical auger or excavator, hydraulic rock hammer, and/or blasting, depending on soil conditions.

Wood poles of each structure will be embedded a depth of 2.5 m to 3 m (10% of pole length plus 0.6 m). Holes are typically dug using mechanical excavators. However, where soil conditions make this method inefficient, hydraulic hammering or blasting may be required to remove the rock. Excavation footprints for each pole are typically 1 m x 3 m at ground surface and 1 m x 1m at excavation bottom. This yields typical excavation volumes of 4.5 m³ to 5.5 m³ per pole. Anchors for guy points are typically 1.5 m deep with a typical excavation footprint of 1 m x 2 m and excavation volumes of 2 m³ to 3 m³ per anchor. Cross plate anchors, rock anchors, or log anchors may be used at some guy points where practical and this would reduce the excavation footprint to nil.

The assembly of structures will take place on-site at structure locations. The disturbance area around the structure site for the equipment, structure assembly and erection activities will be limited to 700 m² to 900 m² for H-frame angle structures. Depending on soil conditions, compacted native soil or material supplied from local established and appropriately licensed quarries will be used to fill the sides of the excavations.

Exact structure locations have yet to be finalized. Structure locations will avoid (e.g. span) watercourses and wetlands and their 30 m buffers to the extent practical; therefore, blasting near watercourses and wetlands will be limited or avoided. The Project design will be developed and refined based on available LiDAR data and input from the environmental field surveys.

Although specific information regarding anchor requirements for guy wires at angle structures yet to be finalized, several types may be used during construction depending on structure location.

It is anticipated that cross plate anchors will be used predominantly for the proposed Project. Cross plate anchors are best suited for soil conditions having good load-bearing characteristics. They are installed by auguring or excavating a hole, placing the cross plate assembly at the base and backfilling the hole, and tamping the soil in layers to increase the holding capacity.

Rock and log anchors may also be used as required. Rock anchors and grout will be used in areas where they are to be installed directly into solid rock while log anchors will be installed in soft areas or at structure locations under high tension. Log anchors are a 1.2 m to 1.8 m section of pole that are typically buried lengthwise 2.4 m underground. Tension (guy) wires are attached to the logs and structures before backfilling and compacting of the area

2.7.2.5 Conductor Stringing

Large reels of conductor wire will be delivered to selected areas along the RoW. The wire will be subsequently strung using tension-stringing equipment and attached to the insulators by hand while pulling lines will be used to draw the wire between structures. In areas where the transmission line crosses a watercourse or wetland, the pulling line (p-line) is walked across and then strung using a tension-pulling machine. A 3 m to 5 m strip along the centre line of the transmission line will be cleared of vegetation in order to string the wires across watercourses.

Once the conductors are in place, they will be correctly sagged and tensioned, then permanently clipped into the clamps at each structure. Miscellaneous hardware such as structure marking, vibration damping devices, or air flow spoilers may also be installed, as required.

In areas where the transmission line crosses a road, rider poles will be temporarily installed on either side of the roadway to support conductors during installation to prevent conductor from sagging which could potentially affect traffic flow and pose safety concerns

2.7.2.6 Connection of Substation and Transmission Line

Upon completion of the substation modifications and the new 138 kV transmission line, the new transmission line will be connected to the substation breakers. This connection will occur within the footprint of the existing Rainsford Substation and Mactaquac Terminal and complete the connection to the grid for the transmission of electric power.

2.7.2.7 Inspection and Energization of the Project

Following construction, and the connection of the transmission line to the substation and terminal, ground and air acceptance patrols will be conducted by NB Power staff to verify that the line is ready for service. Any deficiencies discovered during these patrols will be corrected prior to energizing the line.

2.7.2.8 Clean-up and Revegetation

Clean-up and revegetation of disturbed areas is the final stage of construction. In areas where soil disturbance due to construction may cause erosion, measures will be taken to stabilize the affected area. Such measures may include trimming and back-blading, mulching, seeding, and fabric placement. Erosion control used during construction will be maintained until such time as the disturbed ground has been adequately stabilized with vegetation.

2.7.3 Operation and Maintenance

During the operating life of the transmission line (estimated to be 50 years), certain routine activities will be performed in order to maintain reliability of the network. These activities are described in the following sections.

2.7.3.1 Operation and Maintenance of Hardware

Line inspections (i.e., ground and aerial) will be performed by maintenance staff on a regular basis to check for the deterioration of the transmission line components, including wood poles, conductors, insulators, and hardware. These inspections will also assist in identifying weakened support structures and foundations, as well as changes in terrain which may affect structure stability. Typically, air inspections will be performed once a year, while ground patrols will be conducted every eight years by all-terrain-vehicle (ATV) or other form of transportation using existing access. Additional inspections may be carried out in the event of an emergency or unplanned outage (e.g., ice storm). Inspection results will be provided to NB Power operational personnel who are responsible for planning and scheduling maintenance work.

2.7.3.2 Vegetation Management

NB Power is responsible for providing safe and reliable electricity to homes, businesses, and industries. Uncontrolled vegetation can create fire and safety hazards, hinder routine line maintenance, and cause interruptions in electric service when it grows into or falls onto electric power lines. In order to avoid the

constant interruptions in electric service caused by overgrown or fallen vegetation, NB Power restricts the growth of trees and brush along the lines through its integrated vegetation management program.

Integrated vegetation management involves a variety of methods, including use of hand cutting tools (e.g., chainsaws, brush saws, axes), mechanical equipment (e.g., hydro-axes, excavator with mulching head), and herbicide treatments. The frequency of the program varies depending on the vegetation growth rate, but it is typically carried out in 5 to 6 year cycles.

The focus of vegetation management is on the tall growing tree species that have the potential to grow or fall into, or within, the arcing distance of the transmission lines and or facilities and cause an outage. The use of the various methods depends upon a number of factors including site conditions and the sensitivity of surrounding areas.

Herbicide treatments are formulated to target undesirable tall growing trees and are also effective on broadleaf weeds, leaving grasses unaffected. Foliar applications of herbicides are applied during the warmer months while dormant stem applications are typically applied in the fall. All application methods are conducted from ground, no aerial applications are conducted on behalf of NB Power. A permit for herbicide use is obtained from NBDELG. The process involves public notification as part of the formal permit application. All herbicide applications are completed and supervised by licensed applicators and in accordance with conditions specified in the Permit. Setback distances, ranging from 15 m to 75 m, are established near sensitive areas such as wetlands and watercourses based on the product used. These setback distances are outlined in the permit issued by NBDELG.

2.7.4 Decommissioning and Abandonment

The new 138 kV transmission line will have a design life of 50 years. While decommissioning or abandonment of the transmission line components is not currently envisioned, the transmission line will at some point be decommissioned or rebuilt at the end of its useful service life, in accordance with the applicable standards and regulations current at that time. In the event that the transmission line is no longer required, NB Power will provide the necessary information to the appropriate regulatory agencies so that the regulatory requirements are met prior to commencement of decommissioning activities. As such, decommissioning and abandonment of the new 138 kV transmission line is not considered further in this assessment.

2.8 WORKFORCE AND PROJECT SCHEDULE

Construction will require NB Power staff, line clearing/construction contractor, and a contractor for the substation upgrades. The Project will result in a small, temporary increase in the workforce. The construction period for the new 138 kV transmission line, including RoW clearing, is anticipated to require approximately 8 months of activities between October 2020 to May 2021. Substation upgrades are anticipated to occur in 2021, with an in-service date anticipated for 2022. While changes to the Project schedule are possible, NB Power intends to complete all transmission line construction activities by May 2021.

Contractors that specialize in building transmission lines and substations typically work 9 to 12 hour days, and Monday to Friday, or Monday to Thursday. Work is not typically conducted overnight or on weekends; however, schedule change may require extended work hours to meet contract completion dates. The Project will adhere to the Fredericton By-Law No. S-13 Respecting Noise Disturbance that allows construction activities to occur between 6:00 a.m. and 9:00 p.m. from Monday to Saturday, inclusive (City of Fredericton 2005). A summary of key Project activities and timelines is provided in Table 2.4 below.

Table 2.4 High Level Schedule of Key Project Activities

Project Activities	Timeline
Communication with First Nations and Stakeholders	Summer 2018 through fall 2019 (and throughout Project activities)
Environmental field studies	Summer 2018 through summer 2019
EIA Review	Summer 2019 to spring 2020
Permits/approvals acquisition	Summer to fall 2020 (assumed)
RoW and clearing	Fall 2020
Construction of Line	Fall 2020 to spring 2021
Substation and terminal upgrades and modifications	Winter 2020 to winter 2022
In-service date	2022 (date to be determined)

2.9 EMISSIONS AND WASTE

2.9.1 Airborne Emissions

Emissions associated with fuel combustion in heavy equipment and vehicles, and dust associated with any upgrading of existing roads, are anticipated to occur during construction. Water sprayers would be used to suppress and control dust levels, as required.

Construction of the Project is not anticipated to result in substantive emissions of air contaminants, and greenhouse gases (GHG) are estimated to be low (see Section 5.1). Air contaminant emissions are expected to be generally confined to the PDA and are not expected to result in measurable increases in the air quality conditions in Fredericton, or to exceed provincial air quality standards.

2.9.2 Hazardous Materials

Potentially hazardous materials used during Project construction would include, but is not limited to, propane, diesel, gasoline, hydraulic fluids, motor oil, and grease and lubricants for heavy equipment, ATV and vehicle use. Cleaning and maintenance of vehicles and equipment, site inspections, and the monitoring and inventorying of materials would be essential for environmental protection. Construction is not anticipated to result in substantive releases of hazardous materials into the environment and is addressed further in Section 2.10.1.

2.9.3 Sound Emissions

Sound emissions would occur during the construction activities and would be limited to the use of heavy equipment, vehicles, and chain saws. Mitigation will be used wherever feasible to reduce the potential interactions resulting from sound emissions. Construction is not anticipated to result in substantive emissions of sound into the environment (see Section 5.1)

2.9.4 Solid Waste

Solid wastes generated during construction would include packaging materials, plastics, cardboard, wood, metals, felled vegetation, and sediment runoff. Wherever possible, solid wastes will be re-used or recycled, and felled vegetation will be windrowed and/or mulched along the edge of the RoW to decompose naturally. Other materials will be properly disposed of through the Fredericton Region Solid Waste Commission.

2.9.5 Runoff

Erosion and runoff associated with construction activities are not anticipated to result in a significant deposition of sediments into watercourses (see Section 5.3). Sedimentation and erosion control measures will be used to provide slope stability and prevent undue siltation of construction-related sediments into watercourses.

2.9.6 Electromagnetic Fields and Corona

No noise from corona discharges will be generated as a result of the operation of the proposed 138 kV transmission line or from substation and terminal modifications. The operation of higher voltage transmission lines and substations can result in the production of electromagnetic fields (EMF). Extremely high voltage (EHV) lines can also result in corona discharges which, in turn, may result in audible and radio frequency noise. The highest voltage for the proposed transmission line and associated infrastructure is 138 kV, which is not sufficient for corona discharges.

2.10 ACCIDENTS, MALFUNCTIONS, AND UNPLANNED EVENTS

This section describes potential accidents, malfunctions and unplanned events, which are upset conditions or other events that are not part of any planned activity or normal operation of the Project but have a reasonable probability of occurrence and have the potential to result in adverse interactions. While accidents, malfunctions, and unplanned events could occur during any phase of the Project, many of them can be prevented and addressed by good planning and design, communication, worksite health, safety, and environmental training of personal, emergency response planning, vehicle and equipment maintenance, and mitigation.

Given the adherence of Project-related activities to the mitigation measures and response plans in the Project Specific Environmental Management Plan (PSEMP) that will be developed prior to construction,

adverse interactions related to accidents, malfunctions and unplanned events are not likely to occur during the construction or operation and maintenance of the Project.

This section describes the potential accidents, malfunctions, and unplanned events that have a reasonable probability of occurrence. Mitigative planning and response procedures are also described below.

2.10.1 Hazardous Material Spills

The potential for the release of hazardous materials during construction or maintenance of transmission lines and substations can occur from the operation of vehicles, with the most likely source of a release being the rupture of a hydraulic line or the loss of fuel from construction vehicles. There is also potential for the release of hazardous materials during the operation of oil-filled equipment within the substations or terminals. The mitigation and management of hazardous materials will include:

- The training of personnel in spill prevention and response, and Workplace Hazardous Materials Information System (WHMIS)
- Following proper procedures within the Project Specific Environmental Management Plan (PSEMP)
- Design and installation of secondary containment for the transformer and associated equipment
- Routine cleaning, preventative maintenance, and visual inspections of hydraulic equipment and vehicles
- On-site spill response equipment
- Reporting spill to the appropriate Project personnel and New Brunswick Power Transmission System Operator (PSO) (1-800-756-8411). During normal business hours (i.e., Monday to Friday from 8:15 am to 4:30 pm), the PSO will notify the appropriate authorities (i.e., NBDELG. Outside of normal business hours, on weekends and on holidays, the PSO will notify the Canadian Coast Guard/Spills Action Centre (1-800-565-1633)

In the unlikely event that a hazardous material spill reaches a body of water or other nearby sensitive area, measures will be taken to stop the spill and isolate the affected area as soon as possible. An assessment of the affected area will be completed and remediation will be completed as required

2.10.2 Fire

The potential for fire to occur during Project activities is limited to the use of vehicles, or to infrastructure (e.g., upgraded substations or terminals). The mitigation and management of fire will include:

- Equipping all vehicles with fire extinguishers sized and rated as appropriate
- Training personnel in the location and use of fire extinguishers
- Safely storing wastes that may be soaked in flammable materials (e.g., oily rags)
- Avoiding the parking of vehicles in areas of long grass
- Immediately reporting a fire to local emergency response services

As the Project location is not remote, local emergency response services are available.

2.10.3 Vehicle Collisions

Vehicular activity will be most prevalent during construction of the Project and will be minimal during operation and maintenance. However, during all phases there is potential for vehicles associated with Project activities to collide with other vehicles, Project infrastructure or other infrastructure, and wildlife.

Mitigation and management measures planned to reduce the potential for vehicle collisions will include the following:

- Implementation, as needed, of traffic control measures to reduce the potential for vehicle-to-vehicle collisions
- Licensing of Project staff, as appropriate, to operate vehicles on-site, will obey traffic rules and regulations, and will exercise due care and attention while on-site
- Use of designated truck routes by truck
- Immediate reporting of a collision to local emergency response services

In the event of a vehicle accident there is the potential for loss of life (human or wildlife) and damage to infrastructure. There is also potential for fire and hazardous materials to be released into the environment. These are addressed in previous sections.

2.10.4 Wildlife Encounters

The potential for an unplanned encounter with wildlife is largely limited to disturbances to birds nesting on electrical infrastructure such as equipment and transmission poles during operation and maintenance.

The mitigation and management of wildlife encounters will include the following activities:

- Documenting, mapping, and identifying raptor species and their nests on Project infrastructure
- Scheduling of maintenance activities outside of nesting periods, where possible
- Consultation with a qualified biologist prior to unplanned/emergency maintenance during nesting periods

2.10.5 Legacy Environmental Issues

The potential exists for legacy environmental issues to be encountered during construction activities. These include the contaminated sites or hazardous materials left from illegal dumping activities by the public on the existing RoW. If legacy issues are identified, the NBDELG will be notified and a professional waste disposal company will be contracted to remove the materials.

3.0 OVERVIEW OF ENVIRONMENTAL SETTING

3.1 PHYSICAL SETTING

3.1.1 Physiography and Geography

New Brunswick is divided into six physiographic (geomorphologic) districts defined largely by the underlying bedrock geology. The Project lies within the New Brunswick Lowlands geomorphologic district, (Rampton 1984). This area is largely underlain by Upper Devonian-carboniferous (NBDNR 2003) and Pennsylvanian sedimentary and conglomerate rocks (NBDNR 2007) that are mostly grey sandstone, conglomerate, and red mudstone and siltstone.

3.1.2 Topography and Drainage

The Project is wholly-contained within the Saint John River watershed, but is located within two ecodistricts: the eastern and western ends of the PDA occur within the Aukpaque Ecodistrict of the Grand Lake Lowlands Ecoregion while the middle section of the PDA is located in the Yoho Ecodistrict of the Valley Lowlands Ecoregion. (NBDNR 2007).

The Aukpaque Ecodistrict is characterized by generally low relief, with elevations ranging from 100 m to 150 m above sea level (NBDNR 2007). There are abundant melt-water channels, wide flood plains, peat bogs, and wetlands. The Project area is distinguished from other areas within the Aukpaque Ecodistrict by steep river valleys.

Topography of the northern areas of the Yoho Ecodistrict where the Project is located is similar to that of the Aukpaque Ecodistrict with low-lying rolling relief. The relatively flat terrain supports numerous lakes that drain slowly though meandering channels.

3.1.3 Surficial Geology

The surficial geology in the portion of the Aukpaque Ecodistrict where the Project is situated (i.e., west of Fredericton) is comprised of thick beds of glacial deposits and alluvial sand and gravel that is overlain by silt of fine sand from the Interval Unit (NBDNR 2007). The soils in this area can reach up to 5m in depth in localized areas. (NBDNR 2003). Along the steep slopes of the Saint John River valley in the Keswick Ridge area of the Project, soils consist more of shallow loams derived from calcareous bedrock (NBDNR 2007). These soils support both animal and plant-based agriculture.

Soils in the middle section of the PDA (i.e., northern area of the Yoho Ecodistrict) are mostly finer textured sandy and clay loams derived from red Pennsylvanian sedimentary rocks (NBDNR 2007). These soils tend to be acidic and poorly drained, except on ridges.

3.2 BIOPHYSICAL SETTING

3.2.1 Atmospheric Environment

The atmospheric environment consists of three main components: air quality, climate/greenhouse gases (GHGs) and sound quality.

Air contamination and GHG emissions as well as sound pressure levels (noise) in the area surrounding the Project are expected to be predominantly influenced by vehicle traffic. There are currently no industrial facilities located within 1 km of the Project.

The Government of Canada has developed statistical summaries of climate data collected from weather stations located all over the country. An Environment and Climate Change Canada (ECCC) weather station located in Fredericton (Fredericton A), approximately 15 km southeast of the PDA, meets the World Meteorological Organization Standards and has historical data going back to 1951 (GC 2019a). Climate normal data (1981 – 2010) from the Fredericton A weather station indicate that January is typically the coldest month of the year, with a daily average temperature of -9.4 ºC. July is typically the warmest month of the year, with a daily average temperature of 19.3 ºC. The average annual precipitation (including snow) is 1077.7 mm per year, with November being the month with the most precipitation (106.3 mm on average). The snowiest month of the year is typically January (69.9 cm per year). The strongest hourly winds measured at the Fredericton A weather station have predominantly been from the west and south between the months of February and April, with a maximum hourly wind speed of 80 km/h, recorded in February 1970. The maximum wind gusts, 132 km/h N, were measured in June 1971 (GC 2019a).

3.2.2 Freshwater Fish and Fish Habitat

The Saint John River watershed has an area of over 55,000 km^2 and is the longest river in northeastern North America (Kidd et al. 2011). The Saint John River originates in Québec and Maine and flows through New Brunswick where it empties into the Bay of Fundy at Saint John.

The distribution and abundance of fish species in the Saint John River watershed is influenced by the presence of MGS and Grand Falls/Grand Falls Dam. The Project is located in the lowest reach, approximately 1.3 km downstream of MGS. A total of 53 fish species have been identified within the watershed of the Saint John River, and of those 38 species were identified within the reach downstream of MGS (Kidd et al. 2011). A number of those species support commercial, recreational, or Aboriginal fisheries on the Saint John River.

3.2.3 Water Resources

The PDA is located in the Saint John River Watershed. In this area the watershed drains a mainly rural, mixed-use landscape comprised largely of forested lands. There are no known surface water intakes, Designated Watershed Protected Areas, or protected wellfields within the general vicinity of the Project, nor do any residential or commercial entities acquire potable water from the RoW (see Section 5.2.2).

3.2.4 Terrestrial Environment

The Project spans two ecoregions and ecodistricts. The two ends of the PDA are within the Aukpaque Ecodistrict in the Grand Lake Lowlands Ecoregion, and the central portion of the PDA is within the Yoho Ecodistrict in the Valley Lowlands Ecoregion (NBDNR 2007).

The Valley Lowlands Ecoregion extends from Edmundston in the north to St. Andrews in Passamaquoddy Bay to the south, and includes most of the Saint John River Valley, with the exception of a section surrounding Fredericton and Grand Lake. This ecoregion also includes the Tobique River valley, the Kennebecasis River valley, and a stretch of land in central New Brunswick that forms a transition between the Central Uplands and Eastern Lowlands Ecoregions. Its large area and geographic span contribute to the Valley Lowlands Ecoregion supporting the highest diversity of all New Brunswick ecoregions (NBDNR 2007). The Grand Lake Lowlands Ecoregion encompasses the Grand Lake Basin, the Oromocto River watershed, and the lower Saint John River and its floodplains. The most distinguishing features of this region are its floodplains and the warmest climate of any ecoregion in New Brunswick. A unique assemblage of southern vegetation species grows in the moist, rich soils of this ecoregion, and the soils are dependent on regular flooding (NBDNR 2007).

3.3 SOCIOECONOMIC SETTING

3.3.1 Economic Activity and Economic Drivers

The Project is located within the Central Economic Region of New Brunswick, which includes the counties of York, Sunbury, and Queens. This area has the second-highest population of the five economic regions with 142,340 people comprising about 20% of the provincial total. Within the Central Economic Region, 101,760 people (71%) live in the Fredericton census area (GNB 2018a).

The region includes New Brunswick's capital Fredericton, which contributes largely to the economic fabric of the region through the presence of public service sector and post-secondary educational institutions. The Central Economic Region as compared with the rest of New Brunswick, had proportionally greater representation in professional, scientific, and technical services, public administration, utilities, and education services. Healthcare and social assistance and retail and wholesale trade and were the greatest employers by sector, representing 15.3% and 14.5% of total employment in the region, respectively (GNB 2018a). The Central Economic Region had proportionately lower representation of manufacturing and natural resource use than elsewhere in New Brunswick.

3.3.2 Land Use

Approximately 62% of the Aukpaque Ecodistrict is forested. Of the remaining 38% of the Ecodistrict, 27% is used for agriculture, 21% for other developments, 4% is road infrastructure, with the remaining 48% being water and wetlands (NBDNR 2007). Within the Yoho Ecodistrict, 77% of the landscape is forested, with the remaining 23% comprised of other developments (41%), agriculture (12%), roads (4%), and water and wetlands (43%).

Recreational activities such as hiking, camping, swimming, nature watching, hunting, and fishing are common in the region. Recreational and social activities (e.g., festivals) are also common on the beaches and waterfronts for residents and tourists.

3.3.3 Infrastructure and Services

The most prominent community in the PDA and LAA is the city of Fredericton. Fredericton offers infrastructure typical of a modern municipality in Canada including a municipal drinking water supply and secondary wastewater treatment. Other infrastructure of note in the region includes the MGS and distribution network, and advanced internet and telecommunications. Services include storefront municipal, provincial, and federal government services for licenses and permits (e.g., City Hall, Service New Brunswick, Passport Services), a regional hospital, municipal and federal police forces, commercial and retail businesses, engineering and consulting services, and infrastructure development and maintenance. These services, among others, will be the benefactors of the improvements associated with this proposed Project.

3.3.4 Transportation and Transportation Infrastructure

The Central Economic Region has modern highway and road infrastructure that supports a commercial trucking industry and provides access to businesses and regional attractions for local residents and tourists. The Fredericton International Airport provides connections to major cities in the region (e.g., Toronto, Ottawa, Montreal, Boston) with three airlines (Air Canada, WestJet, and Porter) (YFC 2019). The Saint John River provides access to marinas and islands for sail boats including those travelling from international waters.

4.0 METHODS

4.1 VALUED COMPONENTS

Based on professional experience and work with similar projects, Stantec has selected the following valued components (VCs) to be considered for assessment in this EIA Registration:

- Atmospheric Environment
- Water Resources (surface water and groundwater)
- Freshwater Fish and Fish Habitat
- Vegetation and Wetlands
- Wildlife and Wildlife Habitat
- Socioeconomic Environment
- Heritage Resources
- Current Use of Land and Resources for Traditional Purposes by Indigenous Persons
- Effects of the Environment on the Project

Chapter 5.0 describes each of these VCs, their existing (baseline) conditions, potential interactions with the Project, and planned mitigation to reduce Project-environment interactions.

4.2 VC RATING

A binary qualitative rating system was used to evaluate the potential for interactions between the Project and the valued component of the environment. One of the following two ratings was prescribed for each Project-VC interaction:

- An interaction between the Project and the valued component could occur
- No interaction occurs between the Project and the valued component

Project-VC interactions are discussed in Chapter 5.0.

4.3 BOUNDARIES

4.3.1 Spatial Boundaries

The assessment of potential interactions with the VCs encompasses two spatial boundaries: PDA and Local Assessment Area (LAA).

4.3.1.1 Project Development Area

The PDA is the immediate area encompassing the Project footprint and is limited to the anticipated area of physical disturbance associated with the construction and operation and maintenance of the Project. The PDA includes the footprint of the 16.1 km-long, 30 m-wide RoW for the new 138 kV transmission line to be constructed. The PDA is the same for all VCs and is illustrated in Figure 1.1.

4.3.1.2 Local Assessment Area

The LAA is defined as the maximum area where Project-specific interactions can be predicted and measured with a reasonable degree of accuracy and confidence (i.e., the zone of influence of the Project for each VC). The LAA can vary amongst the VCs and is summarized for each VC in Table 4.1.

Table 4.1 Local Assessment Area for Valued Components

Valued Component[1]	Local Assessment Area
Atmospheric Environment (Air, Noise, GHG)	PDA plus 1 km on either side of RoW centre line
Water Resources (Surface Water and Groundwater)	PDA plus 500 m on either side of RoW centre line
Freshwater Fish and Fish Habitat	PDA plus 100 m on either side of RoW centre line, plus a 30 m buffer on either side of watercourses
Vegetation and Wetlands	PDA plus 500 m on either side of RoW centre line
Wildlife and Wildlife Habitat	PDA plus 500 m on either side of RoW centre line
Socioeconomic Environment	PDA plus 500 m on either side of RoW centre line[1]
Heritage Resources	PDA
Current Use of Land and Resources for Traditional Purposes by Indigenous Persons	PDA
Effects of the Environment on the Project[2]	PDA

[1] Improvements to electrical transmission reliability associated with substation upgrades will result in benefits to businesses and their customers well beyond the designated 500 m LAA. As these positive interactions do not require mitigation, and there is no change in the substation footprints, an LAA inclusive of the substations is not required in this EIA.

[2] Effects of the Environment on the Project is not a VC; however, it is included here for continuity in the assessment of potential interactions between the Project and the environment.

4.3.2 Temporal Boundaries

Temporal boundaries identify when a potential interaction is assessed in relation to specific Project phases and activities (see Table 2.4). The temporal boundaries for the assessment of the potential interactions between the Project and valued components include the following periods:

- Construction – anticipated to be during fall 2020 to winter 2021
- Operation and Maintenance – In-service in summer 2022 with approximately 50 years of operation and maintenance or the end of service life

There is potential for the Project to interact with the VCs, and for the environment to interact with the Project, during various phases of the Project. These will be discussed in detail in Chapter 5.0.

5.0 ASSESSMENT OF POTENTIAL INTERACTIONS BETWEEN THE PROJECT AND THE ENVIRONMENT

Based on the Project Description (Chapter 2.0), the Environmental Setting (Chapter 3.0), the methods described briefly above (Chapter 4.0), and the comments and direction provided by the TRCs of recent transmission line EIAs (Stantec 2017a, 2017b, 2017c, 2018), the potential interactions between the Project and the environment are summarized in Table 5.1 and further described in the sections that follow. As previously indicated, due to lack of physical changes to the existing footprints, potential interactions between substation and terminal modifications will only be described in terms of the effects on the atmospheric environment (5.1) and socioeconomic environment (Section 5.6).

Table 5.1 Potential Interactions Between the Project and the Environment

Activities/Physical Works Associated with the Project	Atmospheric Environment	Water Resources (Surface Water and Groundwater)	Freshwater Fish and Fish Habitat	Vegetation and Wetlands	Wildlife and Wildlife Habitat	Socioeconomic Environment	Heritage Resources	Current Use of Land and Resources for Traditional Purposes by Indigenous Persons	Effects of the Environment on the Project
Construction									
Site Preparation	✓	✓	✓	✓	✓	✓	✓	✓	✓
Excavation, Structure Assembly, and Installation	✓	✓	✓	✓	✓		✓	✓	✓
Conductor Stringing	✓							✓	✓
Connection of Transmission Line									✓
Inspection and Energization									✓
Clean-up/Revegetation	✓	✓	✓	✓	✓	✓			✓
Substation and Terminal Upgrades	✓					✓			
Operation and Maintenance									
Operation and Maintenance of Hardware		✓		✓	✓	✓			✓
Vegetation Management	✓	✓	✓	✓	✓	✓		✓	✓

5.1 ATMOSPHERIC ENVIRONMENT

This section assesses the potential interactions between construction, and operation and maintenance of the Project and the atmospheric environment. The atmospheric environment is included as a VC because of the potential for the Project to interact with air quality, GHGs, and sound quality.

Air quality is defined as the composition of the ambient air, including presence and quantity of contaminants that may have adverse effects on vegetation, wildlife or human health. Levels of contaminants in the ambient air can be compared to established air quality criteria and objectives, which are set to be protective of human health and the environment. Air quality is highly dependent on local air contaminant sources, such as industrial facilities or heavy vehicle traffic.

Climate is the long-term historical and seasonal meteorological conditions in a given area, such as temperature, humidity, precipitation, sunshine, wind and cloudiness. The release of GHGs, on a global scale from natural sources and anthropogenic activity, increase global concentrations of GHGs in the atmosphere, and they are thought to be a contributor to climate change (IPCC 2007). Project-based releases of GHGs, mainly carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), are typically used as an indicator of the potential interactions with climate change although it is understood that any one project's emissions will have a negligible effect on global climate change.

Sound quality is characterized by the sound pressure levels in the ambient air; the type, frequency, and duration of noise (unwanted sound) in the outdoor environment. Sound pressure levels are measured in decibels (dB). For environmental assessments where humans are the focus, an A-weighted dB scale (dB_A) is used to report sound pressure levels.

5.1.1 Scope of Assessment

This assessment considers air contaminants that are typically associated with this type of Project. These contaminants are generated from fossil fuel combustion and the movement of heavy equipment that are required for Project construction. Particulate matter (both from combustion and dust from ground disturbance) and combustion gases are considered the main potential air contaminants of concern relating to air quality. Releases of GHGs from the combustion of fossil fuel in vehicles and heavy equipment are considered pertaining to potential interactions with climate change. For sound quality, changes in sound pressure levels due to noise from heavy equipment use or blasting are considered. Electromagnetic fields (EMF), which may originate from transmission lines, are also considered.

Air quality in New Brunswick is regulated by the *Air Quality Regulation* under the *New Brunswick Clean Air Act*. At the federal level, the main guidance available for managing air quality is the Canadian Ambient Air Quality Standards (CAAQS) (CCME 2019) developed by the Canadian Council of Ministers of the Environment (CCME).

There are no overarching sound guideline levels, regulations or standards that are currently established by the Province of New Brunswick for limiting acceptable sound levels. However, sound is defined as a contaminant in the *New Brunswick Clean Air Act* and is sometimes regulated on a project by project basis

under that Act. There are currently no applicable requirements, standards or objectives relating to GHGs or EMF for construction or operation of transmission lines. There are new federal GHG regulations for large emitters; however, this project is not covered by those requirements. In New Brunswick as of April 1, 2019, there is a new carbon tax on fossil fuels that would apply to fuel consumed by the Project. This tax is a mechanism to encourage curtailment of fossil fuel consumption and associated GHG emissions.

5.1.2 Existing Conditions for Atmospheric Environment

The sections below describe the existing conditions for air quality, GHG emissions, and sound quality.

5.1.2.1 Air Quality

Based on the most recently available data from NBDELG (2017a), ambient air quality in New Brunswick is generally characterized as very good, with few exceedances of the provincial ambient air quality objectives or CAAQS. The majority of exceedances in 2015 were related to odourous compounds (hydrogen sulphide (H_2S) and Sulphur dioxide (SO_2)) released in Saint John and northern New Brunswick (Belledune and Edmundston) (NBDELG 2017a).

There is a provincial ambient air quality monitoring station located in Fredericton, NB, approximately 10 km from the Project PDA. There were no exceedances of the provincial air quality objectives (measurements of carbon monoxide (CO), nitrogen oxides (NOx), ozone (O_3) and fine particulate matter ($PM_{2.5}$) between 2011 and 2015 which is the most recently available published data (NBDELG 2013, 2015, 2016, and 2017a). Although air quality is not directly measured within the LAA, based on the data collected by NBDELG throughout New Brunswick, only areas that are within close range to large industry record infrequent exceedances of air quality objectives while other stations show full compliance. Therefore, it is expected that the provincial air quality objectives are met within the LAA for the Project.

The CAAQS record long-term trends for $PM_{2.5}$ and ground-level O_3 across Canada. The 2015 CAAQS targets were met at all stations in New Brunswick from data collected in 2012, 2013, 2014 and 2015 (NBDELG 2015, 2016, and 2017a).

5.1.2.2 Climate

Climate normals data from the ECCC weather station located in Fredericton are discussed in Section 3.2.1.

5.1.2.3 Greenhouse Gas Emissions

The quantity of GHG emissions released to the atmosphere in Canada in 2016 (the most recently published data from Canada's National Inventory Reports) was 704,000 ktonnes of carbon dioxide equivalent ($ktCO_2e$), 15,300 $ktCO_2e$ of which were released in New Brunswick (ECCC 2018a). Therefore, New Brunswick's GHG emissions represented approximately 2.2% of Canada's emissions in 2016. According to ECCC, Canada's contribution to global GHG emissions in 2013 was 1.6% (ECCC 2018b).

5.1.2.4 Sound Quality

The existing sound quality in the vicinity of the Project is expected to be predominantly influenced by vehicle traffic on nearby roads, and various activities/developments within the LAA. The nearest residential property to the Project is located approximately 40 m away from the PDA, as shown in Figure 3 of Appendix D.

The existing sound pressure levels in the Project area can be estimated based on methodology published by the Alberta Energy Regulator as the contributing factors are the same; population density and traffic patterns (AER 2007). The average ambient sound level in Alberta for areas with comparable population densities and distances from heavily travelled roads as the LAA is estimated to be approximately 56 dB_A at night and 66 dB_A during the day (AER 2007). For reference, a sound pressure level of 50 dB_A is comparable to a quiet suburb or conversions at home; a sound pressure level of 60 dB_A is comparable to sound levels in a restaurant or office setting.

Interactions between the Project and sound quality are expected to occur during construction, during a relatively short time frame near any individual property (8 months total construction, moving along the RoW). During operation and maintenance, limited and infrequent activity would occur along the RoW (e.g., manual clearing of vegetation using chain saws and bush hogs), and activity at the existing substations will be the same as current operation. Therefore, sound quality overall is not expected to be a substantive issue and therefore no background sound pressure level monitoring was conducted as part of this assessment.

5.1.3 Assessment of Potential Interactions with Atmospheric Environment

This section describes how Project activities could interact with the atmospheric environment as well as the techniques and practices that will be applied to mitigate the potential effects of these interactions.

5.1.3.1 Construction

Project-related releases of air contaminants are not expected to exceed provincial or federal air quality objectives or standards during construction. Combustion gases and GHGs are expected to be released from the operation of construction equipment, machinery and large trucks travelling to and from site. However, construction will be short in duration (8 months). Repair and maintenance activities will be performed on equipment, machinery and trucks as required. Idling of vehicle engines, equipment and machinery will be avoided where possible, and transportation routes will be managed, in order to reduce the released of unnecessary combustion gases and GHG emissions. GHG emissions from Project construction activities will be negligible in comparison to annually reported GHG emissions in New Brunswick.

Dust is expected to be generated as a result of excavation activities, exposed soil along the RoW during construction activities. Standard dust control and mitigation practices will be used to control dust levels during construction. These include the use of dust suppressants or water unpaved areas frequented by heavy equipment to limit dust emissions, especially during windy and dry conditions.

The following activities are expected to cause noise and vibration to occur during the construction phase which includes upgrades to substations and terminals: noise from the use of heavy mobile equipment (e.g., engines and back-up beepers); noise from the construction process itself; and potentially noise from blasting. Construction activities within the PDA (i.e., transmission line) will be short in duration; however, noise may be noticeable by nearby receptors given the relatively short distance to the nearest receptor (the nearest residence is approximately 40 m away from the PDA). There are approximately 1,200 residential buildings within the LAA (including houses, garages and sheds), 50 of which are within 200 m of the centreline and would likely be exposed to construction noise.

Receptors near the Rainsford Lane, Aberdeen Street, and Priestman Street substations may also experience short durations of increased noise from construction (upgrades) to these facilities. Any increases in noise will occur during daytime hours: existing nighttime sound pressure levels (i.e., noise) are not expected to be affected as construction is planned to follow City of Fredericton By-Laws which limit such activities to daytime hours (e.g., between the hours of 6:00 am to 9:00 pm) (City of Fredericton 2005). Nevertheless, any delays in the Project schedule may require work to hours to be extended beyond 9:00 pm. NB Power staff will monitor noise qualitatively within the RoW and implement appropriate mitigation in the event that they receive noise complaints from nearby receptors.

5.1.3.2 Operation and Maintenance

No substantial emissions of air contaminants, GHGs, or noise are expected to occur during operation and maintenance of the transmission line or substations/terminals. Operation and management activities that could release air contaminants, GHGs or noise include the use of manual saws and bush hogs for vegetation management, the use of heavy equipment for pole and/or line replacement, or the use of trucks and hoists for repairs to grid stations. There are also no anticipated Project-related environmental effects from EMFs. EMFs produced by the transmission and use of electricity are considered to be of “extremely low frequency” (ELF) (Health Canada 2016). EMFs at ELFs are produced by the transmission and use of electricity, as well as other sources such as household appliances and cell phones. Health Canada has noted there is “no conclusive evidence of any harm caused by exposures at levels found in Canadian homes and schools, including those located just outside the boundaries of power line corridors” (Health Canada 2016).

5.1.4 Summary for Atmospheric Environment

With the implementation of the mitigation and environmental protection measures described in this assessment, it is not anticipated there will be substantial interaction between the Project and the atmospheric environment during any Project phase. Concentrations of air contaminants are not expected to exceed the provincial or federal objectives, guidelines, regulations or standards during construction or operation. The GHG emissions from construction activities are negligible in comparison to the GHG emissions reported annually for the province of New Brunswick. While there is potential for noise levels to increase temporarily at nearby receptors during construction, they will be limited to the PDA and areas near the substations and terminals, will be short in duration, and are expected to occur during daytime hours. There is the potential for EMF to increase during the operation of the Project; however, Health

Canada has noted there is insufficient evidence to establish a relationship between EMFs and human health (Health Canada 2016).

5.2 WATER RESOURCES

This section assesses the potential interactions between construction, and operation and maintenance of the Project and water resources. Water Resources is included as a VC due to its potable, recreational, and commercial value, and because of the potential for the Project to interact with ground water and surface waters.

5.2.1 Scope of Assessment

Water resources are defined for the purposes of this Project as any water supply from the ground or the surface that is available for human use, including consumption and other residential, agricultural, commercial, and industrial uses. Surface water also plays an important role in supporting freshwater fish and fish habitat, as described further in Section 5.3.

5.2.2 Existing Conditions for Water Resources

The PDA is located in the Saint John River Watershed. There are no known surface water intakes or Designated Watershed Protected Areas within the LAA. The RoW crosses through the rural community of Hanwell and a small portion of the RoW falls within the limits of the City of Fredericton. The eastern end of the RoW is located approximately 900 m west of Zone C of the Protected Wellfield area for the City of Fredericton. The protected wellfield provides drinking water to Fredericton residents though a municipal supply. There is no municipal drinking water supply in the community of Hanwell or the surrounding area.

While some of the residents and businesses within the LAA receive their domestic drinking water from a municipal supply, it is anticipated that the remaining population sources their domestic drinking water from groundwater wells. The New Brunswick Online Well Log System (NBOWLS) has record of 23 registered wells within the LAA, all of which are domestic drinking water wells (NBDELG 2019). The available characteristics of these wells are summarized in Table 5.2. Groundwater samples from NBOWLS within the LAA included sample results from 20 groundwater wells. Summary statistics for the analyzed water quality parameters were prepared and are presented on Figure 5.1.

Overall, the water quality in the area is generally good to fair, with water quality meeting the GCDWQ (Health Canada 2017) in most of the water wells reviewed. However, the sample results of eight of the 20 groundwater wells indicated that one or more analyzed parameters exceeded the maximum acceptable concentrations or aesthetic objectives developed for the GCDWQ. Maximum acceptable concentrations were exceeded for arsenic in one sample, fluoride in one sample, lead in one sample, and antimony in two samples. Total coliform was also detected in five of the samples; however, no samples indicated the presence of *E. coli* (NBDELG 2019). Aesthetic objectives were exceeded for chloride in two samples, iron in five samples, manganese in two samples, sodium in two samples, and total dissolved solids in two samples.

Table 5.2 Available Water Well Characteristics in the LAA

Parameter	Minimum	Mean	Maximum	Number of Wells
Wells with Records (NBOWLS)	-	-	-	23
Well Depth (m)	15.2	74.0	167.6	23
Depth to Static Water Level (m)	2.1	13.8	54.9	13
Depth to Bedrock (m)	0.9	2.9	8.5	21
Well Yield (L/min)	0.3	18.8	91.0	22
Notes: Depths are relative to ground surface				

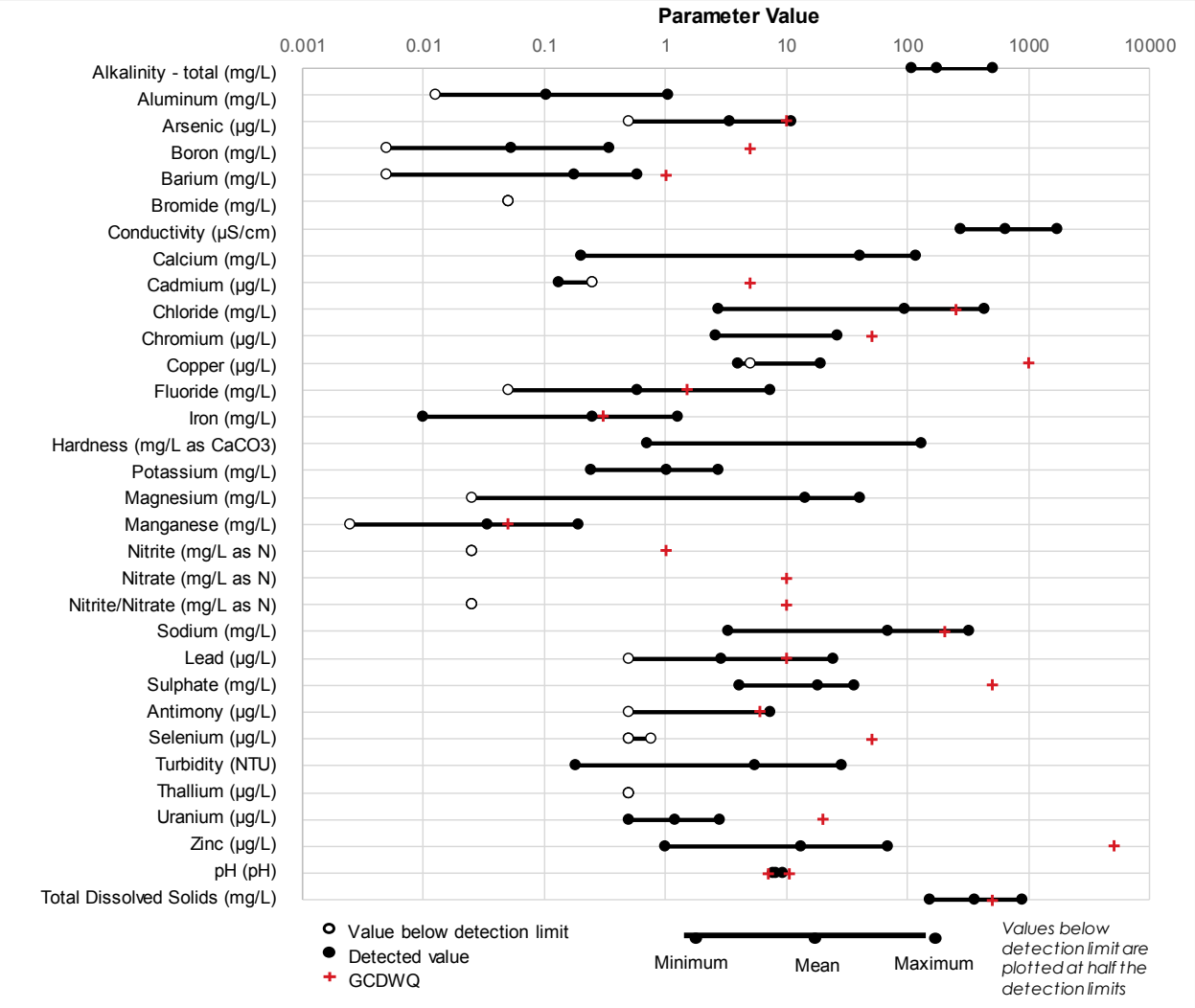

Figure 5.1 Groundwater Chemistry from wells located within the LAA (NBDELG 2019)

5.2.3 Assessment of Potential Interactions with Water Resources

This section describes how Project activities could interact with the water resources as well as the techniques and practices that will be applied to mitigate the potential effects of these interactions.

5.2.3.1 Construction

Construction of the new 138 kV transmission line will involve small areas of excavation to install transmission line poles and vegetation clearing along the transmission line right-of-way.

The area excavated for the transmission line poles is limited to a small area surrounding each location. These excavations are typically shallow (2.5 m to 3 m in depth) and have the potential to interact with groundwater in areas where the water table is shallow (approximately 3 m from the top of ground) if dewatering is required. It is not possible to predict which excavations will require dewatering as the depth of the water table varies both locally, and seasonally. Given this, the requirements for temporary dewatering during construction will be determined based on local water table conditions and will be evaluated during the pre-construction stage of the Project. Excavation to level the site of the new substation is expected to be relatively shallow, and is not anticipated to require dewatering; however, the installation of pier foundations for the bus support structures could require excavation of up to 3 m depth. Dewatering for pier support structures may be required depending upon subsurface conditions.

Excavation for the transmission line poles are anticipated to be completed by auger or an excavator. Mechanical rock breaking activities completed by auger or excavator are unlikely to interact with water resources. However, where soil conditions make these methods inefficient, blasting or rock hammering of consolidated bedrock may be required. This could include areas near outcrops or where the overburden is thin. Blasting has the potential to result in changes to groundwater quantity and/or quality and will be carried out in accordance with best management practices. In rare cases, vibration from blasting in bedrock may alter the fracture geometry, open new fractures, change the aperture of existing fractures, or permanently change the local groundwater flow patterns. The effect on groundwater flow patterns on a nearby receptor well user depends on many factors, including separation distance, seismic properties of the bedrock, strength of the charge and the yield, age, and condition of the well. As a result, well yield can increase, or if fracture apertures are reduced or closed off, the yield of nearby wells could decrease. Changes in fracture patterns or casing integrity can lead to movement of surface water into a well, which has the potential to change groundwater quality. Rock hammering may also result in vibration to the bedrock and may result in the same environmental effects as blasting. However, the potential environmental effects from rock hammering will occur at a lesser magnitude and at a more local scale than blasting.

The removal of vegetation within the PDA may interact with surface water resources by increasing runoff coefficients and decreasing evapotranspiration rates. This will likely increase runoff volumes that are discharged to nearby streams. However, given the linear nature of the Project and the scale of its footprint when compared to the watershed where the RoW is located, any increase in runoff is considered to be minimal and can be attenuated by the receiving watersheds.

Clearing of vegetation and excavation within the PDA may also result in an increased risk of local erosion, which has the potential to result in sediment entering surface water feature. NB Power will reduce the potential for interactions between the Project and water resources by adhering to the best management practices and the PSEMP. Further, with the exception of the locations for pole and guy wire placement, clearing activities do not typically removed the stumps and roots of the vegetation within the RoW, thus retaining the integrity of forest floor and root mat which will help mitigate against erosion. In addition, machinery is not permitted to enter watercourses and preventing the movement of sediments and woody debris into watercourses through the use of temporary sediment control features.

Overall, through careful Project planning, and the construction methods and mitigation to be implemented, the residual environmental effects during construction of the Project are anticipated to be of low magnitude and of short duration and are not expected to result in any measurable changes in water resources.

5.2.3.2 Operation and Maintenance

During operation and maintenance of the Project, vegetation management will be required and will be conducted in accordance with NB Power's integrated vegetation management program. Vegetation management is anticipated to be accomplished largely through the use of manual and mechanical means, in particular near residences, agricultural areas, and watercourses. Should herbicides be required in areas that are difficult to manage by mechanical means, they will be used in accordance with government regulations.

Operation and maintenance of hardware and infrastructure is not anticipated to result in ground disturbance or the release of chemicals that could affect water resources. Given the scale of the activities, operation and maintenance of the Project is not expected to have substantive interactions with water resources.

5.2.4 Summary for Water Resources

With mitigation, the Project is not anticipated to result in be any substantial interaction with water resources during any phase of the Project.

5.3 FRESHWATER FISH AND FISH HABITAT

Freshwater fish and fish habitat was selected as a VC because the Project crosses several watercourses that drain into the Saint John River. The Saint John River contains fish and fish habitats that are protected by federal and provincial legislation. This section assesses the potential interactions between construction and operation and maintenance of the Project and the Freshwater Fish and Fish Habitat VC.

5.3.1 Scope of Assessment

The scope of assessment is limited to freshwater fishes. Freshwater fishes are defined here as fishes that live in freshwater for at least part of their lifecycle. The federal *Fisheries Act* defines fish habitat as

spawning, nursery, rearing and feeding grounds, food supplies, and areas used for migration by fish or other organisms that fishes depend on to carry out their life processes (*Fisheries Act* Section 34(1)).

The freshwater fish and fish habitat VC also includes freshwater species at risk (SAR) and freshwater species of conservation concern (SOCC). SAR include species listed as *extirpated*, *endangered*, *threatened*, or *special concern* by the federal *SARA*, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or the NB *SARA*. SOCC are species not listed or protected by any legislation, but are considered rare in New Brunswick, or their populations may not be considered sustainable. SOCC are here defined to include species that are not SAR, but are ranked S1 (*critically imperiled*), S2 (*imperiled*), or S3 (*vulnerable*) in New Brunswick by the Atlantic Canada Conservation Data Centre (AC CDC).

Freshwater fish habitat includes the physical (e.g., substrate, water temperature, flow velocity, volume, depth), chemical (e.g., dissolved oxygen, nutrients), and biological (e.g., fish, benthic macroinvertebrates, emergent macrophytes) characteristics that are required by freshwater fish to carry out their life cycle.

5.3.2 Existing Conditions for Freshwater Fish and Fish Habitat

The Project is located within the Saint John River watershed. The Project crosses seven mapped watercourses and four unmapped watercourses which were confirmed to be present from field surveys.

5.3.2.1 Fish Habitat

Field surveys were conducted on July 12 and 13, 2018.

In-stream habitat surveys were conducted on eleven of the twelve mapped watercourses crossed by the proposed new 138 kV transmission line (WC-RF-01 to WC-RF-11). Fish habitat information for the Saint John River mainstem crossing location (WC-RF-12) was completed by desktop analysis. In-stream habitat surveys were conducted at the RoW centreline at each watercourse crossing, and at locations 100 m upstream and downstream of the centreline. Habitat information was collected as per Fisheries and Oceans Canada (DFO)/New Brunswick Department of Energy and Resource Development (NBDERD) guidelines. The water quality parameters measured during habitat surveys included water temperature, dissolved oxygen, and conductivity (all measured using YSI 2030 meter); pH (measured using a Hanna Instruments 98127 pH meter); and turbidity (measured using a Hach 2100Q turbidimeter).

Water quality for all streams was generally acceptable for cold water fish species such as brook trout and Atlantic salmon, however the preferred threshold for brook trout of 19°C was exceeded at WC-RF-02, 08 and 12 in summer months (Table 5.3). Dissolved oxygen concentrations for all watercourses exceeded the Canadian Water Quality Guidelines (CWQG 2018) recommended lower limit of 6.5 mg/L for all life stages of fish (Table 5.3). The pH was within the accepted range (6.5 to 9.0) for the protection of freshwater aquatic life at all of the proposed crossing locations except one (WC-RF-11).

Table 5.3 Water Quality Parameters

Watercourse	Water Temperature (° C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µS/cm)	Turbidity (NTU)
WC-RF-01	17.2	9.1	7.5	221.6	2.87
WC-RF-02	23	2.4	7.5	70.2	2.5
WC-RF-03[1]	NA	NA	NA	NA	NA
WC-RF-04	17	9.6	8.0	306.4	2.89
WC-RF-05	16.5	9.4	7.8	331	1.87
WC-RF-06	15.4	9.1	6.1	39.5	1.26
WC-RF-07	17.9	2.6	7.4	475	6.4
WC-RF-08	21.3	1.6	7.4	98.3	3.93
WC-RF-09	16.6	8.2	6.5	49.7	2.42
WC-RF-10[2]	NA	NA	NA	NA	NA
WC-RF-11	18.4	16.4	9.1	239	7.8
WC-RF-12	15.2 to 24.3[ab]	6.7 to 10.5[ab]	7.43 to 8.41[ab]	88 to 148[ab]	0.7 to 1.4[b]

[1] Watercourse where crossed by the PDA is entirely within a culvert. Water quality parameters are not available (NA).

[2] No visible channel. Water quality parameters are not available (NA).

References: [a] CRI no date

[b] NBDELG no date

Table 5.4 Summary of Key Fish Habitat Characteristics for Field Surveyed Watercourses

Watercourse	% Riffle-Run/Pool	Bankfull Width (m)	Maximum Depth (m)	Dominant Substrate(s)	Bank Stability	Dominant Riparian Vegetation	Instream Cover (%)	Description
WC-RF-01	92% Riffle run/8% Pool	2.6	0.5	Large gravel/Fines	Stable	Grass	25	Small watercourse with well-defined channel and very low flow at time of survey. Culvert within survey area. Watercourse forks within survey area.
WC-RF-02	100% Pool	100	1.0	Organic	Stable	Trees	80	Large pond formed by a ford. A small amount of water trickles into the adjacent wetland.
WC-RF-03	Watercourse flows through large culvert underground within RoW as a result of Trans-Canada Highway							
WC-RF-04	95% Riffle-Run/5%Pool	8.2	0.49	Bedrock	Moderately Stable/Stable	Trees	9	Small watercourse with well-defined channel and large substrates that flows through forest. Large falls and pool approximately 70 m upstream of proposed crossing location
WC-RF-05	92% Riffle-run/8% Pool	4.5	0.43	Large Gravel/Cobble	Moderately Stable	Grass/Trees	0	Small watercourse with well-defined channel that flows through forest. Channel is braided 80 m DS of proposed crossing location. Large debris jam/old road crossing within survey area.
WC-RF-06	100% Riffle-Run	0.7	0.32	Fines/Organics	Stable	Grass	67	Small watercourse with well-defined channel and fine substrates. Rusty precipitate observed.
WC-RF-07	100% Riffle-Run (Glide)	6.2	0.6	Fines/Organics	Stable	Trees	82	Watercourse with channel which drains a stagnant wetland and low-lying area. Watercourse ends in a grated culvert. No flow through culvert at the time of the survey.
WC-RF-08	76% Riffle-Run/24% Pool	4.6	1.0	Small Gravel	Stable	Grass	10	Watercourse with channel which drains a stagnant wetland and low-lying area. Impounded at upstream end.
WC-RF-09	94% Riffle-run/6% Pool	7.6	0.39	Cobble	Moderately Stable	Trees	0	Watercourse is highly braided and depositional and not as mapped. Well-defined channel with dry side channels. Additional ephemeral channel is present within RoW.
WC-RF-10	No Visible Channel							
WC-RF-11	44% Riffle-run/56% Pool	38.9	0.04	Organics	Stable	Grass	85	Not as mapped through field, runs along roadway. Intermittent in upstream portion of survey area, develops defined channel and flows into inactive beaver pond in downstream portion of survey area.
WC-RF-12 (Saint John River)	100% Run	535	5	Gravel/Cobble[1]	Stable	Trees/Grass	ND	A large river crossing. Chapel Bar is located immediately below the proposed crossing location. Water depths on the left side of the bar are deeper than the right side of the bar.

Note:
Riffle-run includes riffle, run, flat and intermittent habitat types; Pool includes pools and impounded water

[1] G. Yamazaki, Pers. comm. 2019

5.3.2.2 Fish Species

A total of 53 fish species have been identified within the watershed of the Saint John River (Kidd et al. 2011). Of those, 38 freshwater species were identified within the reach downstream of MGS (Table 5.5). Fish were observed at crossing locations WC-RF-05, WC-RF-06, WC-RF-08, WC-RF-09 and WC-RF-11 and crayfish were observed at WC-RF-05 and WC-RF-09.

Table 5.5 Fish species downstream of the Mactaquac Generating Station

Species	Species
Alewife (*Alosa pseudoharengus*) (D)	Lake chub (*Couesius plumbeus*)
American eel (*Anguilla rostrata*) (D)	Lake trout (*Salvelinus namaycush*)
American shad (*Alosa sapidissima*) (D)	Lake whitefish (*Coregonus clupeaformis*)
Atlantic salmon (*Salmo salar*) (DL)	Longnose sucker (*Catostomus catostomus*)
Atlantic sturgeon (*Acipenser oxyrhynchus*)	Muskellunge (*Esox masquinongy*) (I)
Atlantic tomcod (*Microgadus tomcod*)	Ninespine stickleback (*Pungitius pungitius*)
Banded killifish (*Fundulus diaphanus*)	Pumpkinseed (*Lepomis gibbosus*)
Blacknose dace (*Rhinichthys atratulus*)	Rainbow smelt (*Osmerus mordax*) (D)
Blacknose shiner (*Notropis heterolepis*)	Rainbow trout (*Salmo gairdneri*) (I)
Blueback herring (*Alosa aestivalis*) (D)	Redbreast sunfish (*Lepomis auritus*)
Brook trout (*Salvelinus fontinalis*)	Sea lamprey (*Petromyzon marinus*) (D)
Brown bullhead (*Ameiurus nebulosus*)	Shortnose Sturgeon (*Acipenser brevirostrum*)
Brown trout (*Salmo trutta*)	Slimy sculpin (*Cottus cognatus*)
Burbot (*Lota lota*)	Smallmouth bass (*Micropterus dolomieui*)
Chain pickerel (*Esox niger*) (I)	Striped bass (*Morone saxatilis*) (D)

Table 5.5 Fish species downstream of the Mactaquac Generating Station

Species	Species
Common shiner (*Notropis cornutus*)	Threespine stickleback (*Gasterosteus aculeatus*)
Creek chub (*Semotilus atromaculatus*)	White perch (*Morone americana*)
Fallfish (*Semotilus corporalis*)	White sucker (*Catostomus commersoni*)
Fourspine stickleback (*Apeltes quadracus*)	Yellow perch (*Perca flavescens*)
Golden shiner (*Notemigonus crysoleucas*)	

NOTE:

X – Recent Record (Kidd et al. 2011 – studies conducted by the Canadian River's Institute, New Brunswick Department of Energy and Resource Development or Department of Fisheries and Oceans)

D – Diadromous

I – non-native

L - Landlocked

5.3.2.3 Commercial, Recreational and Aboriginal Fisheries

Commercial, recreational, and Aboriginal fisheries are documented to exist in the LAA and other areas of the Saint John River. Commercial fisheries for American eel, American shad, Atlantic sturgeon, gaspereau (i.e., alewife and blueback herring) and rainbow smelt exist in the lower Saint John River, downstream of MGS (DFO 1996; DFO 2001; DFO 2018a). A commercial harvest for gaspereau occurs at MGS during the spring spawning run, approximately 1.3 km upstream of the LAA (DFO 2001).

Fish such as American eel, American shad, landlocked Atlantic salmon, brook trout, brown trout burbot, chain pickerel, gaspereau (i.e., alewife and blueback herring), lake trout, smallmouth bass, striped bass, rainbow smelt, sturgeon, whitefish, muskellunge, and yellow and white perch are fished recreationally in the lower Saint John River (GNB 2019a).

Aboriginal fisheries exist for alewife, American eel, American shad, sea lamprey, brown bullhead, yellow and white perch, chain pickerel, sunfish, muskellunge, smallmouth bass, striped bass, white sucker, burbot, whitefish, chub, smelt and trout within portions of the lower Saint John River and its tributaries (DFO 2018b).

5.3.2.4 Species at Risk

The LAA has the potential to contain six freshwater fish SAR, which are identified along with their federal and provincial conservation status's below (Table 5.6).

Table 5.6 Conservation Status of Species at Risk in the Lower Saint John River

Species	Conservation Status		
	SARA[1]	COSEWIC[2]	NB *SARA*[3]
American eel	no status	threatened (2012)	threatened
Atlantic salmon– Outer Bay of Fundy Population	no status (under consideration)	endangered (2010)	endangered
Atlantic sturgeon	no status	Threatened (2011)	threatened
Redbreast sunfish	special concern, Schedule 3	data deficient (2008)	no status
Shortnose sturgeon	Special concern, Schedule 1	Special concern (2015)	special concern
Striped bass – Bay of Fundy Population	no status (under consideration)	endangered (2012)	endangered

NOTE:

1. GC (2019b)
2. GC (2019c)
3. New Brunswick Department of Natural Resources, No date

5.3.3 Assessment of Potential Interactions with Freshwater Fish and Fish Habitat

This section describes how the Project activities could interact with freshwater fish and fish habitat as well as the techniques and practices that will be applied to mitigate the potential effects of these interactions.

5.3.3.1 Construction

During construction of the new 138 kV transmission line, accessing, clearing vegetation and grubbing within the RoW will involve the use of heavy equipment (e.g., excavators, clearing equipment). A potential interaction between freshwater fish and fish habitat could occur as a result of heavy equipment entering a watercourse. Equipment entering a watercourse could result in mortality or injury to fish through physical contact and could result in a change in fish habitat through alterations to in-stream habitats, such as erosion of the stream bed and increases in the presence of fines in downstream substrates.

A potential interaction could also occur between the Project and freshwater fish and fish habitat as a result of heavy equipment being used around watercourses or in riparian areas during grading or excavation of holes for structure assembly or riparian clearing. A change in fish habitat could result through alterations to riparian habitats (e.g., change in structure or cover) or as a result from the erosion and transportation of soils within the RoW (e.g., change in sediment concentrations). The removal of riparian vegetation adjacent to the watercourse has the potential to increase water temperatures by exposing the watercourse to direct sunlight, and to reduce protective canopy cover for fish. However, substantial warming is unlikely for small streams (WC-RF-01 to WC-RF-11) because the water surface area available for warming within the RoW is small relative to the overall stream length and there is generally no overhanging vegetation at WC-RF-12.

NB Power will reduce the potential for interactions between the Project and freshwater fish and fish habitat by adhering to best management practices and the PSEMP. Overall, NB Power will mitigate risks to freshwater fish and fish habitat by preventing machinery from entering watercourses, preventing the movement of sediments and woody debris into watercourses, and minimizing the clearing of riparian areas adjacent to watercourses. Specifically, best management practices will include:

- Watercourses and riparian buffers will be clearly marked prior to accessing or operating heavy equipment in the RoW.
- Reasonable measures will be undertaken to prevent the release of deleterious substances (e.g. fuels, lubricants, hydraulic oil) into watercourses; e.g., activities such as fueling will be planned so that deleterious substances do not enter watercourses.
- Existing bridges or temporary structures will be used when crossing watercourses.
- Silt fencing or hay bales will be used in areas where soil disruption could result in the transport of sediment into watercourses.
- Silt fencing will be removed after revegetation has occurred.
- A buffer zone will be left on the banks of watercourses.
- Brush and woody debris will be relocated to areas where it cannot enter watercourses.
- The Project design will adhere to a maximum RoW width of 30 m.

The practices used to mitigate risks to freshwater fish and fish habitat will be applied to all phases and activities of the Project.

5.3.3.2 Operation and Maintenance

During operation and maintenance activities for the new 138 kV transmission line, accessing the RoW to trim vegetation or repair equipment could result in heavy equipment entering the watercourse which could result in changes to fish health (including possible direct mortality of fish) or changes in fish habitat through instream or riparian disturbances (e.g., bank erosion). Mitigation for operation and maintenance activities will be as described above for construction activities.

5.3.4 Summary for Freshwater Fish and Fish Habitat

With mitigation, it is not anticipated that there will be any substantial interaction between the Project and freshwater fish and fish habitat during any phase of the Project. The Project as planned is not anticipated to result in death to fish or a HADD. The Project is not anticipated to result in serious harm to any fish species as defined in the *Fisheries Act*, or result in the killing, harming, or harassment, and damage or destruction of the habitat of any freshwater fish SAR as defined in the federal *SARA* or NB *SARA*.

5.4 VEGETATION AND WETLANDS

This section assesses the potential interactions between construction and operation and maintenance of the Project and vegetation and wetlands. Vegetation and wetlands was included as a VC because of the potential for the Project to interact with vascular plant Species at Risk (SAR), Species of Conservation Concern (SOCC), and habitats including wetlands and Ecological Communities of Management Concern (ECMC).

5.4.1 Scope of Assessment

This VC focuses on vascular plant SAR and SOCC (as defined in section 5.3.1), as well as and ECMC wetlands. ECMC are typically vegetation communities which fulfill special management objectives on Crown land in New Brunswick. They may also have been identified on Crown or private land through field work or by local conservation organizations as supporting unique ecological features (e.g., Environmentally Significant Areas (ESA)).

Wetlands are defined as lands that are permanently or temporarily submerged by water near the soil surface for long enough to maintain wet or poorly drained soils, support plants adapted to saturated soil conditions, and have other biotic conditions characteristic of wet environments (NBDNRE and NBDELG 2002). Wetland conservation is addressed in both the *Federal Policy on Wetland Conservation* (GC 1991) and the New Brunswick *Wetlands Conservation Policy* (NBDNRE and NBDELG 2002). The federal policy aims to protect wetlands on federal lands and waters or within federal programs where wetland loss has reached critical levels, and within federally designated wetlands, such as Ramsar sites (GC 1991). In New Brunswick, regulation and conservation of wetlands are under the jurisdiction of NBDELG. The provincial wetland policy focuses on protecting wetlands in New Brunswick through securement, increasing education and awareness, and maintaining wetland function. These policy goals are enforced through the New Brunswick *Clean Environment Act* and associated *Environmental Impact Assessment Regulation* (EIA Regulation) and the New Brunswick *Clean Water Act* and associated *Watercourse and Wetland Alteration Regulation* (WAWA Regulation). Currently, NBDELG considers only those wetlands visible on the GeoNB Regulated Wetlands Map (i.e., GeoNB-mapped wetlands http//geonb.snb.ca/geonb/; SNB 2011) to be regulated under this legislation (NBDELG 2017b).

5.4.2 Existing Conditions for Vegetation and Wetlands

5.4.2.1 Information Sources

Vegetation community and wetland data were obtained from various sources, including NBDERD forest and non-forest data, GeoNB-mapped wetlands and Provincially Significant Wetlands (PSW) (SNB 2011), and the New Brunswick Hydrographic Network (NBHN) wetlands, waterbodies, and watercourses. These sources were used to map vegetation communities within the LAA, and to assist in wetland interpretation outside of field-surveyed areas.

5.4.2.2 Field Surveys

Vascular plant and wetland field surveys were conducted within the PDA and a 30 m buffer on either side from July 23 to 27, August 7, and September 24, 2018. During the surveys, all vascular plant species encountered were recorded and a GPS location was recorded for each vascular plant SAR or SOCC incidence encountered, along with information such as population size. Any plants for which identification was uncertain were collected and later identified with the assistance of vascular plant flora manuals.

Wetlands encountered within 30 m of the PDA were delineated and classified per the Canadian Wetland Classification System (CWCS, NWWG 1997). This system classifies wetlands to three levels: class,

form/subform, and type. There are five wetland classes: bog, fen, swamp, marsh, or shallow water. Form and subform indicate the physical morphology and hydrological characteristics of the wetland. Wetland type distinguishes wetland plant communities based on one of eight groups of dominant vegetation.

Geographic coordinates were recorded for delineated wetland boundaries. Wetlands that extended beyond 30 m of the PDA were interpreted using aerial imagery, forest cover data, and LiDAR data. Functional assessments were completed for five GeoNB-mapped wetlands located within the PDA using the Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC; NBDELG 2018), a system recently developed by NBDELG and Dr. Paul Adamus. This method requires both a field and office component and is considered less subjective than other wetland functional assessment methods. The WESP-AC data were entered in the most recent form available on December 7, 2018 (Adamus 2018).

5.4.2.3 Overview of Existing Conditions

Vegetation Communities, Including Wetlands

The PDA and LAA are largely forested: forests account for 48.8% of the PDA and 58.0% of the LAA (Table 5.7). The proportion of the LAA that is forested is larger than the proportion of the PDA that is forested, mostly because the PDA parallels and contains part of the adjacent transmission line, which accounts for 16.8% of the PDA. Common forest types in the PDA and LAA include mature-overmature hardwood, young-immature hardwood, mature-overmature mixedwood, and regeneration-sapling hardwood

The anthropogenic land class accounts for 19.5% of the PDA and 11.1% of the LAA. In the PDA, this is largely made up of the adjacent transmission line, whereas in the LAA, anthropogenic land class is nearly equally accounted for by residential areas and roads (Table 5.7).

Table 5.7 Land Classification for the PDA and LAA

Land Classification	PDA		LAA	
	hectares	%	hectares	%
Agricultural	4.5	9.1	120.5	7.0
Anthropogenic	9.6	19.5	192.6	11.1
Industrial	3.2	6.6	73.3	4.2
Forest Types				
Regeneration-sapling Hardwood	3.7	7.5	153.4	8.9
Regeneration-sapling Mixedwood	-	-	9.9	0.6
Regeneration-sapling Softwood	-	-	12.6	0.7
Young-immature Hardwood	5.0	10.1	246.7	14.2
Young-immature Mixedwood	1.4	2.9	61.7	3.6
Young-immature Softwood	1.4	2.9	54.7	3.2
Mature-overmature Hardwood	6.4	13.0	237.5	13.7

Table 5.7 Land Classification for the PDA and LAA

Land Classification	PDA		LAA	
	hectares	%	hectares	%
Mature-overmature Mixedwood	4.1	8.3	161.4	9.3
Mature-overmature Softwood	1.5	3.1	58.8	3.4
Industrial Freehold	0.5	1.0	8.3	0.5
Forest Total	24.0	48.8	1005.1	58.0
Wetlands				
Freshwater Marsh	0.2	0.3	4.8	0.3
Shallow Water Wetland	0.7	1.3	15.9	0.9
Tall Shrub Swamp	1.8	3.7	23.4	1.3
Deciduous Treed Swamp	0.6	1.2	64.2	3.7
Mixedwood Treed Swamp	2.6	5.3	77.9	4.5
Coniferous Treed Swamp	0.5	0.9	51.4	3.0
Wetland Total	6.3	12.7	237.6	13.7
Shoreline	0.07	0.1	0.7	0.04
Waterbody	1.5	3.1	103.0	5.9
Total	49.2	100.0	1732.8	100.0

During field surveys, 58 wetlands were encountered, 50 of which are within the PDA. The wetlands within the PDA total 6.3 ha, or 12.7% of the PDA (Table 5.7), which is below the provincial average of 18-20% of the provincial landscape. The most common wetland type is mixedwood treed swamps, which make up 41% of all wetlands within the PDA. Tall shrub swamps are also common, accounting for 29% of wetlands within the PDA. A summary of wetlands within the PDA is provided in Table 5.8.

Table 5.8 Wetlands within the PDA

Wetland Field ID	Area within PDA (ha)						
	Shallow Water Wetland	Freshwater Marsh	Tall Shrub Swamp	Deciduous Treed Swamp	Mixedwood Treed Swamp	Coniferous Treed Swamp	Total
1[1]	0.16	0.05					0.21
2			0.12		0.34		0.46
5			0.05		0.10		0.16
6[1]			0.03		0.06		0.09
7			0.01		0.02		0.03
8			0.08				0.08
9			0.08		0.29		0.37
11			0.07				0.07
12[1]		0.26		0.02	0.08		0.36
13			0.22		0.14		0.36
14					0.04		0.04
15			0.02		0.02		0.03
16					0.01		0.01
17		0.01			0.05		0.06
18		0.04	0.03	0.08			0.15
19			0.001				0.001
20					0.001		0.001
21			0.01		0.19		0.21
22		0.02		0.02			0.04
23		0.002			0.01		0.01
24			0.05				0.05

Table 5.8 Wetlands within the PDA

Wetland Field ID	Area within PDA (ha)						
	Shallow Water Wetland	Freshwater Marsh	Tall Shrub Swamp	Deciduous Treed Swamp	Mixedwood Treed Swamp	Coniferous Treed Swamp	Total
25					0.21		0.21
26			0.02				0.02
30		0.01					0.01
31	0.002						0.002
32		0.01			0.04		0.05
33					0.01		0.01
34			0.06		0.08		0.15
36		0.01	0.01	0.08			0.10
37			0.01	0.02			0.02
38		0.02					0.02
39			0.05			0.09	0.14
40			0.003				0.003
41			0.02				0.02
42			0.06		0.16		0.22
43					0.03		0.03
45					0.04		0.04
46			0.04		0.12		0.16
48			0.11			0.33	0.44
49		0.05	0.08		0.48		0.61
50		0.02	0.16	0.38			0.57
52			0.01			0.05	0.06

Table 5.8 Wetlands within the PDA

Wetland Field ID	Area within PDA (ha)						
	Shallow Water Wetland	Freshwater Marsh	Tall Shrub Swamp	Deciduous Treed Swamp	Mixedwood Treed Swamp	Coniferous Treed Swamp	Total
53			0.005				0.005
54			0.09		0.07		0.17
55			0.05				0.05
56			0.18				0.18
57		0.02	0.03				0.05
58[1]		0.02	0.02				0.05
59[1]		0.09	0.02				0.10
60		0.02					0.02
Totals	0.16	0.65	1.81	0.60	2.60	0.46	6.27

[1] Mapped (in part) on the Regulated Wetlands Mapping layer depicted online on the GeoNB Map Viewer (SNB 2011) and considered to be “regulated” wetlands by NBDELG

Five of the wetlands in the PDA (1, 6, 12, 58, and 59) intersect with wetlands mapped on the Regulated Wetlands Mapping layer depicted online on the GeoNB Map Viewer (SNB 2011) and considered to be "regulated" wetlands by NBDELG. "Regulated" or GeoNB-mapped wetlands require a Watercourse and Wetlands Alteration (WAWA) Permit for any alteration carried out within the wetland or within 30 m of it (NBDELG 2017b). One of the five wetlands only intersects with the GeoNB-mapped wetland polygon located outside of the PDA. Of these five wetlands, the portions that both intersect with GeoNB-mapped wetlands and are within the PDA are largely freshwater marshes and shallow water wetland. Two of these regulated wetlands (58 and 59) are also PSWs. PSW are wetlands that are considered important in New Brunswick, nationally, or internationally for a variety of reasons outlined in the New Brunswick Wetlands Conservation Policy (NBDNRE and NBDELG 2002), and typically include all coastal wetlands and wetlands associated with the lower Saint John River, among others. Wetlands 58 and 59 are likely considered to be a PSW because of the NBDERD-mapped watercourse that connects them to the Saint John River. Generally, activities are not permitted to occur within PSW or within 30 m of a PSW unless those activities rehabilitate, restore, or enhance the wetland, or the activities are considered to provide necessary public function (NBDNRE and NBDELG 2002, NBDELG 2017c), which can include "public transportation projects, public infrastructure, linear pipeline or transmission corridors, and projects necessary for public safety" (NBDNRE and NBDELG 2002).

WESP-AC functional assessment scores tables for each of the regulated (i.e., GeoNB-mapped wetlands) are presented in Table E.1 to Table E.5 in Appendix E.

Ecological Communities of Management Concern

ECMC are typically vegetation communities which fulfil special management concerns in New Brunswick (e.g., deer wintering areas (DWAs), Protected Natural Areas (PNAs), ESAs).

The Project interacts with two ECMCs: 0.64 ha of conservation forest, composed of NBDERD-designated Old Forest Community or Old-Forest Wildlife Habitat polygons and the Keswick Ridge Escarpment ESA (Appendix D). No specific information is available for Old Forest Community or Old-Forest Wildlife Habitat areas, but these sites are established on New Brunswick Crown Land to preserve and maintain specific amounts of old forest conditions and help maintain wildlife diversity in each ecoregion in New Brunswick (NBDNR 2013). The Keswick Ridge Escarpment ESA is an area on the north side of the Saint John River, from the MGS downstream over 3 km to the McKinley Ferry Road. This ESA contains a variety of uncommon habitats, including a steep-sloped mature mixedwood forest, exposed ledges, and gravelly, ice-scoured beach. The area contains many vascular plant SAR and SOCC (Tims and Craig 1995). Although the boundary of this ESA is not accurately mapped, based on the description of the area it is estimated that the PDA will result in the clearing of approximately 2.3 ha within the ESA.

Vascular Plant SAR and SOCC

During field surveys, 466 vascular plant species were observed (Table E.6 in Appendix E), including one SAR and 17 SOCC (Table 5.9). Of these, three species were observed only within the PDA, six species were observed within the PDA and surrounding LAA, and nine species were only observed within the LAA, outside of the PDA.

Table 5.9 Vascular Plant Species at Risk and Species of Conservation Concern Observed During Field Surveys

Scientific Name	Common Name	AC CDC S Rank[1]	Incidences Observed in PDA	Incidences Observed in LAA[3]
Arabis drummondii	Drummond's rockcress	S2	0	2
Arabis hirsuta	western hairy rockcress	S3	0	1
Cardamine maxima	large toothwort	S3	0	2
Carex rosea	rosy sedge	S3	1	0
Cyperus esculentus	perennial yellow nutsedge	S3	1	1
Elodea nuttallii	Nuttall's waterweed	S2	0	1
Elymus canadensis	Canada wild rye	S2	0	1
Juglans cinerea[2]	butternut	S1	16	15
Muhlenbergia richardsonis	mat muhly	S3	0	1
Penthorum sedoides	ditch stonecrop	S3	1	4
Polygonum amphibium var. emersum	water smartweed	S2	1	0
Polygonum punctatum	dotted smartweed	S3	1	0
Polypodium appalachianum	Appalachian polypody	S3	1	2
Potamogeton obtusifolius	blunt-leaved pondweed	S3	0	1
Rubus occidentalis	black raspberry	S3	2	3
Salix nigra	black willow	S3	0	1
Saxifraga virginiensis	early saxifrage	S1S2	0	1
Thalictrum venulosum	northern meadow-rue	S3	1	1
		Total	25	37

1 S1 = critically imperiled, S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure, SNA = not applicable (typically exotic species) S#S# = a numeric range rank used to indicate any range of uncertainty about the status of the species or community (AC CDC 2019)

2 Butternut is a SAR, listed as *endangered* under the federal *Species at Risk Act* and the New Brunswick *Species at Risk Act*

3 Exclusive of the PDA

Butternut is a medium-sized deciduous tree that typically grows to approximately 25 m in height (Farrar 1995). This species is part of the walnut family and produces large, edible nuts. It grows best in stands with rich soils, often in riparian zones, but can also grow in gravelly soils in calcareous areas (Farrar 1995; Hinds 2000). Butternut is a SAR, listed as *endangered* under *SARA* and NB *SARA*. Its inclusion as a SAR is the result of the spread of a fungal pathogen known as butternut canker, which causes the crowns of trees to die back, and can eventually cause stem girdling, killing the tree (COSEWIC 2003). Unfortunately, there is currently no treatment or cure for the butternut canker once it has become established in a population. Natural Resources Canada (NRCan 2016) recommends the immediate

removal of infected trees to limit the spread of the disease. In New Brunswick, NBDERD has recognized that the state of the infection of butternut is so dire, that prohibitions on cutting this species would not be effective in preserving this species. Thus, butternut is not included in the *Prohibitions Regulation* under NB *SARA* despite its *endangered* ranking and is not protected by the prohibitions listed in NB *SARA*.

Thirty-one butternut trees were observed during the 2018 field surveys. Sixteen of the butternut trees were within the PDA, and 15 trees were in the LAA, outside of the PDA (Appendix D). Although a full assessment was not completed, the majority of butternut observed within and outside of the PDA were notably infected by butternut canker. Note that a single GPS point is typically taken to represent the location of multiple trees in immediate proximity to each other. Therefore, the 31 individual trees observed in the PDA and LAA are represented by 25 butternut locations on Project figures (Appendix D).

Invasive Vascular Plants

Of the 466 vascular plant species observed during field surveys conducted in support of the Project, 95 (20.4%) are considered exotic (Appendix E). Exotic species are those that, through human activity, have been introduced to an area that was previously outside of their natural range (CESCC 2016). These introductions have been both deliberate and accidental. Many exotic species have been part of New Brunswick's flora for hundreds of years. Invasive species are those exotic species that pose a threat to either humans, or the environment. The environmental threat posed by most invasive species is a reduction in native biodiversity, typically through competition (MTRI 2012).

Of the 95 exotic species observed during field surveys, seven are considered invasive by some sources: woodland angelica (*Angelica sylvestris*), spotted knapweed (*Centaurea biebersteinii*), Canada thistle (*Cirsium arvense*), purple loosestrife (*Lythrum salicaria*), wild parsnip (*Pastinaca sativa*), Japanese knotweed (*Polygonum cuspidatum*), and common tansy (*Tanacetum vulgare*) (MTRI 2012; NBISC 2012; NCC 2018).

5.4.3 Assessment of Potential Interactions with Vegetation and Wetlands

This section describes how Project activities could interact with vegetation and wetlands as well as the techniques and practices that will be applied to mitigate the potential effects of these interactions.

5.4.3.1 Construction

Construction activities have the potential to result in adverse environmental effects resulting in the change and loss of vegetation communities (including wetland and ECMC) as well as the loss of vascular plant SAR and SOCC. Clearing will remove overstory vegetation such as trees and shrubs from within the PDA and could damage understory vegetation.

Construction will result in disturbance to up to 34.8 ha of vegetation communities. This includes forest, wetland, and agricultural land, but excludes shoreline and water bodies (1.6 ha), and anthropogenic and industrial land classes which together comprise 12.8 ha of the PDA. All forested land, treed swamps, and shrub swamps within the PDA will require clearing. With mitigation, most of this disturbance will result in a change, but not a permanent loss of vegetation communities. Forested areas will be converted to shrub

or regenerating/sapling aged forests following initial construction activities. The conversion of forested habitat represents approximately 2.4% of available forested habitat within the LAA. The forest type that will experience the highest percentage of loss (2.7%) is mature-overmature hardwood. Of 237.5 ha of this forest type in the LAA, 6.4 ha are within the PDA. The 3.7 ha of regeneration-sapling hardwood within the PDA will experience the least amount of functional change, given that the area beneath the transmission line is expected to be maintained in a regeneration-sapling stage. Agricultural areas will likely be maintained in a similar state, with the exception of the area within the footprint of permanent structures.

Of the vegetation communities that will be disturbed as a result of construction of the Project, approximately 6.3 ha, or 12.7% of the PDA, is wetland. It is anticipated that 3.7 ha of wetland habitat (i.e., treed swamps or forested wetlands) will be subject to vegetation clearing, none of which is located within GeoNB-mapped wetland polygons. However, approximately 0.02 ha of deciduous treed swamp and 0.14 ha of mixedwood treed swamp will be cleared in field-delineated wetland associated with GeoNB-mapped wetland polygons. Approximately 0.7 ha of freshwater marsh supports vegetation low enough that clearing will not be required. The 3.7 ha of wetland that will be subjected to vegetation clearing includes 2.6 ha of mixedwood treed swamp, 0.6 ha of deciduous treed swamp, and 0.5 ha of coniferous treed swamp. Clearing and subsequent vegetation control will likely result in the conversion of these wetland types to shrub-dominated wetlands or freshwater marsh. Approximately 0.6 ha of tall shrub swamp may require clearing and temporary disturbance, depending on vegetation and pole height where those wetlands are located, but these areas will likely be maintained as tall shrub swamp throughout the life of the Project.

No grubbing is planned for the transmission line PDA; however, excavation of holes with a footprint of 1 m x 3 m (i.e., 3 m²) will be required for each pole within the approximately 103 new structures that are required for the Project, plus an excavation footprint of 1 m x 2 m (i.e., 2 m^2) for each anchor point for guy wires. It is anticipated that H-frame poles will be used for most of the Project. Steel H-frame structures with a longer spanning distance will be used over sensitive areas, and three-pole dead end structures will be used where angles or line tensioning are required. Although the boundaries of wetlands delineated in the field were considered when line design was conducted, and wetlands were avoided to the extent possible based on the range of valued environmental components (VCs) in the region (e.g. heritage resources, species-at-risk, watercourses), some wetland area will be affected by the installation of structures. The total loss of various habitats associated with pole structure footprints is estimated to be approximately 1,291 m². Approximately 142 m² of this habitat loss will occur in wetlands along the route. Only one structure will be located in a GeoNB wetland; a three-pole dead end structure with four guy wires is required within a PSW located near the Saint John River. Approximately 41 m² of PSW will be lost as a result of structure installation. As noted in Section 5.4.2.3, transmission corridors are generally permitted within 30 m of, or directly within, a PSW.

Excavation removes soil and the associated seed bank layer and heavy machinery used during construction can cause soil compaction, changing habitat quality. These two factors could potentially change the species that regenerate following construction disturbance. Wheel rutting associated with clearing and construction activities can alter surface and sub-surface flow paths potentially altering a wetland's ability to regulate stream flow or conduct biogeochemical processes such as nutrient and contaminant uptake. Wheel rutting can also result in the mixing of mineral and organic soil layers resulting

in changes in the availability of nutrients that can change the trophic status of a wetland and cause changes in plant species composition. Excavation for pole placement, where it occurs in wetlands, is expected to result in permanent wetland loss, although individual poles occupy a small footprint on a pole-by-pole basis. Where clearing and excavation occur in wetlands, these activities can cause a loss of wetland function. If wetland soils are soft, some infilling immediately around poles may be required for the integrity of the backfill material in order to properly secure the poles.

Vegetation clearing and placement of poles and conductors can potentially adversely affect wetland functions and services. Alteration of plant communities can reduce a wetland's ability to support plant and wildlife species including SOCC and SAR. With the implementation of mitigation to protect SAR, SOCC and reduce soil and vegetation disturbance in wetlands, there should not be a substantial loss of wetland functions. Very little wetland area will be lost as a result of construction of the new transmission line. Instead, forested wetland will be converted to shrub wetland or freshwater marsh. The wetland function that would most likely be adversely affected by conversion of forested wetland to shrub wetland would be a potential change in the terrestrial bird species using the portion of the wetlands crossed by the PDA.

Clearing of the RoW will occur within two ECMCs: conservation forest composed of NBDERD-designated Old Forest Community or Old-Forest Wildlife Habitat and the Keswick Ridge Escarpment ESA. The Project will result in the clearing of approximately 0.64 ha of conservation forest. This represents approximately 1.2% of the 53.95 ha of conservation forest present within the LAA. Although the Project will result in the loss of conservation forest, approximately 53.31 ha will remain in the LAA. This loss will occur in an area where there is already some fragmentation, as it is adjacent to an existing transmission line. Although the boundaries of the Kedgwick Ridge Escarpment ESA are not well defined, the Project passes through it, and will result in some loss of area. Clearing will result in tree removal through a portion of the ESA along the top of the ridge, but because of the steepness of the slope, no poles or associated clearing are needed in the more sensitive habitats at the base and mid sections of the ridge. These uncleared areas are expected to remain unchanged by the Project.

One plant SAR and 17 plant SOCC were observed during field surveys. Of these, nine species were observed within the PDA, and three species were observed only within the PDA: rosy sedge, water smartweed, and dotted smartweed (Table 5.9). Rosy sedge was observed within a mature hardwood stand located at the top of the slope which makes up part of the Keswick Ridge Escarpment ESA. Water smartweed was observed within a relatively open, previously disturbed area on the south side of the Saint John River. Although this area floods during high water events, it was not considered wetland habitat during field surveys. Dotted smartweed was observed in a mixedwood treed swamp on the edge of the existing RoW.

The greatest threat to SAR and SOCC found within the PDA is physical damage to the plants or disturbance of the soils they grow in caused by vegetation clearing, pole placement and movement of heavy equipment. With planned mitigation, including flagging and avoiding direct disturbance, many of the SOCC can likely persist at these locations and will not be affected by construction activities. Of the three plants that were only observed within the RoW, it is likely that water smartweed and dotted smartweed will persist at their observed locations. Rosy sedge is found in forests (Arsenault et al. 2013) and is unlikely to persist within the transmission line RoW; however, this species has been observed nearby during surveys

conducted in support of other NB Power projects (Stantec unpublished data). None of the vascular plant SAR or SOCC observed within the PDA are expected to be lost from the surrounding region as a result of the Project.

Vegetation clearing can have indirect effects on areas adjacent to the PDA through edge effects. Changes in abiotic environmental factors such as light availability, wind penetration, humidity, and temperature because of vegetation removal constitute edge effects, and a change in these factors can influence the success of species that inhabit the area, including SAR and SOCC. Edge effects can also allow the establishment of invasive or exotic species, resulting in a change in community dynamics. Many invasive plant species are strong competitors and can thrive in disturbed (i.e., cleared) habitats. When these species are introduced to an area, their presence can result in native species being outcompeted and lost. Invasive plants that are already found within the existing RoW and PDA can be spread into adjacent areas through edge effects, and new invasive plant species can be introduced into the PDA by equipment that was previously operated in areas with invasive plants.

Staging (i.e., temporary workspaces) may require additional clearing outside of the PDA. Although the areas where these activities will occur have not yet been identified, these activities could result in minor changes to vegetation communities, including wetlands.

NB Power will reduce the potential for interactions between the Project and vegetation and wetlands by adhering to best management practices and the PSEMP and employing applicable mitigation. Specifically, best management practices and mitigation includes the following:

- An application for a Watercourse and Wetland Alteration Permit will be submitted to NBDELG prior to the commencement of work within 30 m of a watercourse or wetland.
- Wherever feasible, poles will be situated outside of wetlands and conductors will span the wetland. Conductors will be drawn though the wetland by hand using progressively larger cables. Where it is not feasible to span a wetland, poles will be established as close to the edges of the wetland to minimize traffic on wetland soils.
- The locations of poles in wetlands will be planned to minimize the distance that heavy equipment must travel through wetlands.
- When travelling through wetlands, swamp mats will be used to reduce soil disturbance through rutting. The areas where vehicles are permitted to operate in wetlands will be restricted to the minimum area required.
- Standard erosion and sedimentation control measures will be employed to minimize erosion and sedimentation in wetlands and areas adjacent to wetlands.
- In order to reduce the adverse effects of clearing on wetlands, clearing activities will be restricted to the minimum amount required. Only as much wetland vegetation as is required to safely install poles, draw conductors, and provide adequate clearance between conductors and vegetation should be removed.
- Where avoidance is not possible, compensation for the permanent net loss of wetland function may be considered, following a plan to be developed in coordination with, and approved by, NBDELG.
- Prior to the onset of clearing activities, the populations of plant SOCC identified during the field surveys will be marked with symbolic fencing to prevent accidental damage to these plants.
- Where feasible, poles required to be installed in wetlands will be installed during the winter months when the ground is frozen to reduce disturbance from the movement of vehicles and equipment to vascular plant SAR and SOCC and wetland soils and vegetation.

- Where feasible, access routes to pole placement sites will be planned to avoid populations of plant SAR or SOCC or particularly sensitive wetland features.
- Local Indigenous communities will be offered an opportunity to harvest traditional plants, such as black ash and butternut, prior to clearing activities.
- All equipment arriving on site will be examined to make sure it is clean and free of soil or vegetative debris before it enters the Project RoW to begin work.
- Quarried, crushed material will be used for road building to reduce the risk of introducing or spreading exotic and/or invasive vascular plant species.
- The area of soil disturbed by heavy equipment will be minimized to reduce the amount of open soil available for exotic species to colonize.
- Wherever possible, natural regeneration will be allowed to occur to re-establish native plant communities. This can be encouraged by minimizing soil disturbance and leaving the root mat and seed bank in place. If natural regeneration is not possible, a seed mix that contains native species or exotic species that are known to be non-invasive will be used through consultation with the regional biologist at NBDERD.
- The sizes of temporary workspaces will be kept to the minimize size feasible in order to reduce adverse effects of clearing in these areas. These sites will be restored to pre-construction conditions as soon as practicable. Where practical, developed areas will be used for staging.

These practices used to mitigate interactions between the Project and vegetation and wetlands will be applied to all phases of the Project, where applicable.

5.4.3.2 Operation and Maintenance

Operation and maintenance activities have the potential to result in adverse environmental effects resulting in the loss of vascular plant SAR and SOCC, or changes in vegetation communities including wetlands. Periodic vegetation management during operation and management could result in adverse environmental effects resulting in further change to previously disturbed vegetation communities including wetlands. Vascular plant SAR and SOCC growing on the RoW could be adversely affected by vegetation management activities such as the use of hydro-axes and herbicides. The creation of a cleared RoW can attract ATV activity which can result in secondary disturbance of wetland soils and vegetation; however, ATV activity is already present on the existing transmission RoW and not anticipated to increase as a result of the Project.

To mitigate additional disturbance to vegetation and wetlands within the PDA, vegetation control in wetlands and in areas where plant SAR or SOCC are present will be conducted by mechanical means only, using hand tools where feasible, to minimize disturbance to soils and to non-target vegetation. All herbicide applications will be completed and supervised by licensed applicators and in accordance with conditions specified in the Permit. Setback distances will be established near sensitive areas such as wetlands and watercourses and the distance will be based on the product used.

5.4.4 Summary for Vegetation and Wetlands

With mitigation and environmental protection measures, it is not anticipated that there will be any substantial changes to vegetation and wetlands within the LAA. There will be some loss of area of ECMC, which is not expected to affect the functionality of these areas. Some individual vascular plant SAR and SOCC will likely be lost from the PDA, but the population status and viability of these species in the

surrounding area is not expected to be affected by the Project. The Project is not expected to contribute to the spread of invasive vascular plant species.

5.5 WILDLIFE AND WILDLIFE HABITAT

This section assesses the potential interactions between construction, and operation and maintenance of the Project and wildlife and wildlife habitat. Wildlife and wildlife habitat was included as a VC due to its environmental, cultural, and social importance, and for the potential for the Project to interact with wildlife and wildlife habitat in the PDA.

5.5.1 Scope of Assessment

This VC includes wildlife and wildlife habitat, including SAR and SOCC, as defined in Section 5.3.1.

Migratory birds in Canada are protected under the *Migratory Birds Convention Act* (*MBCA*), by way of the Migratory Birds Regulations and Migratory Birds Sanctuary Regulations. These regulations define the provisions by which an estimated 450 native species of migratory birds (including their nests and eggs) are protected in Canada.

5.5.2 Existing Conditions for Wildlife and Wildlife Habitat

5.5.2.1 Information Sources

Records for wildlife occurring within the LAA and surrounding area were obtained from various sources including the AC CDC, and the Maritimes Breeding Bird Atlas (MBBA). AC CDC data, including SAR, SOCC, and managed areas, were obtained for the area within 5 km of the Project (AC CDC 2018). The proposed transmission lines fall into four MBBA atlas squares: 19FL68, 19FL69, 19FL78, and 19FL79.

No Atlantic Canada Nocturnal Owl Surveys (ACNOS) routes are located near the LAA.

5.5.2.2 Field Methods

NB Power leveraged experience gained from TRC reviews and post-construction monitoring programs of recent EIAs in the development and scheduling the field surveys for birds. For this Project, the bird surveys were delayed by one year until 2019 to allow additional information to be gained on habitat types and road access locations from the vegetation and wetlands surveys that were conducted in 2018. This allowed for the selection of bird survey locations that would cover a representative cross-section of the habitats in the PDA and LAA (Table 5.10; Appendix F).

Early Breeding Bird Surveys

Early breeding bird surveys were conducted on April 11 and 12, 2019. These early bird surveys targeted early breeders, including woodpeckers and raptor species, and consisted of 10-minute point counts, that were conducted in good weather with low winds and no precipitation. Incidental bird observations were collected between point counts. A total of 16 point counts were conducted over the two days. Because of

access limitations, all point counts were conducted from the existing transmission line. All survey points were at least 250 m from another survey point. Surveys began near dawn and continued until approximately 10:00 am. Observers collected data on each bird species observed, and information about environmental conditions at each survey point including wind conditions, cloud cover, temperature, and precipitation. All species observed during the surveys were recorded.

Nocturnal Owl Surveys

Nocturnal owl surveys were conducted on April 11, 2019 at five different locations along the proposed transmission line by one team consisting of two Stantec biologists. Playback surveys were used that played boreal owl (*Aegolius funereus*) and barred owl (*Strix varia*) songs and included silent listening periods. Each survey was a total of 12 minutes. Surveys occurred between 9:50 pm and 11:10 pm and were conducted in good weather with low winds and no precipitation.

Common Nighthawk Surveys

Common nighthawk surveys were conducted on June 4, 2019 at three locations by one team consisting of two Stantec biologists. Survey locations were chosen in suitable habitat for common nighthawks, in areas that were accessible at night. Surveys began with 6-minutes of silent listening, as per the CWS Canadian Nightjar Survey Protocol (2016). If no common nighthawks were observed, an audio playback was broadcasted, followed by an additional two-minutes of silent listening. Surveys were conducted in good weather with low winds and no precipitation.

Breeding Bird Surveys

Breeding bird surveys were conducted as a series of point counts completed from June 3-5, and June 7, 2019. Rainy weather conditions did not allow for surveys to be completed on June 6. One team consisting of two Stantec biologists completed 10-minute point counts in good weather with low winds and no precipitation. All surveys were established within 500 m of the PDA, a minimum of 250 m from another survey point, and 100 m from the edge of another habitat type, where possible. Forest and non-forest data from NBDERD were refined using data collected during vegetation and wetland surveys to create a habitat database for the LAA, which was used when choosing point count locations. In total, 27 point counts were completed over the four survey days.

Wood Turtle Assessment

An assessment of wood turtle (*Glyptemys insculpta*) habitat was conducted from field observations made in conjunction with the aquatic habitat assessments on July 31, 2018 for 200 m sections of watercourses crossed by the PDA (Section 5.3.2.1). As suitable basking, hibernation and nesting habitat for wood turtles was not identified (Section 5.5.2.3) basking surveys were not considered to be an effective method of detecting the species within the PDA and were not conducted.

Other Wildlife

Incidental wildlife observations were recorded during all field surveys conducted during the 2018 and 2019 field seasons, including during breeding bird, and vegetation and wetland surveys.

5.5.2.3 Overview of Existing Information

Information from Existing Data Sources

The AC CDC data search produced records of 33 SOCC and 12 SAR within 5 km of the PDA. These included 21 birds, 1 amphibian, and 23 invertebrates. The AC CDC data report is included in Appendix B.

The maritime breeding bird atlas identified 131 species of birds that have been observed in the four atlas squares that the proposed transmission line crosses. Of these, 24 were not previously identified by the AC CDC.

SAR identified by in the above data sources are presented in section 5.5.2.3. All species identified by these data sources are presented in Table E.7 in Appendix E.

Early Breeding Bird Surveys

During the early breeding bird surveys, 26 species were observed, including one SAR: bald eagle (*Haliaeetus leucocephalus*, ranked *endangered* under NB SARA); and two SOCC: pine siskin (*Spinus pinus*, ranked S3 by the AC CDC) and killdeer (*Charadrius vociferous*, ranked S3B, S3M by the AC CDC). The species observed included two raptors: northern goshawk (*Accipiter gentilis*) and bald eagle; and two woodpecker species: pileated woodpecker (*Dryocopus pileatus*) and downy woodpecker (*Picoides pubescens*).

Nocturnal Owl Surveys

No owls were detected during the nocturnal owl surveys conducted on April 11, 2019.

Common Nighthawk Surveys

No common nighthawks were observed during surveys completed on the evening of June 4, 2019.

Breeding Bird Surveys

During the 27 point counts conducted in early June 2019, 60 bird species were detected. Incidental observations recorded during and following point counts identified an additional 11 species. SAR and SOCC are discussed further below. Detailed results of the breeding bird surveys are presented in Appendix E.

Species richness (defined as the number of different species recorded within a habitat type) was calculated for each of the habitat types sampled within the LAA (Table 5.11). Species richness indicates the number of species observed in each habitat type during point count surveys. Level of effort varied between habitat types, and as such, species richness is not directly comparable between habitats. Due to the fragmented habitat within the LAA, species were often recorded in a different habitat type than the location of the observer. In calculating species richness, birds that were observed as fly-bys were excluded, as there was no evidence that they were using the habitat type over which they were seen.

Table 5.10 Habitat Types Sampled During Field Surveys, and Species Richness

Land classification type	Breeding Bird Point Counts Completed	Area within LAA (ha)	Species Richness (Number of Species)
Agricultural	4	120.5	19
Anthropogenic	1	192.6	3
Industrial	1	73.3	6
Forest Types			
Regeneration-sapling Hardwood	2	153.4	15
Regeneration-sapling Mixedwood	0	9.9	3
Regeneration-sapling Softwood	0	12.6	0
Young-immature Hardwood	5	246.7	19
Young-immature Mixedwood	1	61.7	11
Young-immature Softwood	1	54.7	10
Mature-overmature Hardwood	3	237.5	13
Mature-overmature Mixedwood	1	161.4	19
Mature-overmature Softwood	1	58.8	11
Industrial Freehold	0	8.3	0
Wetlands			
Freshwater Marsh	3	4.8	11
Shallow Water Wetland	0	15.9	3
Tall Shrub Swamp	1	23.4	8
Deciduous Treed Swamp	1	64.2	6
Mixedwood Treed Swamp	1	77.9	13
Coniferous Treed Swamp	1	51.4	11
Shoreline	0	0.7	0
Waterbody	0	103	0
Total	27	1,732.8	56

Wood Turtle Assessment

Aquatic assessments conducted in 2018 indicated that watercourses crossed by the PDA did not provide good quality wood turtle habitat. The watercourses crossed by the PDA were either too steeply graded with higher flow and coarse substrate unsuitable for wood turtle nesting or hibernation (WC-RF-01, WC-RF-04, WC-RF-05, WC-RF-08, WC-RF-09, WC-RF-12), or were small with deep, mucky and organic

substrates unsuitable for hibernation (WC-RF-02, WC-RF-06, WC-RF-07, WC-RF-011), had no defined channel (WC-RF-10), or were entirely within a culvert (WC-RF-03) .

No appropriate nesting areas (e.g., sandy to small gravel beaches with an exposed or south-facing aspect) were observed along any of the watercourses crossed by the PDA. Wood turtle were neither reported for the Project area in the AC CDC report (Appendix B) nor observed incidentally during other field assessments (i.e., wetlands, vegetation, breeding birds, aquatics, or archaeology).

Species at Risk and Species of Conservation Concern

As a result of all field surveys and desktop information, of a total of 17 wildlife SAR (15 bird species) and 51 wildlife SOCC (30 bird species) were identified as occurring or with potential of occurring within the LAA. All SAR and SOCC and their rankings are presented below inTable 5.11. All SAR are discussed in detail below.

Table 5.11 Wildlife SAR and SOCC Reported or Recorded Within or Near the LAA

Common Name	Scientific Name	SARA	COSEWIC	NB Provincial Ranking	AC CDC S-Rank	Data Sources
Birds						
northern shoveler	*Anas clypeata*				S2S3B,S2S3M	MBBA
northern pintail	*Anas acuta*				S3B,S5M	MBBA
common goldeneye	*Bucephala clangula*				S4B,S5M,S4N	AC CDC, MBBA
red-breasted merganser	*Mergus serrator*				S3B,S5M,S4S5N	AC CDC
least bittern	***Ixobrychus exilis***	**Schedule 1, *threatened***	***threatened***	***threatened***	**S1S2B,S1S2M**	**MBBA**
green heron	***Butorides virescens***				**S1S2B, S1S2M**	**Stantec**
turkey vulture	*Cathartes aura*				S3B,S3M	MBBA, Stantec
bald eagle	***Haliaeetus leucocephalus***		**Not at Risk**	***endangered***	**S4**	**MBBA, Stantec**
cooper's hawk	*Accipiter cooperii*		Not at Risk		S1S2B,S1S2M	MBBA
red-shouldered hawk	*Buteo lineatus*		Not at Risk		S2B,S2M	MBBA
killdeer	*Charadrius vociferus*				S3B,S3M	AC CDC, MBBA, Stantec
common tern	*Sterna hirundo*		Not at Risk		S3B,SUM	MBBA
black-billed cuckoo	*Coccyzus erythropthalmus*				S3B,S3M	MBBA, Stantec
long-eared owl	*Asio otus*				S2S3	MBBA
common nighthawk	***Chordeiles minor***	**Schedule 1, *threatened***	***special concern***	***threatened***	**S3B,S4M**	**AC CDC, MBBA**
eastern whip-poor-will	***Antrostomus vociferus***	**Schedule 1, *threatened***	***threatened***	***threatened***	**S2B,S2M**	**AC CDC**
chimney swift	***Chaetura pelagica***	**Schedule 1, *threatened***	***threatened***	***threatened***	**S2S3B,S2M**	**AC CDC, MBBA**
American three-toed woodpecker	*Picoides dorsalis*				S2S3	AC CDC
olive-sided flycatcher	***Contopus cooperi***	**Schedule 1, *threatened***	***special concern***	***threatened***	**S3B,S3M**	**MBBA**
eastern wood-pewee	***Contopus virens***	**Schedule 1, *special concern***	***special concern***	***special concern***	**S4B,S4M**	**AC CDC, MBBA, Stantec**
willow flycatcher	*Empidonax traillii*				S1S2B,S1S2M	AC CDC
great crested flycatcher	*Myiarchus crinitus*				S2S3B,S2S3M	AC CDC, MBBA
warbling vireo	*Vireo gilvus*				S3B,S3M	MBBA
purple martin	*Progne subis*				S1B,S1M	AC CDC
northern rough-winged swallow	*Stelgidopteryx serripennis*				S1S2B,S1S2M	MBBA
bank swallow	***Riparia riparia***	**Schedule 1, *threatened***	***threatened***		**S2S3B,S2S3M**	**AC CDC, MBBA**
cliff swallow	*Petrochelidon pyrrhonota*				S2S3B,S2S3M	AC CDC, MBBA, Stantec
barn swallow	***Hirundo rustica***	**Schedule 1, *threatened***	***threatened***	***threatened***	**S2B,S2M**	**MBBA, Stantec**
Carolina wren	*Thryothorus ludovicianus*				S1B,S1M	MBBA
house wren	*Troglodytes aedon*				S1S2B,S1S2M	MBBA
wood thrush	***Hylocichla mustelina***	**Schedule 1, *threatened***	***threatened***	***threatened***	**S1S2B,S1S2M**	**AC CDC**
northern mockingbird	*Mimus polyglottos*				S2B,S2M	AC CDC

Table 5.11 Wildlife SAR and SOCC Reported or Recorded Within or Near the LAA

Common Name	Scientific Name	SARA	COSEWIC	NB Provincial Ranking	AC CDC S-Rank	Data Sources
brown thrasher	*Toxostoma rufum*				S2B,S2M	AC CDC, MBBA
Cape May warbler	*Setophaga tigrina*				S3B,S4S5M	MBBA
Canada warbler	***Cardellina canadensis***	**Schedule 1, *threatened***	***threatened***	***threatened***	**S3B,S3M**	**AC CDC, Stantec**
indigo bunting	*Passerina cyanea*				S3B,S3M	MBBA
bobolink	***Dolichonyx oryzivorus***	**Schedule 1, *threatened***	***threatened***	***threatened***	**S3B,S3M**	**AC CDC, MBBA, Stantec**
eastern meadowlark	***Sturnella magna***	**Schedule 1, *threatened***	***threatened***	***threatened***	**S1B,S1M**	**MBBA**
rusty blackbird	***Euphagus carolinus***	**Schedule 1, *special concern***	***special concern***	***special concern***	**S3B,S3M**	**AC CDC**
brown-headed cowbird	*Molothrus ater*				S3B,S3M	AC CDC, MBBA
Baltimore oriole	*Icterus galbula*				S3B,S3M	AC CDC, MBBA
red crossbill	*Loxia curvirostra*				S3	MBBA
pine siskin	*Spinus pinus*				S3	AC CDC, MBBA, Stantec
evening grosbeak	***Coccothraustes vespertinus***		***special concern***		**S3B,S3S4N,SUM**	**AC CDC, MBBA**
scarlet tanager	*Piranga olivacea*				S3B,S3M	AC CDC, MBBA
Herpetiles						
northern dusky salamander	*Desmognathus fuscus*		Not at Risk		S3	AC CDC
Invertebrates						
shy cleg	*Haematopota rara*				S1	AC CDC
Indian skipper	*Hesperia sassacus*				S3	AC CDC
banded hairstreak	*Satyrium calanus*				S2	AC CDC
hoary elfin	*Callophrys polios*				S3	AC CDC
henry's elfin	*Callophrys henrici*				S2S3	AC CDC
greenish blue	*Plebejus saepiolus*				S1S2	AC CDC
Aphrodite fritillary	*Speyeria aphrodite*				S3	AC CDC
meadow fritillary	*Boloria bellona*				S3	AC CDC
satyr comma	*Polygonia satyrus*				S3	AC CDC
hoary comma	*Polygonia gracilis*				S3	AC CDC
Compton tortoiseshell	*Nymphalis l-album*				S3	AC CDC
monarch	***Danaus plexippus***	**Schedule 1, *special concern***	***endangered***	***special concern***	**S3B,S3M**	**AC CDC**
cobra clubtail	*Gomphus vastus*				S3	AC CDC
skillet clubtail	***Gomphus ventricosus***	**Schedule 1, *endangered***	***endangered***	***endangered***	**S1S2**	**AC CDC**
boreal snaketail	*Ophiogomphus colubrinus*				S1S2	AC CDC
harlequin darner	*Gomphaeschna furcillata*				S3	AC CDC
petite emerald	*Dorocordulia lepida*				S3	AC CDC

Table 5.11 Wildlife SAR and SOCC Reported or Recorded Within or Near the LAA

Common Name	Scientific Name	SARA	COSEWIC	NB Provincial Ranking	AC CDC S-Rank	Data Sources
forcipate emerald	*Somatochlora forcipata*				S3	AC CDC
clamp-tipped emerald	*Somatochlora tenebrosa*				S2	AC CDC
ebony boghaunter	*Williamsonia fletcheri*				S3	AC CDC
fragile forktail	*Ischnura posita*				S2	AC CDC
zebra clubtail	*Stylurus scudderi*				S3	AC CDC
Species at Risk are presented in **Bold** Text.						

Least Bittern

The least bittern (*Ixobrychus exilis*) is a small secretive heron, which is seldom seen in its dense marsh habitat. It is listed as threatened under Schedule 1 of *SARA*, and has an AC CDC S-rank of S1S2B,S1S2M indicating the breeding and migrating populations of this species range from imperiled to critically imperiled in New Brunswick. Least bittern are associated with coastal and inland wetlands including freshwater and brackish marshes with tall aquatic vegetation such as cattails (COSEWIC 2009a. Nests are placed on a platform of emergent vegetation constructed over water and are well hidden.

A Recovery Strategy is in place for least bittern, and critical habitat is partially identified for breeding habitat (suitable habitat within 500 m of records of breeding activity recorded since 2001). A total of 115 critical habitat units have been identified, of which three are located in New Brunswick. The Project does not interact with any of the three identified critical habitat units in the province. No least bittern were observed in or near the LAA during field surveys conducted in support of the Project.

Bald Eagle

Bald eagle (*Haliaeetus leucocephalus)* is listed as *endangered* under Schedule A of NB *SARA*, and has an AC CDC S-rank of S4, indicating that it is apparently secure in New Brunswick. This species can be found throughout New Brunswick year-round. Bald eagles are associated with aquatic habitats during all times of year. Breeding habitat typically includes forested shorelines or cliffs. Nests are built in one of the largest trees available, with a large canopy capable of holding the large nest built by this species. Coniferous or deciduous trees may be used, depending on what is dominant in the region (Buehler 2000).

There is currently no Recovery Strategy or Critical Habitat designated for this species. Bald eagles are well documented within the LAA and are known to feed on fish passing through the MGS. Bald eagles were observed within the LAA during field surveys conducted in support of the Project.

Common Nighthawk

The common nighthawk (*Chordeiles minor*) is listed as *threatened* by COSEWIC, under Schedule 1 of *SARA*, and Schedule A of NB *SARA*. The AC CDC ranks this species as S3B, S4M, indicating the breeding population is conserved to be vulnerable and the migrating population is considered to be apparently secure in New Brunswick. The common nighthawk is a medium-sized crepuscular bird in the nightjar family. Common nighthawks breed in open areas, including gravel pits, clear-cuts, burnt over areas, barrens, and pastures. They sometimes nest on gravel rooftops. Eggs are laid directly on exposed ground, and no actual nest is made (Brigham et al. 2011). Forest harvesting is common in the LAA, and as such, suitable habitat for common nighthawks is relatively common. Common nighthawks do occur within the PDA; six individuals were observed during the common nighthawk surveys in June 2014.

A Recovery Strategy is in place for common nighthawk, however adequate available information to identify the habitat necessary for the survival of the species in Canada is not available. As such, Critical Habitat has not yet been identified or designated for this species. Suitable breeding habitat for this

species exists within the LAA, but no common nighthawks were observed in or near the LAA during field surveys conducted in support of the Project.

Eastern whip-poor-will

The eastern whip-poor-will are a gray-brown, cryptically patterned passerine listed as threatened under Schedule 1 of *SARA*. The AC CDC ranks this species as S2B, S2M indicating the breeding and migrating populations are imperiled in New Brunswick. Breeding habitat for this species is dependent upon the structure of forest stands more so than composition (COSEWIC 2009b). Whip-poor-wills prefer semi-open forests or patchy forests with clearings and little ground cover, such as forests that are regenerating following major disturbances.

A recovery strategy for eastern whip-poor will is in place which partially identifies critical habitat for the species, based on the best available information. Overall, 212 critical habitat units have been identified, five of which are located in New Brunswick. The Project does not interact with any of these units, and no eastern whip-poor-will were observed in or near the LAA during field surveys conducted in support of the Project.

Chimney Swift

Chimney swift (*Chaetura pelagica*) is listed as *threatened* by COSEWIC, under Schedule 1 of *SARA*, and Schedule A of NB *SARA*. The AC CDC ranks this species as S2S3B, S2M, indicating that the breeding population ranges from imperiled to vulnerable, and the migratory population is imperiled in New Brunswick. Chimney swifts breeds throughout New Brunswick. In pre-colonial North America, the chimney swift nested in hollow trees in mature forests. Since the arrival of Europeans, chimney swifts have been using chimneys as nesting cavities. However, as chimneys are now becoming less common, populations of chimney swifts appear to be declining (COSEWIC 2007a).

There is currently no Recovery Strategy or Critical Habitat designated for this species. The LAA may include buildings with chimneys, or mature, hollow trees. As such, chimney swifts have the potential to occur in the PDA, but none were observed in or near the LAA during field surveys conducted in support of the Project.

Olive-sided Flycatcher

The olive-sided flycatcher (*Contopus cooperi*) is listed as *threatened* by COSEWIC, under Schedule 1 of *SARA*, and Schedule A of NB *SARA*. The AC CDC lists the olive-sided flycatcher as S3B,S3M, indicating that the breeding and migratory populations of this species are considered to be vulnerable in New Brunswick. The olive-sided flycatcher is a medium-sized insectivore which breeds in scattered locations throughout most of forested Canada (COSEWIC 2007b). Olive-sided flycatchers are most often associated with edge habitats with open areas with edges, including forest openings, open wetlands, burned or harvested forest. This bird is often observed perching in tall trees or snags in these habitats, where they forage for flying insects (COSEWIC 2007).

A Recovery Strategy is in place for Olive-sided flycatcher, however adequate available information to identify the habitat necessary for the survival of the species in Canada is not available. As such, Critical Habitat has not yet been identified or designated for this species. Suitable breeding habitat for this species exists within the LAA, but no olive-sided flycatchers were observed in or near the LAA during field surveys conducted in support of the Project.

Eastern Wood-Pewee

The eastern wood-pewee (*Contopus virens*) is listed as *special concern* by COSEWIC, under Schedule 1 of *SARA*, and Schedule A of NB *SARA*. The provincial AC CDC ranking for the eastern-wood pewee is S4B, S4M indicating that the breeding and migratory populations are considered to be apparently secure in New Brunswick.

During the breeding period, the eastern wood-pewee is generally associated with the mid-canopy layer within forest clearings and edges of hardwood and mixed forest stands (COSEWIC 2012). In migration periods this species utilizes a variety of habitats including edges, and clearings (COSEWIC 2012).

There is currently no Recovery Strategy or Critical Habitat designated for this species. Suitable breeding habitat for this species is found within the PDA and LAA. This species was observed in the LAA during vegetation and wetland surveys conducted in 2018 and during breeding bird surveys conducted in 2019.

Bank Swallow

The bank swallow (*Riparia riparia*) is listed as *threatened* by COSEWIC, under Schedule 1 of *SARA*, and Schedule A of NB *SARA* and has an AC CDC rank of S2S3B, S2S3M, indicating that both the breeding and migratory populations range from imperiled to vulnerable in New Brunswick. The bank swallow is a small, colonial which feeds primarily on aerial insects (COSEWIC 2013). This species breed in a wide variety of natural and anthropogenic sites including riverbanks, aggregate pits, road cuts, and vertical sand banks or stockpiles of soil. Nesting sites are generally situated adjacent to open terrestrial habitat used for aerial foraging (COSEWIC 2013).

There is currently no Recovery Strategy or Critical Habitat designated for this species. No suitable breeding habitat for this species was noted in the PDA during vegetation and wetland surveys in 2018, but some may exist within the LAA; however, no bank swallows were observed in or near the LAA during field surveys conducted in support of the Project.

Barn Swallow

The barn swallow (*Hirundo rustica*) is ranked as *threatened* by COSEWIC, under Schedule 1 of *SARA*, and Schedule A of NB *SARA*, and S2B,S2M by the AC CDC, indicating that the breeding and migratory populations are imperiled in New Brunswick. This mid-sized aerial insectivore is closely associated with rural human settlements. The barn swallow shifted from nesting in caves and on ledges to nesting largely in man-made structures following European settlement of North America (COSEWIC 2011a). This insectivorous species prefers open habitats for foraging such as agricultural fields, shorelines, and cleared rights-of-way.

There is currently no Recovery Strategy or Critical Habitat designated for this species. Suitable nesting habitat exists within the LAA, and barn swallows were observed in the LAA during field surveys conducted in support of the Project.

Wood Thrush

The wood thrush (*Hylocichla mustelina*) is listed as *threatened* by COSEWIC, under Schedule 1 of *SARA*, and under Schedule A of NB *SARA*. The wood thrush has an AC CDC s-rank of S1S2B, S1S2M, which indicates that the breeding and migratory populations range from imperiled to critically imperiled in New Brunswick. This species is present in New Brunswick throughout the breeding season. Breeding habitat includes a variety of forests, including both deciduous and mixedwood forest. Key elements of suitable habitat include tall trees (>16m), a variety of deciduous tree species, shade, moist soil, and open forest floor (Evans et al. 2011). Nests are built in shrubs or trees, usually in the shade and concealed. Common trees used for nesting include American beech, oaks, and eastern hemlock (Evans et al. 2011).

There is currently no Recovery Strategy or Critical Habitat designated for this species. Potentially suitable habitat for this species exists within the LAA, but no wood thrush were observed in or near the LAA during field surveys conducted in support of the Project.

Canada Warbler

The Canada warbler (*Cardellina canadensis*) is ranked as *threatened* by COSEWIC, under Schedule 1 of *SARA*, and under Schedule A of NB *SARA*. It has an AC CDC rank of S3B, S3M, indicating that the breeding and migratory population is considered vulnerable in New Brunswick. Canada warblers are present in New Brunswick during the breeding season. Canada warblers breed in a wide range of forest types, including deciduous, coniferous and mixedwood forests. It is often associated with moist mixedwood forest and riparian shrub forests on slopes and ravines (COSEWIC 2008). The presence of a well-developed shrub layer also seems to be associated with preferred Canada warbler habitat.

A recovery strategy is in place for Canada warbler, however adequate available information to identify the habitat necessary for the survival of the species in Canada is not available, and it is unknown whether breeding habitat is limiting in Canada. As such, Critical Habitat has not yet been identified or designated for this species. Suitable breeding habitat for this species exists within the PDA, and Canada warblers were observed during vegetation and wetland field surveys in the LAA in 2018, and during breeding bird surveys conducted in support of the Project in 2019.

Bobolink

The Bobolink (*Dolichonyx oryzivorus*) is listed as *threatened* by COSEWIC, under Schedule 1 of *SARA*, and under Schedule A of NB *SARA*. AC CDC has ranked the bobolink as S3B, S3M, indicating that both the breeding and migratory populations are considered to be vulnerable in New Brunswick. Bobolink originally nested in the tall-grass prairie of the mid-western U.S and south-central Canada. As this habitat was converted to agricultural land, and forests of eastern North America were cleared to hayfields and meadows, the range of bobolink expanded (COSEWIC 2010a). Bobolink presently nest in a variety of

forage crop habitats, and natural grassland habitats including wet prairie, graminoid peatlands, and abandoned fields dominated by tall grasses.

There is currently no Recovery Strategy or Critical Habitat designated for this species. Potentially suitable breeding habitat for this species exists within the PDA, and bobolink were observed in the LAA during breeding bird surveys conducted in support of the Project in 2019.

Eastern Meadowlark

The eastern meadowlark is a ground-foraging passerine which is listed as *threatened* on Schedule 1 of *SARA* and under Schedule A of NB *SARA*. AC CDC has ranked this species as S1B,S1M indicating that both the breeding and migratory populations are considered to be critically imperiled in New Brunswick. Eastern Meadowlark nest on the ground in grassland habitats including native prairies and savannahs, as well as non-native pastures, hayfields, weedy meadows, and airfields (COSEWIC 2011b).

There is currently no recovery strategy in place, or critical habitat designated for eastern meadowlark. Potentially suitable habitat for this species is not abundant within the PDA, and no eastern meadowlarks were observed in or near the LAA during field surveys conducted in support of the Project.

Rusty Blackbird

The rusty blackbird (*Euphagus carolinus*) is listed at *special concern* by COSEWIC, under Schedule 1 of *SARA*, and under Schedule A of NB *SARA*. This species is listed as S3B, S3M indicating that the breeding and migratory populations are considered to be vulnerable in New Brunswick. Rusty blackbirds are present in New Brunswick during the breeding season. Breeding habitat typically consists of wet coniferous or mixedwood forests. Nests are typically built near open water in coniferous trees or shrubs, living or dead. Black spruce, red spruce and balsam fir are commonly used for nesting (Avery 2013).

There is currently no recovery strategy in place, or critical habitat designated for rusty blackbird. Suitable habitat, including forested wetlands, exists for this species in the LAA and PDA, but no rusty blackbirds were observed in or near the LAA during field surveys conducted in support of the Project.

Evening Grosbeak

Evening grosbeak (*Coccothraustes vespertinus*) has recently been listed as *special concern* under COSEWIC. It has an AC CDC s-rank of S3B, S3S4N, SUM, indicating that in New Brunswick the breeding population is considered to be vulnerable, the nonbreeding population is ranges from vulnerable to apparently secure, and the migratory population is unrankable due to lack of information. Evening grosbeaks are typically found in coniferous, northern forests. They breed in mature or second growth conifer or mixedwood forests. This species can be found in high numbers during forest insect outbreaks, and spruce budworms are a preferred food during the breeding season (Gillihan and Byers 2001). They often form large feeding flocks. Evening grosbeaks nest in both hard and softwood trees, as well as in large shrubs.

There is currently no recovery strategy or critical habitat designated for this species. Potentially suitable habitat for this species exists within the LAA, but no evening grosbeaks were observed in or near the LAA during field surveys conducted in support of the Project.

Monarch

The monarch is a large, showy butterfly, and one of the most well-studied in the world. This species is listed as *special concern* under Schedule 1 of *SARA* and Schedule A of NB *SARA*. AC CDC lists this species as S3B,S3M indicating the species is considered vulnerable in New Brunswick. Monarch adults migrate into New Brunswick in summer and seek out milkweed (numerous species) plants on which to deposit their eggs. The larvae feed exclusively on milkweed, which are found predominantly in open and periodically disturbed habitat such as roadsides, fields, wetlands and open forests (COSEWIC 2016).

There is a Management Plan in place for monarch, however there is no Critical Habitat identified at this time. Milkweed plants (Asclepias syriaca, and A. incarnata) were noted in the PDA during vegetation and wetland surveys conducted in July and August of 2018. A total of 19 records of milkweed in eight areas were noted. No monarch larvae were observed on those plants during those surveys, nor during bird surveys conducted in 2019. None of the milkweed locations interact with the footprint of the Project structures, therefore it is assumed that all milkweed locations can be avoided by the Project. These species of milkweed typically grow in open locations, therefore, most locations with milkweed present are unlikely to require extensive pre-construction clearing.

Skillet Clubtail

The skillet clubtail is a striking brown black and yellow dragonfly species with a circular expansion at the end of its abdomen. This species is listed as *endangered* under Schedule 1 of *SARA* and Schedule A of NB *SARA*. It has an AC CDC s-rank of S1S2 indicating that in New Brunswick, the population is considered imperiled to critically imperiled. The range of this dragonfly species is confined to eastern North America, and in Canada it has been reported in Nova Scotia, New Brunswick, Ontario, and Quebec. This species has specific habitat requirements, and is a specialist of clean, large to medium to slow-running waters with a fine substrate, usually with a significant component of silt or clay (COSEWIC 2010b).

A recovery strategy has been developed for this species, and Critical Habitat has been identified partially and to the extent possible based on the best available information. Several patches of Critical Habitat for this species lie along the Saint John River, downstream of the Project. The closest patch is approximately 17 km from the Project crossing of the Saint John River. Skillet clubtail has been recorded along the southern Saint John River and was reported within 5 km of the Project by the AC CDC.

Incidental Wildlife Observations

A variety of wildlife were observed during bird and wildlife surveys conducted in 2019 and vegetation and wetland field surveys conducted in 2018. The following non-bird wildlife species were either observed directly, or indirectly (e.g. scat, footprints):

Mammals:

- white-tailed deer (*Odocoileus virginianus*)
- moose (*Alces americanus*)
- American black bear (*Ursus americanus*)
- red squirrel (*Tamiasciurus hudsonicus*)
- snowshoe hare (*Lepus americanus*)
- striped skunk (*Mephitis mephitis*)
- northern raccoon (*Procyon lotor*)
- North American porcupine (*Erethizon dorsatum*)
- eastern coyote (*Canis latrans*)
- red fox (*Vulpes vulpes*)
- American beaver (*Castor canadensis*)
- North American river otter (*Lontra canadensis*)
- long-tailed weasel (*Mustela frenata*)
- American mink (*Neovison vison*)

Herpetiles:

- spring peeper (*Pseudacris crucifer*)
- wood frog (*Lithobates sylvaticus*)
- American toad (*Anaxyrus americanus*)
- mink frog (*Lithobates septentrionalis*)
- pickerel frog (*Lithobates palustris*)
- green frog (*Lithobates clamitans*)
- eastern newt (*Notophthalmus viridescens)*
- maritime garter snake (*Thamnophis sirtalis*)

All of these species have a general status rank of secure and have an AC CDC s-rank of S4 or S5. No non-bird SAR or SOCC were found in the PDA.

5.5.3 Assessment of Potential Interactions with Wildlife and Wildlife Habitat

This section describes how Project activities could interact with wildlife and wildlife habitat as well as the techniques and practices that will be applied to mitigate the potential effects of these interactions.

5.5.3.1 Construction

Construction activities can affect wildlife and wildlife habitat in a variety of ways, and many of these interactions can vary seasonally. The most substantial interaction between construction activities and wildlife and wildlife habitat may occur during clearing activities, when forested habitat is lost. Most clearing and construction will occur within the PDA and should be scheduled to occur during fall and winter, outside of the breeding bird season. If clearing is required during breeding bird season (mid-April to late-August), nest searches will be conducted prior to any clearing which must take place during the breeding bird season. If nests are found, a species-specific buffer should be established around the nest that must not be disturbed until chicks have fledged.

During construction, heavy equipment will be operating onsite during vegetation clearing and other construction activities. These activities will create possible sensory disturbance to wildlife resulting from the lights and noise of construction equipment. Wildlife may react to sensory disturbance in different ways. Some species may simply avoid the area, which results in temporary habitat loss for the duration of construction (Bayne *et al.* 2008). Spring construction activities could change breeding and rearing success for birds resulting in reduced productivity or nest abandonment.

Direct mortality of birds could also occur during construction activities through collisions with construction equipment. Lighted equipment can attract migrating birds. While this phenomenon is more pronounced at night and in poor weather conditions (Avery et al. 1976; Longcore and Rich 2004; Ogden 1996; Wiese *et al.* 2001), it can occur at any time. During construction, full cut-off temporary lighting should be used to reduce attraction to migrating birds.

Some herpetiles and species of small mammals may leave protective cover in response to construction noise and activity, which could increase direct mortality resulting from increased predation rates or collision with equipment. Herpetiles such as turtles are slow moving and may not be able to get out of the way of vehicles or equipment, which could result in injury or mortality. Turtle nests, if present, may also be at risk if construction is occurring in the riparian zone. Nests could be destroyed if they are run over by vehicles or equipment, or as a result of ground disturbance. Wood turtles' nests, in particular, hatch in the fall, which means that eggs or young turtles may be present during the RoW clearing and transmission line construction.

During construction, wildlife habitat will be altered through the creation or expansion of edges. Edge effects can also increase access for herbivores and predators, resulting in changes to indirect mortality through herbivory or predation, and can also lead to increased nest parasitism. Nest predators and parasites (e.g., brown headed cowbirds) are more abundant near forest edges (Lloyd et al. 2005; Rich et al. 1994). Edge habitats are already abundant throughout the PDA and LAA. The new transmission line will be paralleling an existing line. No new edges will be created; the RoW will simply be widened. Following the existing transmission line also avoids additional habitat fragmentation.

5.5.3.2 Operation and Maintenance

The presence of transmission lines can pose an increased mortality risk for wildlife, through collisions with the lines. Transmission line collision is estimated to be the third leading cause of bird-mortality from human influences (Calvert et al. 2013). Waterfowl and waterbirds are at higher risk of collisions due to their higher wing loading (body weight relative to wing area) and reduced maneuverability in the air (Bevanger 1998; Rioux et al. 2013). Transmission line design can also influence bird mortality, as transmission lines with inadequate spacing between components such as conductors can lead to electrocutions. This occurs when birds with large wing spans, such as raptors, touch more than one conductor with fleshy body parts (touching with dry feathers will not cause electrocutions). The transmission lines (i.e. conductors) in this Project have a spacing of at least 3.8 m, which provides adequate clearance for large bird species such as raptors to avoid electrocutions (BirdsFlight 2019). Diurnal migrants, including waterfowl, waterbirds and raptors, may fly at lower elevations during migration. This increases their vulnerability to collisions with transmission lines. The transmission lines crossing the

Saint John River will have large reflectors attached that are intended to warn airplanes and helicopters. Large markers on transmission lines have been shown to improve the ability of birds to detect the lines (APLIC 2012) and these aviation markers could also provide a deterrent to deflect the path of migratory birds.

With the exception of Saint John River, there are no major waterfowl staging areas near the PDA. There are also very few areas of open water that waterfowl may use as breeding or stopover or habitat, other than the Saint John River. Although waterfowl may occur in the PDA or may pass through during migration, this group of birds is not abundant, and not at a high potential for collisions. Transmission line collisions would be as likely as they are now, as the new transmission line will be parallel and at approximately at the same height/elevation as the adjacent line.

Vegetation management activities along the RoW include hand-cutting, mechanical cutting and the use of herbicides (as described in section 2.7.2.2). These activities have the potential to affect nesting birds. Many small passerines, including various species of warblers, nest in thick shrubs often found in re-growing or disturbed habitats. Edge habitats are also preferred by many bird species. NB Power, through its PSEMP, remains committed to the safe and efficient maintenance and operation of electrical transmission infrastructure, while protecting migratory birds in the region.

5.5.4 Summary for Wildlife and Wildlife Habitat

With mitigation and environmental protection measures, it is not anticipated that there will be any substantial changes to wildlife populations or wildlife habitat that overlaps the LAA. The habitat in this area is already highly fragmented. In addition, the new transmission line will follow an existing transmission line. As such, edge habitats and the risk for collisions already exist in these areas. The Project schedule limits potential disturbance to wildlife, as the majority of the Project clearing and construction will occur in the fall and winter, outside of the breeding bird season. No SAR or SOCC are expected to be lost as a result of this Project.

5.6 SOCIOECONOMIC ENVIRONMENT

This section assesses the potential interactions between the construction and operation and maintenance of the Project and the socioeconomic environment. Socioeconomic environment was included as a VC due to the potential for this Project to interact with land and resource use, transportation, infrastructure and services, and employment and the economy.

5.6.1 Scope of Assessment

Land use refers to the current and future use of public and private land/resources in the immediate vicinity of the Project. It includes industrial and commercial use, private ownership, and changes in the use of land for recreational purposes. The current use of land and resources for traditional purposes by Indigenous persons is discussed in Section 5.8.

The scope of assessment is based on applicable regulations and policies, professional judgment and knowledge of the study team, and potential interactions.

5.6.2 Existing Conditions for the Socioeconomic Environment

5.6.2.1 Information Sources

A combination of spatial analysis and baseline research was used to characterize the socioeconomic environment in the PDA and LAA. Baseline research included a review of online sources for land and resource use information (Appendix C). Information on existing conditions was drawn from the following sources:

- GIS databases
- Published maps and aerial/satellite photography
- Government sources, including
  - Statistics Canada
  - various departments of the Government of New Brunswick
  - municipal governments
- Community organizations
- Past project assessments and technical reports

5.6.2.2 Overview

The Project, as described in Sections 1.2, 2.2, and 3.3, is located near the provincial capital city of Fredericton in York County, New Brunswick. Combined with Sunbury and Queens counties, the area makes up the Central Economic Region of the province which has an estimated 142,340, or about 20% of the population of New Brunswick (GNB 2018a). Of the estimated 142,340 people who live in this region, 101,760 (~ 71%) of them live in the Fredericton census area (GNB 2018a).

The largest land component of the PDA is private land (85.0% by area) followed by crown land (15.0%). About 1,005 ha (58.0%) of land within the LAA is forested, with the remaining area being used for anthropogenic purposes (buildings, residential and industrial purposes, transportation, utilities, and recreation) as well as agricultural uses and open water (Appendix C).

The western-most 1.7 km section of the PDA including the Rainsford Substation is located near several residential subdivisions that are accessible from Hanwell Road (Route 640). From the 1.7 km mark west to the end of the PDA the Project only passes near (e.g. within 75 m) of a few residences located on Deerwood Drive. With the exception of the last four kilometers near the Saint John River and the MGS, the PDA largely runs through undeveloped forested land that is accessible by off-road vehicles only. There are 63 properties within the PDA of which one belongs to a business (forestry company). The nearest private residence to the Project is located approximately 40 m from the PDA.

Businesses within the 500 m LAA of the transmission line, including the Rainsford Substation, are predominantly small and medium-sized service and retail entities including building supplies, vehicle rentals, boat sales and service, technology, and a veterinary clinic.

While there are no expansions to the footprints of the substations associated with this Project, businesses and services within 500 m of the substations are included in recognition of potential Project-related

interactions by way of improvements to the reliability of electrical transmission and short duration changes to traffic patterns. The businesses and services within 500 m of these substations are as follows.

Priestman Street Substation: District Highway Office and school bus depot for the New Brunswick Department of Transportation and Infrastructure, Community Centre, church, telecommunications depot, commercial strip mall, elementary school, and regional hospital.

Vanier Substation: Coop store, two tire dealerships, pharmacy, and a building supplies wholesaler.

Aberdeen Street Substation: Located within a highly developed residential area in downtown Fredericton, there are numerous businesses and services including a Government of Canada parole office, telecommunications depot, shoe factory, NB Liquor outlet, daycare, middle school, financial cooperative, church, farmer's market, and numerous bed and breakfasts.

There are no businesses within 500 m of the Mactaquac Terminal.

There are no registered recreational sites within the PDA of the Project. The PDA crosses (spans) the Woodstock to Silverwood section of the Trans Canada Trail which runs adjacent to Route 102 (SentierNBTrail 2019). There are no registered all-terrain vehicle (ATV) trails (NBATVF 2019) or registered snowmobile trails (NBFSC 2019) in the PDA. Horseback riding may also occur within the LAA, especially on the most eastern end near the Rainsford Subdivision and the western end near Route 102.

There are no Oil and Natural Gas Licences or mining licences within the LAA (GNB 2005; SNB 2017).

Hunting, fishing, and trapping are popular activities in the more remote areas of the LAA. The LAA is located within New Brunswick Wildlife Management Zone (WMZ) 21, which is typically open for hunting deer, game bird, varmint, small game, moose, bear hunting, and trapping (GNB 2019b).

5.6.3 Assessment of Potential Interactions with the Socioeconomic Environment

This section describes how Project activities could interact with the socioeconomic environment as well as the techniques and practices that will be applied to mitigate the potential environmental effects and enhance beneficial effects of these interactions.

5.6.3.1 Construction

Project-related construction of the transmission line and substations is expected to employ a small contingent of skilled workers that could have a positive effect on employment and economy within the LAA. NB Power will follow its existing practice of encouraging local and Indigenous content and will, where possible and relevant, work toward a hire-local-first practice. Workers will be paid wages consistent with the Eastern Canadian labour market, and NB Power will procure goods and services from local and Indigenous businesses in accordance with its existing purchasing policies and procedures. Construction is anticipated to be beneficial to both employment and the economy, because local employment and business opportunities will be created, and taxes will be paid to municipal and provincial governments. However, due to the size of the Project, any interaction with the local economy during construction is expected to be relatively small and short in duration.

Project-related interactions with the road transportation network will temporarily and intermittently restrict access for vehicular and/or pedestrian traffic and affect local traffic patterns in the transportation network leading to and from the PDA, substations, terminals, and surrounding area. Construction will also result in a slight increase in passenger vehicles and heavy trucks transporting workers, materials, and equipment to and from the site. However, traffic will be managed through standard procedures such as signage and flagging crews. All large-sized vehicles will obtain appropriate weight and size permits. Moving large equipment involving road closures will be conducted at low traffic times. The public will also be notified about long delays or disruptions to the transportation network, and construction.

Safety restrictions during construction activities will have an effect on land use through short-term restricted access to portions of the PDA but will not affects substations or terminal properties as there is currently no access permitted to these areas. The PDA does not cross any registered ATV or snowmobile trails, and as the TransCanada Trail at Route 102 will be spanned, restricted access to this portion of the trail could be limited to one day for line stringing. Owners of private land that will be affected will be consulted and accommodated for use of their land as appropriate, prior to construction. Access to private properties will be maintained during the Project. Public notices will be made by NB Power to communicate schedules for Project activities, particularly those related to access restrictions. Access restrictions will be defined and will be limited in size to reduce the interactions with land and resource users. Transmission route planning (Section 2.3) such as utilizing existing NB easements adjacent to the existing Line 1135 will reduce disruption of land use throughout most of the PDA. Aerial/satellite photographs, GIS based mapping, and biological databases were referenced to reduce the potential for the crossing of wetlands, and other constraints.

Noise, vibration, and dust related to construction activities for the transmission line and substations could also cause short-term nuisance issues with residents in the area and subsequently affect residential and commercial land use for short periods. Mitigation described for the Atmospheric Environment (Section 5.1.3) will be used to reduce these nuisance effects. These include limiting noise emitting construction activities to daytime hours (i.e., between the hours of 6:00 am and 9:00 pm); and the use of dust suppressants and water on access roads to limit dust emissions. Construction is also planned to occur in fall 2020 and winter 2011 during which snow cover and more frequent precipitation which will reduce the potential for dust.

5.6.3.2 Operation and Maintenance

Operation and maintenance of the new 138 kV transmission line and substations is expected to have mostly beneficial interactions with the socioeconomic environment once these facilities are in operation. The Project will improve the reliability of electrical transmission to some customers in Fredericton by reducing the dependency on the one existing Line 1135. The addition of the new transmission line and substation upgrades will provide redundancy to decrease the risk of power failures that can be both a financial and emotional burden on customers. The decreased duration and frequency of power failures will reduce the risks to health and safety of customers during periods of extreme cold. The improvement of transmission reliability to services (e.g., businesses, schools, government services, churches) will have indirect positive effects to the customers that rely upon them. However, as it is difficult to accurately

measure these indirect benefits, they are recognized but not elaborated on in this EIA Registration document.

Vegetation management activities within the RoW will limit vegetation growth, preventing further forest maturation and harvesting; however, forest areas will be restored upon decommissioning at the end of its useful life. Attempts will be made to avoid placing poles within the agricultural lands that are incorporated into the RoW. However, fields of low-growing crops and hayfields will be allowed to continue throughout the operation and maintenance of the transmission line. The use of lands along the RoW for recreational purposes such as snowmobiling and ATV use is currently not encouraged by NB Power; however, the decision to allow access to the RoW for such purposes is ultimately at the discretion of the property owner.

5.6.4 Summary for the Socioeconomic Environment

Adverse interactions between the Project and the socioeconomic environment will be mitigated largely through Project planning, nuisance mitigation (e.g., dust and noise controls), and providing notice of Project activities to the public and affected and adjacent landowners. Consultation and accommodation will be conducted with private landowners for use of their land as appropriate, and nearby landowners and businesses will be advised of Project activities. Residual effects are temporary, localized, and of low magnitude. These interactions will be temporary (approximately 8 months total) during construction with negligible interactions during operation and maintenance, similar to the operation and maintenance of the adjacent line. Socioeconomic benefits are expected through the provision of upgraded energy transmission lines and substations to increase transmission reliability. Based on the predicted characterization of residual environmental effects and mitigation measures described above (including compensation for loss of land, and maintenance of access to private properties), it is anticipated that Project activities will not cause a long-term disruption or degradation of land use to a point where current use would be substantially affected.

5.7 HERITAGE RESOURCES

This section includes an assessment of potential interactions between construction and operation and maintenance of the Project and heritage resources. Heritage resources have been selected as a VC in recognition of the interest of provincial and federal regulatory agencies who are responsible for the effective management of these resources; the scientific community; and Indigenous peoples and the public who have an interest in the preservation and management of heritage resources related to their respective history and culture. For this VC, heritage resources include consideration of historical, archaeological, built heritage, and palaeontological resources. Heritage resources will focus on archaeological resources (consisting of Indigenous and Euro-Canadian archaeological sites), built heritage (historical buildings and structures), and palaeontological resources (fossil sites), as all resources that would be understood to be “historical” are captured under one of these heritage resource types.

5.7.1 Scope of Assessment

Heritage resources are those resources, both human-made and naturally occurring, related to human and natural activities from the past, that remain to inform present and future societies of that past. Heritage resources are permanent, although highly tenuous, features of the environment. Where heritage resources are present, their integrity is highly susceptible to construction and ground-disturbing activities. The value of heritage resource sites is measured in terms of the information about the past that might be obtained from studying the materials that remain and, where applicable, their spatial relationship and context within the site and landscape. These resources are particularly susceptible to disturbance in terms of losing information that comes from the context of the ground. As a result, removing or disturbing these resources from an in-situ context without scientifically recording that original context can result in a permanent loss of information, as in some cases these resources are the only means society has of learning about this past.

Any Project activity that includes surface or sub-surface ground disturbance has the potential for interaction with heritage resources, where they are present. Accordingly, construction represents the greatest potential for interaction with heritage resources.

Heritage resources in New Brunswick are regulated under the *Heritage Conservation Act*. The regulatory management of heritage resources falls under the NBDTHC and is administered by its Archaeological Services Branch (for archaeological resources), Historic Places Section (for built heritage resources), and Natural Sciences Section (for palaeontological resources).

The review for heritage resources has been undertaken through the completion of historical, archaeological, built heritage, and palaeontological research. The Province of New Brunswick does provide some guidance for conducting heritage assessments, such as the *Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick* (the “Archaeological Guidelines”; AS 2012).

Consultation and engagement activities have been ongoing as part of the heritage resources component of the Project. During the background research for heritage resources, regulatory agencies were contacted in order to gather information on potential heritage resources within the PDA.

NB Power has initiated First Nations consultation for the Project. As the consultation process progresses, any areas of interest and concern regarding heritage resources expressed by First Nations representatives, with respect to the potential for them to be located within the PDA and affected by the Project, will be taken into consideration during the planning stage of the Project. Mitigation will be developed, as warranted, in consultation with regulatory agencies and First Nations, as applicable. First Nations representatives were present and participated in the fieldwork undertaken for the archaeological impact assessment for the Project.

Consultation has occurred with staff at Archaeological Services Branch (AS). This consultation involved requesting and reviewing the provincial archaeological potential maps and map data to identify registered archaeological sites and heritage resources in the Archaeological Services Sites Database, identifying any potential palaeo-shorelines, and areas of elevated archaeological potential within, or potentially

interacting with, the PDA. An Archaeological Field Research Permit (AFRP) application, detailing the methodology to be employed in the Archaeological Impact Assessment (AIA) for the Project, was submitted to, and approved by AS. The results of the walkover survey portion of the archaeological impact assessment have been submitted to AS. This included areas of elevated archaeological potential identified during the fieldwork, and associated recommendations for shovel testing and further assessment. Given the lack of structures and buildings within the PDA, contact with the Historic Places Section for information on built heritage resources was not undertaken prior to the field survey.

5.7.2 Existing Conditions for Heritage Resources

Archaeological resources, palaeontological resources, and built heritage were considered when describing existing conditions as part of this VC.

5.7.2.1 Archaeological Resources

Pre-Contact Period

The Pre-contact period is defined as the period of human occupation of the lands of what is now eastern Canada for the entirety of the timeframe from the first arrival of humans, approximately 13,000 years Before Present (BP), up to the time of contact between these Indigenous populations and the European explorers when they first encountered North America, generally interpreted to be approximately 500 years BP.

A review of the Archaeological Potential Map (APM; AS 2018) for the Project indicates that there are no registered Pre-Contact Period archaeological sites located inside or near the PDA.

The PDA lies within the traditional territory of the Indigenous people of the Wolastoqey First Nation, whose territory is largely defined by the drainage area of the Saint John River, which they had originally named the Wolastoq, or “beautiful river” (Rayburn 1975). Much of the livelihood efforts of the Wolastoqey were focused on major river systems because this was a primary mode of travel. Due to its size and the fact that it covers such a large land area, the Saint John River was considered the main travel route. It provided access to a vast territory of land but also, through it and its tributaries, to virtually any location in what is now known as Maine and the Maritimes, including the Bay of Fundy and Gulf of Saint Lawrence. It also provided bountiful resources for hunting, fishing, trapping, and other subsistence activities.

The Palaeoindian Period (11,500 - 9,500 BP) was the earliest period of human occupation in the province, although recent evidence from Pennfield, New Brunswick suggests this period began earlier, between 12,9000 - 12,500 BP (Suttie et al. 2013). It occurred during a time of extreme environmental and geographic change in the region immediately following the melting of glaciers in New Brunswick, the exact nature of which is not well understood. At the end of the last glaciation, a general warming trend began and the glaciers that covered all the lands that would become New Brunswick began to break apart. By 12,000 years B.P., most of the interior portions of New Brunswick, including the current location of the headpond, were ice-free (Shaw *et al.* 2006). The mixture glacial lake mosaics, incremental forest development, and open habitats during this period created favourable conditions for caribou herds (Newby *et al.*, 2005) and a number of other small and large mammals, which are believed to be the

primary food sources for people moving into the area at that time. The only confirmed artifact from this period near the headpond area of the PDA, called the “Kingsclear Point”, is a single fluted point recovered near Kingsclear by a private collector (Turnbull 1974; Erickson 2007).

Stone artifacts from the Archaic Period (9,500 - 3,000 BP) were located in the current headpond along the shorelines of the Saint John River before the construction of the MGS (McIntosh no date (n.d.); Pearson 1968). One of the most significant Late Archaic Period finds in the headpond was from a terrace opposite the mouth of the Eel River at Meductic. This very rich archaeological site served as one of the most important Wolastoqey settlements on the Saint John River and was used continuously up to and including the Historic Period. Prior to the flooding of this location, Pre-Contact artifacts could be found eroding from virtually every point along the shoreline at this location, where *“literally thousands of chippings, many whole and broken artifacts, pottery shards, fire and food pits, [and] burned beach stones”* could be found (Clarke 1970, p. 41–42). Clarke also notes that *“on practically every yard of the three terraces one finds flint flakes and fire-stones where wigwams once stood”* (Clarke 1970, p. 43). Other archaeological sites from the Archaic Period have also been documented within the headpond, including at the outlet of Lane’s Creek, located north of Woodstock, where *“literally bushels of large broken and chipped flint stones”* were found (Clarke 1970, p. 152). According to oral tradition, several battles were fought at Meductic and the remains of the dead were buried on both sides of the river (Raymond 1897).

The current inventory of archaeological sites in the province reveals that most have been dated to the Maritime Woodland Period (3,000 - 500 BP), based on the type of stone tools identified as well as evidence from style and dates of pottery found (Petersen and Sanger 1993; Rutherford 1993). Apart from the rich inventory of Woodland Period resources located at Meductic, four sites from this period are located within 5 km of the PDA: BlDq-1 and BlDq-5 located on Eqpahak Island and BlDp-47 and BlDp-49 located on the north shore of the Saint John River near the mouth of the Nashwaaksis (AS 2018), down river from the Project.

Historic Period

The Historic Period is defined as the period from the arrival of mostly European-derived peoples to North America, approximately 500 years BP, until the modern era.

A review of the APM (AS 2018) reveals one registered Historic Period archaeological site (BlDr-6) inside the PDA and two other registered Historic Period sites (BlDr-2 and BlDr-3) within a 700 m radius of that portion of the PDA that includes the switching substation in the field north of the MGS (Appendix D). During the environmental review for the refurbishment of the MGS Project, the archaeological assessment of the lands around the dam conducted by Stantec in 2016 identified a number of historic period archaeological features and these features were registered as archaeological sites with the Province of New Brunswick (Stantec 2017d).

The site located inside the PDA, BlDr-6, is a Historic Period homestead located approximately 200 m north-northeast of the switching substation. While the area is grassed over now, depressions likely from former building locations, are visible on the surface and likely represent the home, barn and various outbuildings on the property (Appendix D). The land was granted to Abraham Close in the late 18th or

early 19th century, likely a Loyalist settler. Features of the homestead are visible on the 1950s and 1960s aerial imagery of the area and were likely torn down during the construction of the MGS. As a registered site, BlDr-6 will have a provincial regulatory buffer of 100 m applied by default, and any planned ground-breaking activities within the buffer zone of any registered site will require a Site Alteration Permit (SAP) to be submitted to the Province prior to the initiation of those activities.

The earliest examples of European presence in the headpond area are the French missionaries who worked with Indigenous peoples at Fort Meductic (located near the confluence of the Eel River and Saint John River) under the support of the Bishop of Québec. Although originally established by the Wolastoqey people as a settled village extending deep into the past, Meductic had been transformed into a Jesuit mission by the end of the 17th Century (CRHP 2018a). By 1716, the French had established a mission at Meductic, and the first church on the Saint John River was constructed adjacent to the burial ground (Raymond 1897). A school was established at Meductic in 1788 (Raymond 1897) which remains, along with an earlier trading post, were uncovered during salvage excavations funded by the New Brunswick Electric Power Commission in the 1960s (Caywood 1969). Literature suggests that the headpond area would likely have been a stopping place between Québec and the French outposts located along the Saint John River at and downstream of what is now Fredericton (McIntosh n.d.). Following the expulsion of the Acadians in 1755, most, if not all, of the Acadian settlements along the Saint John River were destroyed by 1758 (Gordon and Grant 1975). Some Acadians fled to Maugerville, and later to what is now Keswick Ridge (“The French Location”).

Following the end of the American Revolution in 1783, approximately 1,300 settlers, Loyalists, as well as others of European descent, established themselves up and down the Saint John River valley. Within one year, the number had risen to 9,260 (Gordon and Grant 1975). The majority of these settlers were farmers and working in forestry activities. Woodstock, New Brunswick’s first town, was established by Loyalist settlers in 1786. Houses in the Saint John River valley that were constructed out of logs, with chimneys and fireplaces constructed from stones embedded in clay, were being replaced by homes constructed of stone, or frame houses, built from timber provided by nearby mills (e.g., Jewett’s Mills), with brick chimneys (Gordon and Grant 1975). Many of the homes included cellars dug up to at least four feet deep to prevent damage to the foundations from the cold winters and provide for cool storage areas for the harvest (Trail 2002).

Farms and other operations remained active in the area now occupied by the headpond until the decision to construct the MGS in the 1960s when the provincial government encouraged (and eventually forced) those living in the portion of the river valley that was to be flooded to leave the area. Progress reports leading up to the construction of the MGS (Resource Development Engineering 1966) indicated that 340 buildings (not including churches and schools) were located within the flood zone needed for the headpond. Some homes were moved to other locations above what would become the high-water mark of the current headpond. Some of the more prominent or historic homes and structures were moved to the newly established tourism village, Kings Landing, in an attempt to preserve them and to provide some compensation for flooding of the land through increased tourism potential for the area. Other buildings were either demolished or burned so that there were virtually no standing buildings within the headpond at the time of flooding, with the exception an NB Tel building constructed out of stone (Myles, D., pers.

comm. 2015 in Stantec 2017d). All bridges within the area now covered by the headpond were demolished, but some remnants remain today, either submerged or visible on the banks of the headpond.

The flooding of the land following the construction of the MGS resulted in the widening of the Saint John River and its tributaries including Kelly Brook (now Kelly's Creek) and Longs Creek, creating a lake. The flooding resulted in the loss of islands including Snowshoe, Wheeler, Great Bear, and Long islands, and portions of the old TransCanada Highway No. 2, as well as the abandonment of a portion of the Canadian National Railway (H.G. Acres and Company Ltd. 1969). Some of this now submerged infrastructure remains discernible to this day by careful observation of bathymetric records collected by the Canadian Rivers Institute in support of the Mactaquac Project (Stantec 2016).

Results of the 2018 Archaeological Impact Assessment

The field survey (walkover) component of the archaeological impact assessment (AIA) for the Project was completed in the summer of 2018. During the walkover, a total of twenty-six (26) areas of elevated archaeological potential were identified (Appendix D). Details on the areas of elevated archaeological potential, which also includes registered site BlDr-6, are summarized in Table 5.12.

It should also be noted that while traversing the northern shoreline of the Saint John River to gain access to the location where the PDA crosses the river, the Stantec Archaeology Team discovered two possible Pre-contact lithic artifacts. The location where each lithic was found was recorded well outside of the limits of PDA and depicted on the maps in Appendix D. Following subsequent review and confirmation from Archaeological Services that the two lithic pieces are archaeological, the location of the discoveries has been registered as an archaeological site (temporary site no. 2018NB32-01). As the site is located well outside of the PDA, it is not anticipated to be affected in any way by the Project.

Table 5.12 Summary of the Elevated Archaeological Potential Areas

Elevated Potential Area	Description	Potential
BlDr-6	Archaeological Site: Historic Period homestead	High
TCD-2018-ARCH-005	Extensive terrace on east side of intermittent cut channel. The terrace represents an extensive landform feature that sits above the steep slope overlooking the Saint John River.	Medium
TCD-2018-ARCH-007	Small elevated terrace on west side of deeply cut intermittent channel. The terrace sits above the steep slope overlooking the Saint John River.	Medium
TCD-2018-ARCH-010	Relatively flat well-drained floodplain terrace located in between the extension to Fish Hatchery Lane (south side of Saint John River near PDA) and where the road bends to contour the base of the slope.	High
TCD-2018-ARCH-011	Extensive flood plain terrace on south side of Saint John River and north of Fish Hatchery Lane extension	High
TCD-2018-ARCH-018	Elevated ridge adjacent to a potential palaeo-channel. The terrain is well-drained with mature mixed wood growth.	High

Table 5.12 Summary of the Elevated Archaeological Potential Areas

Elevated Potential Area	Description	Potential
TCD-2018-ARCH-021	Elevated ridge adjacent to a potential palaeo-channel. The terrain is well-drained with mature mixed wood growth.	High
TCD-2018-ARCH-023	Small elevated ridge adjacent to a potential palaeo-channel. The terrain is well drained with mature mixed wood growth.	High
TCD-2018-ARCH-027	Extensive land form feature overlooking the Saint John River. The upland feature has a gentle rolling topography near its crest before it tapers down into intermittent wetland.	High
TCD-2018-ARCH-030	Small terrace on west side of McIntosh Brook. The flat and level terrace is elevated several meters above the small meandering brook that flows approximately 100 m to the east.	High
VJB-2018-ARCH-015	Small terrace on east side of McIntosh Brook. In contrast to TCD-2018-ARCH-030, this terrace sits at lower elevation with a gentle 80m slope separating it from the brook.	Medium
TCD-2018-ARCH-034	Small terrace on west side of an un-named watercourse. The terrace is well-defined with an abrupt slope down to watercourse.	High
VJB-2018-ARCH-016	Flat and well-drained terrace, slightly elevated compared to adjacent areas which is low and carved by ephemeral channels.	Medium
VJB-2108-ARCH-019	Prominent hilltop offering a vantage point of the Saint John River valley. The terrain is characterized by level, well-drained terrace with mixed-age conifer forest.	Medium
VJB-2108-ARCH-020	Terrace separating two wetlands. The terrain is well-drained with a mature mixed wood forest.	Medium
VJB-2108-ARCH-021	Elevated terrace east of a wetland. The western edge of the terrace is abrupt and steep, while the eastern edge slopes gently towards low lying wet terrain.	Medium
TCD-2018-ARCH-054	Small elevated and well-drained terrace. It is visible on the LiDAR mapping and could be associated with a palaeo-channel.	High
TCD-2018-ARCH-059	Well-drained, sandy land form just north of the archaeological potential buffers linked to Springhill Brook tributary.	Medium
TCD-2018-ARCH-061	Elevated terrace north of Springhill Brook. The terrain is similar to TCD-2018-ARCH-059.	Medium
TCD-2018-ARCH-063	Small terrace on west side of Springhill Brook. The terrace is relatively flat and well-drained and overgrown with immature mixed forest.	High
TCD-2018-ARCH-064	Elevated terrace on east bank of Springhill Brook. The terrace is positioned above the steep east slope of the brook.	Medium
TCD-2018-ARCH-067	Small ridge terrace elevated high above the western slope of Garden Creek and can be seen on LiDAR mapping.	Medium
TCD-2018-ARCH-068	Narrow floodplain-terrace positioned between the base of slope and Garden Creek.	High

Table 5.12 Summary of the Elevated Archaeological Potential Areas

Elevated Potential Area	Description	Potential
TCD-2018-ARCH-070	Elevated terrace on eastern side of Garden Creek. It is located above the steep slope of the creek.	Medium
TCD-2018-ARCH-043	Well-drained terrace on the east side of wetland.	High
TCD-2018-ARCH-044	Well-drained terrace on the west side of wetland.	High
TCD-2018-ARCH-049	Level terrace on top of bedrock ridge which offers an excellent vantage point of the surrounding areas.	High

5.7.2.2 Palaeontological Resources

While no specific palaeontological study has been undertaken for this Project, the PDA is located in a relatively uniform geological setting with very few features located within the PDA. The bedrock base is characterized by Silurian-aged Kingsclear Group, Burtts Corner formation, which includes light grey, medium- to coarse-grained wacke, noncalcareous siltstone and shale (St. Peter and Fyffe 2005). The surficial geology of the PDA and surrounding area is characterized by a lag deposit of sandy or stony till veneer diamicton (sediments originating during Pleistocene glaciation) occurring in patches over rock and reworked by glaciolacustrine or glaciomarine processes. An extensive alluvial floodplain deposit is present within the PDA along the south bank of the Saint John River (Allard and Gilmore 2016). Overall, these geological conditions have the potential to contain fossils. It is possible, therefore, where bedrock is encountered that interactions could occur between Project activities and fossil resources.

5.7.2.3 Built Heritage

A search of the Canadian Register of Historic Places (CRHP 2018b) and the New Brunswick Register of Historic Places (NBRHP 2018) found that there are no registered historic places or heritage sites located within or near the PDA. Furthermore, no buildings of heritage value were found during the 2018 AIA (Stantec 2019). As a result, interactions between Project activities and built heritage resources are not anticipated, and therefore build heritage resources will not be assessed further in this VC.

5.7.3 Assessment of Potential Interactions with Heritage Resources

This section describes how the Project activities could interact with heritage resources as well as the techniques and practices that will be applied to mitigate these potential interactions.

5.7.3.1 Construction

During construction, activities that could result in a potential interaction with heritage resources include vegetation clearing, site preparation, and excavation and structure assembly. Though the RoW will be cleared for the Project, groundbreaking and earth moving activities will be limited to the areas where excavations are carried out to place the transmission line poles, and guy wires for some pole locations. Archaeological resources, where present, are typically located in the upper soil layers of the earth and therefore potential interactions between these resources, if they are present, and the Project would take

place during construction. Any potential for interactions with heritage resources that might occur due to construction activities will be permanent, as no archaeological site can be returned to the ground in its original state.

Vegetation clearing for the Project will largely be carried out by mechanical means and has the potential to interact with heritage resources as these activities may result in some ground disturbance, as a result of potentially significant rutting along the RoW exceeding a depth of 15 cm. Where access and staging occur, there is the potential for the use of heavy equipment which may also cause rutting resulting in ground disturbance and potential interaction with subsurface heritage resources. Excavation for pole placement and structure assembly may involve mechanical augering, excavation, or blasting, all of which have the potential to interact with heritage resources.

Activities listed under construction that are not anticipated to interact with heritage resources include: conductor stringing, connection of the transmission line, inspection and energization, and clean-up/revegetation. Construction activities within the existing substations are not anticipated to interact with intact heritage resources as these areas are already heavily disturbed from previous construction. Clean-up and revegetation may involve back blading but will occur within the existing previously disturbed construction footprint for pole placement and thus, no new ground disturbing activities will occur. Therefore, interactions with heritage resources are not anticipated to occur from these activities and they are not considered further in this assessment.

The following mitigation measures, through careful design and planning, will be implemented to avoid or reduce the potential for interactions with heritage resources:

- Planned avoidance (e.g., transmission line pole and guy wire placement) of areas identified during the walkover survey to exhibit elevated potential for archaeological resources, where practical
- Planned avoidance (e.g., transmission line pole and guy wire placement) for buffers zones around registered heritage sites (i.e., BlDr-6) will be implemented, where practicable
- Implement additional mitigation (e.g., shovel testing or archaeological monitoring), where avoidance of known or elevated potential areas for heritage resources is not practicable in order to determine the presence or confirm absence of archaeological resources
- Apply for a Site Alteration Permit from the Province of New Brunswick for any planned construction activities within the 100 m buffer zone of registered site BlDr-6
- Should any heritage resources be identified that could be affected by the Project it is recommended that NB Power developed appropriate mitigation in consultation with provincial regulators and First Nations, as applicable
- To mitigate for the unplanned discovery of a potential heritage resource (including archaeological and palaeontological resources) during construction, NB Power will include a Heritage Resources Discovery Contingency Plan as part of the PSEMP that will be followed during all phases of the Project

5.7.4 Summary for Heritage Resources

In consideration of the above and considering the nature of the interactions between the Project and heritage resources as well as the planned implementation of known and proven mitigation, based on applicable legislation and guidelines, no substantial interactions between the Project and heritage

resources are anticipated. Shovel testing mitigation at pole placement locations was initiated in fall 2019 and the results will be provided to Archaeological Services prior to construction. If any heritage resources are discovered during the shovel testing, additional mitigation will be developed in consultation with NB Power, Archaeological Services, and First Nations, as appropriate.

5.8 CURRENT USE OF LAND AND RESOURCES FOR TRADITIONAL PURPOSES BY ABORIGINAL PERSONS

This section assesses the potential interactions between construction and operation and maintenance of the Project and the current use of land and resources for traditional purposes by Aboriginal persons (current use) VC. Current use was chosen as a VC in recognition of the potential importance of the lands and resources within the PDA for current use by Aboriginal persons, as well as the constitutionally protected rights of Aboriginal persons to carry out those activities.

In addition, as described in the *Guide to Environmental Impact Assessment in New Brunswick*, pursuant to Section 5(2) of the New Brunswick *Environmental Impact Assessment Regulation 87-83*, proponents are required to take into consideration all cultural activities, hunting, fishing, gathering and traditional uses and practices by Aboriginal persons.

5.8.1 Scope of Assessment

Current use of land and resources for traditional purposes by Aboriginal persons is a VC because Aboriginal persons carry out traditional activities that use the land and resources as an integral part of their lives and culture. In this section, “current” refers to use of the land and resources for traditional purposes in the area of the proposed Project within the last 100 years of “living memory”, which includes the period prior to the construction of the present-day alignment of the existing transmission line (Line 1135).

“Use” refers to traditional activities such as hunting, fishing, and gathering conducted by Aboriginal persons for traditional purposes, and considers subsistence, social, and ceremonial uses, and for which the right to engage in those activities is afforded constitutional protection.

The assessment of environmental effects in this VC has been made based on data and documentary information available at the time of writing. NB Power will maintain communications and information exchange through Aboriginal engagement (Section 8.0) and will consider the implications of any new information related to current use on Project planning, design, and mitigation, if applicable. The Wolastoqey Nation in New Brunswick (WNNB) has been approached to conduct a Traditional Land and Resource Use Study (TLRU) to accompany the assessment provided for this Project.

For the assessment of potential environmental effects of the Project on the use of the PDA by Aboriginal persons prior to 100 years ago, the reader is referred to the heritage resources VC (Section 5.7), where such use would result in archaeological sites that may have been created during earlier timeframes.

The PDA lies within the traditional territory of the Aboriginal people of the Wolastoqey First Nation, whose territory is largely defined by the drainage area of the Saint John River, which they had originally named the Wolastoq, or “beautiful river” (Rayburn 1975). The entire Saint John River valley would have been used by Wolastoqwiyik for hunting, fishing, gathering, and travel within and outside of their traditional territory. While there are no current First Nations communities located within the PDA itself, Kingsclear First Nation is located only 0.55 km west of the PDA; Saint Mary’s First Nation is located approximately 6 km northeast of the PDA; and Woodstock First Nation is located approximately 60 km west-northwest of the PDA.

The proposed route for the new 138 kV transmission line crosses both private and Crown land, with approximately 1.33 km of the RoW for the new transmission line located on Crown land (7.4 ha; 15.0% of the RoW). For the purposes of this assessment only traditional activities practiced on Crown or publicly-owned land (as those lands were not ceded as part of peace and friendship treaties with colonial Europeans) will be considered. Any current use activities that may be taking place on privately-owned land within the RoW are anticipated to be incidental (i.e., at the convenience of the private landowner and subject to landowner permission).

In addition to Crown land identified in Appendix D, all watercourses within the PDA are also considered Crown land. As such, they include riparian rights by all members of the public including Aboriginal persons. Therefore, the ability to access and fish watercourses as well as to hunt and gather resources within the Crown portion of the RoW is included in the assessment of this VC.

The Crown (e.g., NBDELG, NBDERD, Department of Aboriginal Affairs (DAA)) has a duty to consult with First Nations prior to carrying out any activity or authorization that might infringe Aboriginal and treaty rights held by Aboriginal people. As a Crown corporation, NB Power has assumed responsibility for implementing consultation with First Nations, based on the guidance provided from DAA. The New Brunswick Duty to Consult Policy (AASNB 2011) provides direction to the provincial government on consultation with the Wolastoqey and Mi’kmaq First Nations of New Brunswick. Similarly, federal regulatory agencies also have a duty to consult prior to exercising any power, duty or function that might infringe upon Aboriginal and treaty rights.

NB Power has also entered into Relationship and Capacity Funding Agreements with both WNNB, representing the six Wolastoqey communities along the Wolastoq River, as well as with Mi’gmawe’l Tplu’taqnn Incorporated (MTI), representing 8 of the 9 Mi’kmaq communities. These agreements provide a framework for consistent consultation on NB Power project matters, while providing internal capacity for key roles such as EIA review, TLRU/Indigenous Knowledge (IK) studies, and Aboriginal Monitors.

5.8.2 Existing Conditions for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

There are many areas in New Brunswick which have historical and cultural significance to Aboriginal people. These areas include locations where Aboriginal people continue to pursue traditional activities that are an element of a practice, custom, or tradition integral to their distinctive culture.

5.8.2.1 Methods

Consultation activities with First Nation leaders and organizations in central New Brunswick have been initiated by NB Power and are on-going. The exact nature, scope, and detail of First Nations consultation will be determined with the First Nations involved. At this time, the assessment presented below should be considered preliminary as consultation activities are ongoing. This basis for the assessment of potential environmental effects to current use of land and resources for traditional purposes by Aboriginal persons is derived primarily from information included in biophysical assessments associated with other VCs (e.g., fish and fish habitat) regarding the availability of species currently being used for fishing, hunting, trapping and other traditional activities. This, in combination with information from a literature review, past project experience in relation to current use of land and resources for traditional purposes by Aboriginal persons as documented through consultation with Aboriginal communities for those past projects, and professional judgment of the Stantec study team, have formed the basis for the information on current use for this assessment.

The reliance on other VC assessments is based on the assumption that assessments of resources such as fish, wildlife, and vegetation species can be used to inform an assessment of ability to continue to undertake traditional land and resource-use activities. The assessment of effects on fish species for example, may not capture the conditions that influence the act of harvesting (e.g., personal choice); however, effects by the Project on the availability of such species will directly affect the current use of those species.

5.8.2.2 Overview of Existing Conditions

The traditional territory of the Wolastoqwiyik includes the watershed of the Saint John River and its tributaries and is understood to be comprised of what is now northern Maine, USA, a portion of the Gaspé Peninsula in Québec, and most of the western half of New Brunswick. Wolastoqey territory in New Brunswick extends east where it meets the neighbouring territory of the Mi'kmaq First Nation. The general delineation of the territory appears to be the drainage area of the Saint John River watershed as far north as the Gulf of St. Lawrence and south to the Bay of Fundy (Paul 1993; Berneshawi 1997).

There are fifteen First Nations communities within the province of New Brunswick, consisting of six Wolastoqey Nation communities and nine Mi'kmaq Nation communities. In addition to these fifteen communities, there is one other distinct, self-governing community belonging to the Peskotomuhkati Nation at Skutik (St. Andrews, New Brunswick). The Government of New Brunswick is currently working with this Peskotomuhkati community towards their official recognition as a First Nation community. Based on ethno-historical accounts, oral histories, archaeological research, and historical texts, Wolastoqey, Mi'kmaq, and Peskotomuhkati nations and their ancestors have lived and used the land and resources of what is now New Brunswick since the retreat of the glaciers approximately 13,000 years ago.

The majority of land within the PDA is forested or wetland and is primarily rural in nature. The Project crosses seven mapped watercourses and four unmapped watercourses that were confirmed to be present from field surveys. Based on the literature review and field observations as outlined in the freshwater fish and fish habitat VC (Section 5.3), a total of 53 fish species have been identified within the

Saint John River watershed (Kidd et al. 2011). The watercourses crossed by the Project contain freshwater fish and fish habitat. Fisheries are documented to exist in the LAA and other areas of the Saint John River. Commercial fisheries for American eel, American shad, Atlantic sturgeon, gaspereau (i.e., alewife and blueback herring) and rainbow smelt exist in the lower Saint John River, downstream of MGS (DFO 1996, 2001 and 2018a). A commercial harvest for gaspereau occurs at MGS during the spring spawning run, approximately 1.3 km upstream of the LAA (DFO 2001). Fish such as American eel, American shad, landlocked Atlantic salmon, brook trout, brown trout burbot, chain pickerel, gaspereau (i.e., alewife and blueback herring), lake trout, smallmouth bass, striped bass, rainbow smelt, sturgeon, whitefish, muskellunge, and yellow and white perch are fished recreationally in the lower Saint John River (GNB 2019). Aboriginal fisheries exist for alewife, American eel, American shad, Atlantic sturgeon, sea lamprey, brown bullhead, yellow and white perch, chain pickerel, catfish, sunfish, muskellunge, smallmouth bass, striped bass, white sucker, burbot, whitefish, chub, smelt and trout within portions of the lower Saint John River and its tributaries (DFO 2018b).

The PDA is located on both privately-owned land and on Crown land and at this time, it is not known if any traditional use activities are taking place within the PDA; however, given the proximity of First Nations communities in the areas of the PDA, for the purposes of this assessment it is assumed that there are current use activities taking place in parts of the PDA.

Based on the nature of the existing sub-stations, and that the facilities are fenced off for the public's protection, it is anticipated that no current use is taking place within those facilities and therefore they will not be considered further in this assessment.

Should any information regarding current use be identified during NB Power's discussions with First Nations, through the TLRU, or at any time during the planning and regulatory approval process for the Project, this information will be provided to NBDELG.

5.8.3 Assessment of Potential Interactions with Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

This section describes how the Project activities could interact with current use of land and resources for traditional purposes by Aboriginal persons as well as the techniques and practices that will be applied to mitigate those potential interactions.

5.8.3.1 Construction

Construction activities related to the Project could result in a change in current use of land and resources for traditional purposes by Aboriginal persons if these activities result in temporary loss of access to resources on Crown land.

During construction, it is anticipated that activities that require the use of heavy equipment, including access and staging, excavation, structure assembly, anchoring, and conductor stringing, could result in temporary restrictions in access to portions of the RoW as well as the portion of the watercourses crossed by the Project within the PDA. It is anticipated that temporary exclusion zones will be established for safety reasons where heavy equipment is operating within the RoW and crossing watercourses. These

exclusions zones could, during construction, result in a short-term restriction to Aboriginal fishing, harvesting, hunting, gathering opportunities, and ceremonial activities (if practiced) within the PDA.

Vegetation clearing required for the RoW for the new transmission line has the greatest potential to interact with current use of land and resources for traditional purposes by Aboriginal persons as the removal of trees and shrubs within the PDA will result in the modification of vegetation communities and wildlife habitat that could be used for hunting and gathering opportunities. Although the majority of the new transmission line will be constructed on privately owned land, vegetation clearing required for the development of the RoW for the new 16.1 km-long 138 kV transmission line and the excavation for placement of poles will result in the loss of vegetation and trees and the consequential loss of wildlife habitat and may also cause sensory disturbance to wildlife. This includes the 1.33 km (7.4 ha; 15.0% of the RoW) of Crown Land which could be used by Aboriginal people. On a short-term basis while construction is taking place, these activities may affect current use if traditional activities are practiced on those portions of the PDA crossed by Crown land. These activities can also have subsequent indirect effects to wildlife habitat due to the changing habitat; however, the cleared width of the new RoW will be narrow (i.e., 15 m for its southern half) since its northern half will be using the already cleared existing RoW for Line 1135, the construction period will be relatively short-term, and similar wildlife habitat will remain adjacent to the RoW and surrounding area.

Vegetation clearing required for the Project may also result in the removal of some vegetative canopy (overhang) in the RoW, where it currently exists, which has the potential to result in a change in fish habitat (freshwater fish and fish habitat VC, Section 5.3) and potentially in vegetation habitat in the riparian areas. While complete clearing of the riparian zone is not likely (no in-water work will be done, and alteration within the 30 m watercourse buffer will be limited and subject to a Watercourse and Wetland Alteration permit), it is likely that tall trees will be removed so as to not interfere with transmission conductors. Such an alteration in habitat may result in a change in the ability to participate in traditional activities, if practiced, at the specific RoW location for each watercourse, but given the limited amount of disturbance in the riparian zone (i.e., limited to the width of the RoW—15 m), a substantive change in availability of resources (e.g., fish) at these crossing locations is not likely.

The mitigation for this VC relies on other assessments where terrestrial, aquatic, and heritage resources may be affected by the Project, and the reader is directed to those VC's for that information.

Mitigation that will be implemented to protect habitats and species of traditional importance to Aboriginal people that may use land within the PDA for traditional purposes include the following:

- Continued consultation activities with First Nations communities to determine if there is any current use within the Crown land portion of the proposed Project RoW
- If any use is identified, provide First Nations communities or individuals who currently use the PDA the opportunity to harvest/gather any species of importance to traditional activities prior to the initiation of construction activities. It is further recommended that the opportunity to conduct these harvesting/gathering activities be timed appropriately for the seasonality of the species of interest.
- Measures used to mitigate the risk of fish mortality and fish habitat as included in the freshwater fish and fish habitat VC, Section 5.3
- Measures used to mitigate a change in plants, vegetation, and wetlands as included in the vegetation and wetlands VC, Section 5.4

- Measures used to mitigate a change in wildlife habitat or risk of wildlife mortality as included in the wildlife and wildlife habitat VC, Section 5.5
- Measures used to mitigate sites of cultural and/or ceremonial importance as included in the heritage resources VC, Section 5.7
- Signage will be placed on access roads used by construction equipment to warn the public of activities in that area

The changes to forest conditions as a result of the clearing of trees are not anticipated to affect wildlife or fish populations adjacent to the PDA. Given the narrow RoW in areas paralleling the existing RoW, traditional activities will be able to resume following the completion of construction activities either within the existing RoW or in the areas immediately adjacent to the new RoW. Further, the forests in the existing RoW will be allowed to fully regenerate after decommissioning of that line and forest habitat lost within that area will return in time.

5.8.3.2 Operation and Maintenance

During operation and maintenance, vegetation management will consist of limiting the extent of revegetation within the RoW through manual and mechanical means, on a periodic basis (e.g., every five years). After the completion of construction, the vegetation communities and wildlife habitat within the 138 kV transmission line RoW will convert from primarily forest to tall shrub habitat (with periodic vegetation management to maintain access to the line and its safe operation), for the life of the transmission line. Species that prefer forested habitat will likely relocate to adjacent forested areas outside of the RoW, while different species than those that use the current forested habitat will occupy the new habitat (Section 5.4). There is no critical habitat for any species at risk in the RoW for the new 138 kV transmission line, and there is an abundance of similar habitat nearby to the Project. Some larger mammal species such as moose may be drawn to the open area of the RoW as it revegetates with tall shrubs. Given the openness of the existing RoW, no substantive net change in habitat and related mammal behaviour is expected, and the environment will remain suitable for hunting by Aboriginal people on Crown lands within the PDA.

Vegetation management will be carried out periodically by NB Power and will follow the schedule for the existing transmission Line 1135. These activities could also result in some temporary restricted access to watercourses in the PDA used for fishing, plant harvesting, and ceremonial activities, if practiced there. Any interruption in access due to vegetation management would be infrequent and temporary.

During operation and maintenance activities, there could be brief restrictions to Aboriginal persons' access to the portions of Crown land within the PDA where equipment is operating (e.g., for vegetation maintenance), due to health and safety protocols. However, these restrictions will be brief, and access would resume after the maintenance activities are completed.

5.8.4 Summary for Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons

With mitigation and environmental protection measures, it is not anticipated that there will be any substantial interaction between the Project and current use of land and resources for traditional purposes

by Aboriginal persons. The Project is not anticipated to result in changes to an Aboriginal person's ability to participate in traditional activities due to changes in availability of resources (e.g., change in fish species or populations or terrestrial environment). Areas immediately adjacent to the PDA will remain unaffected by Project activities and will be available for traditional uses even during construction activities on the RoW.

NB Power is committed to continuing consultation with First Nations that may have an interest in the Project by providing information about the Project and its potential environmental effects. Should any additional interaction be identified, NB Power will develop appropriate mitigation in consultation with the affected First Nations and regulatory agencies as warranted. As consultation is ongoing, should traditional knowledge information become available, this information will be considered and residual effects on current use of land and resources for traditional purposes by Aboriginal persons will be reviewed.

5.9 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

This section assesses the potential effects of the environment on the Project. Effects of the environment on the Project is not technically a VC; however, it is analyzed here for continuity in the assessment of the potential interactions between the Project and the environment.

5.9.1 Scope of Assessment

Interactions between the environment and the Project may include events associated with climate, including climate change over time, extreme weather events, natural forest fires, and seismic activity. If adverse effects associated with these events are unanticipated or unmanaged, they can result in adverse changes to Project infrastructure, schedule and costs, and potential environmental effects. These potential effects are typically addressed with Project design, scheduling, and operational procedures that are implemented in consideration of expected and extreme environmental conditions.

Forest fires are assessed as accidents, malfunctions, and unplanned events in Section 2.10 and will not be discussed further here. Some effects on the Project, such as damage to infrastructure, could also result in effects from the environment; they are also addressed in Section 2.10.

This assessment considers the potential interactions between the environment and the construction and operation and maintenance phases of the Project, with consideration of the following environmental conditions/events:

- Climate (including weather and its variables such as temperature, precipitation, winds and extreme weather events)
- Climate change forecasts in the area of the Project
- Seismic activity

5.9.2 Existing Conditions for Effects of the Environment on the Project

The following sections describe the existing conditions for climate, extreme weather events, climate change, and seismic activity.

5.9.2.1 Climate

Refer to Section 3.2.1 for a description of climate, GHGs, and historical weather data.

5.9.2.2 Extreme Weather Events

Earthquakes, floods, hurricanes, landslides, severe storms, storm surges, wildfires and tornadoes are amongst New Brunswick's regional environmental hazards or extreme weather events (GC 2018). Earthquakes (seismic activity) are discussed under Section 5.9.2.4. Wildfires (natural forest fires) are discussed under Section 2.10.2.

Although a handful of tornadoes have occurred in New Brunswick since 1879 (Global News 2013), their occurrence is rare (Cheng et al. 2013). Therefore, tornadoes will not be considered further in this assessment.

Extreme weather, storms, and precipitation tend to be more common and severe during the winter months in New Brunswick. Winter storms can consist of high winds, and mixed precipitation of snow, ice and rain.

Mild spring weather and heavy precipitation have the potential to result in rapid spring freshet flows and ice jams, which can lead to flooding along the Saint John River and its tributaries (GNB 2018b; CBC News 2018a). In the spring of 2018, southern New Brunswick (including the Fredericton area) experienced extreme flooding, causing an estimated 80-million dollars' worth of damage (CBC News 2018b). The Project has poles located near Fish Hatchery Lane on the Saint John River that are within a flood risk zone.

5.9.2.3 Climate Change

Climate change is "*a change in the state of climate that can be identified (*e.g.*, by using statistical tests) by changes in the mean and/or variability of its properties and that persists for an extended period, typically decades or longer"* (IPCC 2014)*.* Climate change can be caused by naturally-occurring events (such as volcanic eruptions or solar cycles) and/or human activities that cause changes to land use, or the atmosphere (IPCC 2014).

Predictions of climate change trends are derived from mathematical and statistical models. While such models can provide useful information for predicting climate change, their ability to predict changes on a small, regional scale is quite limited to larger-scale predictions such as continental climate change (Randall et al. 2007; Flato et al. 2013). However, the results obtained from climate change prediction models can be used as a guide for Project planning and can facilitate Project design and climate adaptation.

Future climate change in New Brunswick is expected to include, but not be limited to, changes (increases) in temperature, increased precipitation, more frequent winter thaws, increased risk of ice jams and more significant flooding events, and more extreme and variable weather patterns and storms (GNB 2018c).

5.9.2.4 Seismic Activity

When rocks break apart and slip along a fault under the earth's surface (e.g., the movement of tectonic plates), seismic waves are released. The seismic waves radiate and cause vibration of the ground, known as earthquakes (NRCan 2017a).

The Project is located in the Northern Appalachians seismic zone, which includes most of New Brunswick and parts of New England. Seismic activity in this area has generally been low over the years. However, the risk of seismic hazard can be elevated depending on various factors such as topography and the characteristics of the earthquake (NRCan 2015).

New Brunswick's most severe earthquake, with a magnitude of 5.7 on the Richter scale, occurred in 1982 near Miramichi. According to Natural Resources Canada, a magnitude 3 earthquake is strong enough to be felt in the immediate area, whereas an earthquake with a magnitude of 5 is the threshold for damage (NRCan 2017b).

The probability of a major seismic event occurring and having an impact on Project-related activities or phases is low. Project structures will be built in accordance with industry standards to withstand minor seismic events. Therefore, seismic activity/earthquakes are not considered further in this report.

5.9.3 Assessment of Potential Effects of the Environment on the Project

This section describes how the environment could interact with Project activities. The techniques and practices that will be applied to mitigate potential adverse effects of these interactions are also noted.

5.9.3.1 Construction, Operation and Maintenance

Climate and Extreme Weather

Very low temperatures could reduce the ductility of construction materials and increase their susceptibility to breaking.

Heavy rain has the potential to result in flooding and erosion. These events can lead to sedimentation, the release of total suspended solids in runoff, or access roads being washed out. Extreme precipitation can exacerbate the effects of freezing or high winds on Project components, by allowing water to enter stress fractures in the insulators, resulting in a power failure (NB Power 2017). As mentioned above, the portion of the Project that is near Fish Hatchery Lane on the Saint John River is prone to flooding as this area is a flood risk zone.

Wet snow, freezing rain and ice could potentially damage infrastructure and construction equipment, if ice builds to a point where the structures are unable to bear the weight. Wires and conductors could be weighted down, causing a short circuit and power interruption, or the wires and conductors could break, causing a power outage (NB Power 2017).

The potential effects of extreme weather, rainfall and winter precipitation will be taken into account in Project design, including the selection of materials and equipment, planning and maintenance of the

Project. Delays due to poor weather will be anticipated and can often be predicted; allowance for them will be included in the construction schedule.

NB Power adheres to engineering best practices, designs and design standards to consistent manage the potential effects of the environment on their transmission infrastructure. NB Power will monitor any observed effects of the environment on the Project, and will take action as required to maintain, repair, and upgrade Project infrastructure as required, and modify operations to facilitate its continued safe operation. The Project design will consider predictions for future climate change.

The Project will be constructed to meet the standards of the Canadian Electrical Code (a CSA Group standard) which includes the applicable building, safety, industry codes, and standards for wind, snowfall, extreme precipitation, and other weather variables associated with climate. These standards and codes provide factors of safety regarding environmental loading and Project specific activities and events.

See Section 5.2 (Water Resources) for a discussion of mitigation and best management practices related to vegetation and grading.

High winds (>90 km/h) have the potential to break trees and tree limbs, which can then fall onto transmission infrastructure and cause damage or cause temporary outages by falling onto transmission lines before falling to the ground (NB Power 2017). Strong winds also have the potential to cause damage to other Project infrastructure and/or equipment. NB Power will maintain a minimum RoW width and remove danger trees adjacent to the RoW to avoid wind-related tree strikes.

During electrical storms, poles are susceptible to lightning strikes (NB Power 2017). When lightning strikes occur, fault currents (electric currents that flow from one conductor to the ground, or from one conductor to another conductor) (IESO 2015) can occur, which may damage Project infrastructure, equipment, or workers. Lightning strikes can also ignite fires (see Section 2.10 for discussion of fire as an accidental event).

Other mitigation actions to be undertaken by NB Power include:

- The Project will adhere to NB Power's EPP (NB Power 2012) and the PSEMP.
- A maintenance and safety management program will be implemented.
- Contingency plans will be implemented, including emergency back-up power and dispatch of crews for emergency repairs.

Climate Change Projections

The Government of New Brunswick calculated future climate change projections for the province using existing historical climate records and global climate model climate projections (GNB 2017b). The climate change projections are based on four GHG emission scenarios, which are referred to as representative concentration pathways (RCP). The four RCPs are RCP2.6, RCP4.5, RCP6, and RCP8.5. They represent the potential range of radiative forcing (2.6 Watts per square meter (W/m²), 4.5 W/m², 6 W/m², and 8.5 W/m²) that could result in GHG-related heating of the earth by the year 2100, as compared to pre-industrial times (Moss et a. 2010, Van Vuuren et al. 2011). The climate change projections for New Brunswick only include RCP4.5 and 8.5. Climate change projections for RCP4.5 are presented below, as

this scenario assumes GHG emissions will peak around the year 2040 and then decline to 2080 before levelling off (Thomson et al. 2011), which is in line with Canada's target to reduce GHG emissions by 30% below 2005 levels by the year 2030 (ECCC 2018c). For the purposes of this report, climate change scenarios for the year 2080 are used in the assessment of potential interactions with the Project.

The forecasted temperature and precipitation data at the Fredericton, NB weather station is presented below (Table 5.13). These data are considered to be representative of the Project area.

Table 5.13 Forecasted Temperature and Precipitation Data in Fredericton, NB

Weather Station Location	Mean Temperature (ºC)		Annual Total Precipitation (mm)		Winter Total Precipitation[2] (mm)	
	Year: Current (normals 1980-2010)	Year: 2080; RCP4.5	Year: Current (normals 1980-2010)	Year: 2080; RCP4.5[1]	Year: Current (normals 1980-2010)	Year: 2080; RCP4.5
Fredericton, NB (A Station)	5.6	8.6	1077.7	1149.5	263.3	290.4

1 RPC4.5= represent scenario in which GHG-related heating of the planet by the year 2100 occurs at a rate of 4.5 Watts per square metre (W/m²)

2 Winter precipitation presented as Liquid Equivalents in mm to account for snowfall and rainfall.

Source: GNB 2017b

Mean annual temperature at the Fredericton weather station is estimated to increase by 3.0 ºC by the year 2080 under the RCP4.5 climate projection scenario (Table 5.13). Increased temperatures could result in more rain instead of snow and freezing rain.

The projected mean total annual precipitation at the Fredericton weather station is expected to increase from 1077.7 mm to 1149.5 mm by the year 2080 (Table 5.13). This represents a 6.7% increase in the total annual mean precipitation. Winter precipitation is estimated to increase from 263.3 mm to 290.4 mm, or an increase of 10.3% by the year 2080 (Table 5.13). As discussed under Section 5.9.2.2, heavy precipitation can result in increased spring freshet flows, flooding, erosion, sedimentation, and damage to project infrastructure and/or equipment, causing power interruptions and outages.

In some areas of New Brunswick, mean annual precipitation between 1981 – 2010 exceeded 1298 mm, and winter precipitation exceeded 324 mm (Figure 5.2), which is more precipitation than what is expected to occur in the Fredericton area by 2080 under RCP4.5 (Table 5.13).

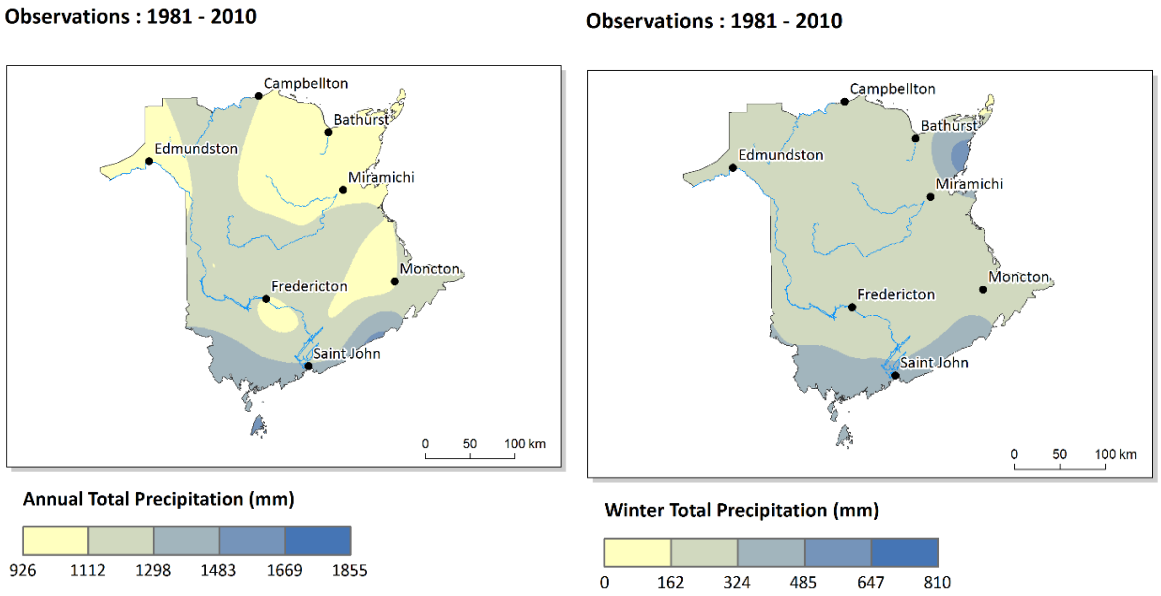

Figure 5.2 Total Annual Precipitation and Winter Total Precipitation (mm) in New Brunswick (1981 – 2010).

Intensity-Duration-Frequency (IDF) climate change curves, that reflect trends of extreme rainfall patterns in the future, were used to create future climate change scenarios in Fredericton, NB (UWO 2019) for comparison with historical data. Table 5.14 and Table 5.15 below display the total historical and projected precipitation amounts (mm) in specific time intervals (5 minutes to 24 hours) over various return periods (2 years to 100 years).

Table 5.14 Historical Precipitation Accumulation (mm), Fredericton A Station

Interval	T (years)					
	2	5	10	25	50	100
5 min	5.13	7	8.26	9.88	11.11	12.35
10 min	7.78	10.95	13.29	16.53	19.17	21.11
15 min	10.71	14.51	16.55	18.68	19.99	21.11
30 min	14.14	19.47	22.87	26.63	28.24	29.66
1 h	17.88	21.88	24.14	26.63	28.24	29.66
2 h	22.36	26.27	30.05	36.78	43.73	52.88
6 h	36.22	45.75	55.52	74.03	94.23	122.16
12 h	42.79	56.47	69.41	92.09	115.11	145.01
24 h	50.79	66.41	82.96	115.22	151.43	202.7

Source: UWO 2019

Table 5.15 Projected Precipitation Accumulation (mm), Fredericton A Station, RCP4.5, 2020-2080

Interval	T (years)					
	2	5	10	25	50	100
5 min	5.61	7.71	9.11	11.1	12.68	14.29
10 min	8.48	12.03	16.65	18.45	21.78	24.39
15 min	11.71	16.07	18.47	21.12	22.83	24.39
30 min	15.45	21.51	25.47	30.09	32.29	34.23
1 h	19.54	24.17	26.92	30.09	32.29	34.23
2 h	24.41	29.04	32.85	39.71	47.38	57.82
6 h	39.5	50.48	60.23	78.25	99.87	131.14
12 h	46.61	62.26	75.65	99.36	125.1	159.43
24 h	55.4	73.2	89.57	120.73	158.09	212.06
Source: UWO 2019						

As the above results indicate, an increase in precipitation amounts can be expected for all rainfall events. The projected percentage increase from the historic data to the period of 2006-2080 for precipitation events under RCP 4.5 range from 4% to 25%. As discussed above, there are some areas in New Brunswick which currently have higher rates of precipitation than the Fredericton area, and the transmission infrastructure in these areas have not been adversely affected by precipitation. A portion of the Project (near Fish Hatchery Lane) is in a flood risk zone; this will be considered and integrated into Project planning and design. Therefore, in consideration of the design and construction methods used, it is not anticipated that climate change related effects associated with an increase in total annual precipitation or winter precipitation will cause adverse effects on the Project.

5.9.4 Summary for Potential Effects of the Environment on the Project

With the implementation of the mitigation and environmental protection measures described in this assessment, it is not anticipated there will be substantial adverse effects of the environment on the Project. Project construction techniques, design, best practices, scheduling and equipment maintenance account for environmental factors such as extreme weather conditions and climate predictions. If interruption of service or power outages occur, NB Power will rely on standard contingency and response plans to repair damaged equipment and reduce interruptions of service.

6.0 SUMMARY OF PROPOSED MITIGATION

Table 6.1 Summary of Proposed Mitigation

#	Valued Component (VC) (if applicable)	Project Phase	Proposed Mitigation/Compensation Measure	Location within EIA Registration Document where Mitigation Measure is Identified
1.	Atmospheric Environment	Construction	Repair and maintenance activities will be performed on equipment, machinery and trucks as required.	Section 5.1.3.1
2.			Idling of vehicle engines, equipment and machinery will be avoided where possible, and transportation routes will be managed, in order to reduce the released of unnecessary combustion gases and GHG emissions.	Section 5.1.3.1
3.			Standard dust control and mitigation practices will be used to control dust levels during construction. These include the use of dust suppressants or water on access roads to limit dust emissions, especially during windy and dry conditions.	Section 5.1.3.1
4.			Construction is planned to be limited to daytime hours (e.g., between the hours of 6:00 am to 9:00 pm)	Section 5.1.3.1
5.			NB Power staff will monitor noise within the RoW and implement appropriate mitigation in the event that they receive noise complaints from nearby receptors.	Section 5.1.3.1
6.	Water Resources	Construction	Blasting will be carried out in accordance with best management practices.	Section 5.2.3.1
7.			NB Power will reduce the potential for interactions between the Project and Water Resources by adhering to the best management practices and the PSEMP. This includes preventing machinery from entering watercourses, preventing the movement of sediments and woody debris into watercourses.	Section 5.2.3.1
8.		Operation and Maintenance	Vegetation management will be conducted in accordance with NB Power's integrated vegetation management program.	Section 5.2.3.2
9.			If herbicides are required, they will be used in accordance with government regulations.	Section 5.2.3.2
10.	Freshwater Fish and Fish Habitat	Construction	Machinery will be prevented from entering watercourses.	Section 5.3.3.1
11.			The movement of sediments and woody debris will be prevented from entering watercourses.	Section 5.3.3.1
12.			Clearing of riparian areas adjacent to watercourses will be reduced.	Section 5.3.3.1
13.			Watercourses and riparian buffers will be clearly marked prior to accessing or operating heavy equipment in the RoW.	Section 5.3.3.1
14.		All Phases	Reasonable measures will be undertaken to prevent the release of deleterious substances (e.g. fuels, lubricants, hydraulic oil) into watercourses, e.g., activities such as fueling will be planned so that deleterious substances do not enter watercourses	Section 5.3.3.1
15.			Existing bridges or temporary structures will be used when crossing watercourses.	Section 5.3.3.1
16.		Construction	Silt fencing or hay bales will be used in areas where soil disruption could result in the transport of sediment into watercourses.	Section 5.3.3.1
17.		Construction	Silt fencing will be removed after revegetation has occurred.	Section 5.3.3.1
18.		All Phases	A buffer zone will be left on the banks of watercourses.	Section 5.3.3.1
19.		All Phases	Brush and woody debris will be relocated to areas where it cannot enter watercourses.	Section 5.3.3.1
20.		All Phases	The Project design will adhere to a maximum RoW width of 30 m.	Section 5.3.3.1
21.	Vegetation and Wetlands	Construction	An application for a Watercourse and Wetland Alteration Permit will be submitted to NBDELG prior to the commencement of work within 30 m of a watercourse or wetland.	Section 5.4.3.1
22.			Wherever feasible, poles will be situated outside of wetlands and conductors will span the wetland. Conductors will be drawn though the wetland by hand using progressively larger cables. Where it is not feasible to span a wetland, poles will be established as close to the edges of the wetland to minimize traffic on wetland soils.	Section 5.4.3.1

Table 6.1 Summary of Proposed Mitigation

#	Valued Component (VC) (if applicable)	Project Phase	Proposed Mitigation/Compensation Measure	Location within EIA Registration Document where Mitigation Measure is Identified
23.	Vegetation and Wetlands	Construction	The locations of poles in wetlands will be planned to minimize the distance that heavy equipment must travel through wetlands.	Section 5.4.3.1
24.			When travelling through wetlands, swamp mats will be used to reduce soil disturbance through rutting. The areas where vehicles are permitted to operate in wetlands will be restricted to the minimum area required.	Section 5.4.3.1
25.			Standard erosion and sedimentation control measures will be employed to minimize erosion and sedimentation in wetlands and areas adjacent to wetlands.	Section 5.4.3.1
26.			Only as much wetland vegetation as is required to safely install poles, draw conductors, and provide adequate clearance between conductors and vegetation should be removed during clearing.	Section 5.4.3.1
27.			Prior to the onset of clearing activities, the populations of plant SOCC identified during the field surveys will be marked with symbolic fencing to prevent accidental damage to these plants.	Section 5.4.3.1
28.			Where feasible, poles required to be installed in wetlands will be installed during the winter months when the ground is frozen to reduce disturbance from the movement of vehicles and equipment to vascular plant SAR and SOCC and wetland soils and vegetation.	Section 5.4.3.1
29.			Where feasible, access routes to pole placement sites will be planned to avoid populations of plant SAR or SOCC or particularly sensitive wetland features.	Section 5.4.3.1
30.			Local Aboriginal Communities (e.g., Kingsclear FN) will be offered an opportunity to harvest traditional plants, such as black ash and butternut, prior to clearing activities.	Section 5.4.3.1
31.			All equipment arriving on site will be examined to make sure it is clean and free of soil or vegetative debris before it enters the Project RoW to begin work.	Section 5.4.3.1
32.			Quarried, crushed material will be used for road building to reduce the risk of introducing or spreading exotic and/or invasive vascular plant species.	Section 5.4.3.1
33.			The area of soil disturbed by heavy equipment will be minimized to reduce the amount of open soil available for exotic species to colonize.	Section 5.4.3.1
34.			Wherever possible, natural regeneration will be allowed to occur to re-establish native plant communities. This can be encouraged by minimizing soil disturbance and leaving the root mat and seed bank in place. If natural regeneration is not possible, a seed mix that contains native species or exotic species that are known to be non-invasive will be used.	Section 5.4.3.1
35.			The sizes of temporary workspaces will be kept to the minimize size feasible in order to reduce adverse effects of clearing in these areas. These sites will be restored to pre-construction conditions as soon as practicable. Where practical, developed areas will be used for staging	Section 5.4.3.1
36.		Operation and Maintenance	Vegetation control in wetlands and in areas where plant SAR or SOCC are present will be conducted by mechanical means only, using hand tools where feasible, to minimize disturbance to soils and to non-target vegetation	Section 5.4.3.2
37.			All herbicide applications will be completed and supervised by licensed applicators and in accordance with conditions specified in the Permit. Setback distances will be established near sensitive areas such as wetlands and watercourses and the distance will be based on the product used.	Section 5.4.3.2
38.		Construction	Conduct vegetation clearing for construction outside of breeding bird season (mid-April to late-August).	Section 5.5.3.1
39.			To mitigate risk, nest searches should be conducted prior to any clearing which must take place during the breeding bird season. If nests are found, a species-specific buffer should be established around the nest that must not be disturbed until chicks have fledged.	Section 5.5.3.1
40.		All Phases	Use full cut-off temporary lighting to reduce attraction to migrating birds. Lighting should also be minimized whenever it is safe to do so.	Section 5.5.3.1
41.		All Phases	NB Power remains committed to working with ECCC and NBDELG to identify a strategy that allows for the safe and efficient maintenance and operation of electrical transmission infrastructure, while protecting migratory birds in the region.	Section 5.5.3.2

Table 6.1 Summary of Proposed Mitigation

#	Valued Component (VC) (if applicable)	Project Phase	Proposed Mitigation/Compensation Measure	Location within EIA Registration Document where Mitigation Measure is Identified
42.	Wildlife and Wildlife Habitat	Construction	Conduct nest searches prior to any clearing within the breeding bird season.	Section 5.5.3.1
43.		Operation and Maintenance	Transmission lines will be spaced at least 3.8 m apart	Section 5.5.3.2
44.		Operation and Maintenance	Aviation deflectors will be placed on lines crossing the Saint John River.	Section 5.5.3.2
45.	Socioeconomic Environment	Construction	To increase beneficial economic interactions NB Power will follow its existing practice of encouraging local and Aboriginal content and will, where possible and relevant, work toward a hire-local-first practice.	Section 5.6.3.1
46.			NB Power will procure goods and services from local and Aboriginal businesses in accordance with its existing purchasing policies and procedures.	Section 5.6.3.1
47.			Traffic will be managed through standard procedures such as signage and flagging crews	Section 5.6.3.1
48.			All large-sized vehicles will obtain appropriate weight and size permits.	Section 5.6.3.1
49.			Moving large equipment involving road closures will be conducted at low traffic times.	Section 5.6.3.1
50.			NB Power will communicate schedules for all Project activities, particularly those related to access restriction. The public will be notified about long delays or disruptions to the transportation network, and construction.	Section 5.6.3.1
51.			Noise emitting construction activities will be limited to daytime hours (i.e., between the hours of 6:00 am and 9:00 pm)	Section 5.6.3.1
52.			Planned construction to occur in fall 2020 and winter 2011 during which snow cover and more frequent precipitation which will reduce the potential. Dust suppressants and water will be applied on access roads as needed.	Section 5.6.3.1
53.		Operation and Maintenance	Fields of low-growing crops and hayfields will be allowed to continue as such throughout the operation and maintenance of the transmission line	Section 5.6.3.2
54.	Heritage Resources	Construction	Planned avoidance (e.g., transmission line pole and guy wire placement) for areas identified during the walkover survey to exhibit elevated potential for archaeological resources will be implemented.	Section 5.7.3.1
55.			Planned avoidance (e.g., transmission line pole and guy wire placement) for registered heritage sites will be implemented.	Section 5.7.3.1
56.			Shovel testing as per the Archaeological Guidelines, where avoidance is not practicable, will be implemented in an effort to determine the presence or confirm absence of potential archaeological resources in areas determined to have elevated potential for archaeological resources.	Section 5.7.3.1
57.			Should any heritage resources be identified that could be affected by the Project, additional mitigation, as required, will be developed in consultation with provincial regulators and First Nations, as applicable.	Section 5.7.3.1
58.			In areas of elevated archaeological potential, archaeological monitoring will be implemented, if shovel testing is not practicable.	Section 5.7.3.1
59.			A First Nations field monitor will be present during construction activities	Section 5.7.3.1
60.			Apply for a Site Alteration Permit from the Province of New Brunswick for any planned construction activities within the 100 m buffer zone of registered site BIDr-6.	Section 5.7.3.1
61.			A Heritage Resource Discovery Contingency Plan outlined in the PSEMP will be followed during all phases of the Project.	Section 5.7.3.1
62.	Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons	Construction	If any use is identified, provide Aboriginal communities or individuals who currently use the PDA the opportunity to harvest/gather any species of importance to traditional activities that might be affected by Project activities prior to the initiation of any construction activities. It is further recommended that the opportunity to conduct these harvesting/gathering activities be timed appropriately for the seasonality of the species of interest.	Section 5.8.3.1

Table 6.1 Summary of Proposed Mitigation

#	Valued Component (VC) (if applicable)	Project Phase	Proposed Mitigation/Compensation Measure	Location within EIA Registration Document where Mitigation Measure is Identified
63.	Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons	All Phases	Continued engagement activities with Aboriginal communities to determine if there is any Current Use within the proposed Project RoW.	Section 5.8.3.1
64.			Measures used to mitigate the risk of fish mortality and fish habitat as included in the Freshwater Fish and Fish Habitat VC, Section 5.3.	Section 5.8.3.1
65.			Measures used to mitigate a change in or risk to vegetation and wetland habitat as included in the Vegetation and Wetlands VC, Section 5.4	Section 5.8.3.1
66.			Measures used to mitigate a change in wildlife habitat or risk of wildlife mortality as included in the Wildlife and Wildlife Habitat VC, Section 5.5.	Section 5.8.3.1
67.			Measures used to mitigate sites of cultural and/or ceremonial importance as included in the Heritage Resources VC, Section 5.7.	Section 5.8.3.1
68.			Signage will be placed on access roads used by construction equipment to warn the public of the activities in that area.	Section 5.8.3.1
69.	Effects of the Environment on the Project	Construction	Project structures will be built in accordance with industry standards to withstand minor seismic events.	Section 5.9.2.4
70.		All Phases	The potential effects of extreme weather, rainfall and winter precipitation will be taken into account in Project design, including the selection of materials and equipment, planning and maintenance of the Project. Delays due to poor weather will be anticipated and can often be predicted; allowance for them will be included in the construction schedule.	Section 5.9.3.1
71.		All Phases	NB Power adheres to engineering best practices, designs and design standards to consistent manage the potential effects of the environment on their transmission infrastructure. NB Power will monitor any observed effects of the environment on the Project, and will take action as required to maintain, repair, and upgrade Project infrastructure as required, and modify operations to facilitate its continued safe operation. The Project design will consider predictions for future climate change.	Section 5.9.3.1
72.		Construction	The Project will be constructed to meet the standards of the Canadian Electrical Code (a CSA Group standard) which includes the applicable building, safety, industry codes, and standards for wind, snowfall, extreme precipitation, and other weather variables associated with climate. These standards and codes provide factors of safety regarding environmental loading and Project specific activities and events.	Section 5.9.3.1
73.		All Phases	NB Power will maintain a minimum RoW width and remove danger trees adjacent to the RoW to avoid wind-related tree strikes.	Section 5.9.3.1
74.		All Phases	The Project will adhere to NB Power's EPP (NB Power 2012) and the PSEMP.	Section 5.9.3.1
75.		All Phases	A maintenance and safety management program will be implemented	Section 5.9.3.1
76.		All Phases	Contingency plans will be implemented, including emergency back-up power and dispatch of crews for emergency repairs	Section 5.9.3.1

7.0 PUBLIC INVOLVEMENT

NB Power initiated a Public Involvement Program to inform elected officials, landowners, stakeholders, and the general public about the Project. The key elements of the Public Involvement Program are presented below, as well as future involvement initiatives to fulfill the public involvement requirements of the New Brunswick Environmental Impact Assessment Regulation under the Clean Environment Act and the "Guide to Environmental Impact Assessment in New Brunswick" (NBDELG 2012a).

The Public Involvement Program uses a multifaceted approach to distribute Project information to reach as many people as possible. The approach includes maintaining a Project mailing list, distributing Project information across multiple platforms in various formats, placing information on the NB Power website, and conducting an open house session for the public.

7.1 OBJECTIVES

The objectives of the Public Involvement Program are as follows:

- Provide information on the proposed Project directly to potentially affected landowners, as well as stakeholders, the general public, community groups, and other interested parties;
- Provide information on the proposed Project directly to elected officials and local service districts;
- Address issues and concerns raised during this process;
- Identify measures that will mitigate or resolve public issues or concerns; and
- Identify need for further consultation initiatives.

7.2 PUBLIC INVOLVEMENT PROGRAM ELEMENTS

The following section describes the Public Involvement Program elements as they relate to the Project.

7.2.1 Communication Methods

The methods employed to communicate with elected officials, stakeholders, community groups, and affected property owners are described below:

- **Letters to Landowners** – NB Power has been communicating with landowners in the area by letters and by phone since 2018 and will continue to do so to answer any of their questions and address any potential concern throughout the entire project.
- **Fact Sheet** – A fact sheet was distributed to provide interested parties with basic information about the Project (Appendix A).
- **Web Postings** – The NB Power website (www.nbpower.com) is being used as an electronic method for members of the public to get information on the Project, access Project documents, view maps, and send comments.
- **News Release** – A new release was issued to inform the public about the project and the open house (Appendix B).
- **Public Notice** – A paper copy of the EIA Registration document will be made available for viewing during the public review period at the following locations:

New Brunswick Department of Environment and Local Government, Project and Approvals Branch
20 McGloin St
Fredericton, NB
E3A 5T8

- **Media Interviews** – To demonstrate transparency and general public awareness about the Project, media requests for interviews or information will be responded promptly by NB Power.
- **Open House** – A public open house was conducted on September 17, 2019 from 6 to 9 p.m. to share information about the Project. The public open house was held at the Riverside Resort (35 Mactaquac Road, French Village, NB). Advertising in local newspapers and on radio stations notified the public about the time, location, and purpose of the open house (Appendix C). Further open houses may be considered during the EIA review period, if required.
- **Summary Report** – A brief summary report on the public notification initiatives carried out, and the key issues raised by the public during the EIA review, will be provided to NBDELG within 60 days following registration.

Table 7.1 List of Key Groups, Stakeholders, and Organizations

NB Department of Environment and Local Government Marysville Place P. O. Box 6000 Fredericton, NB E3B 5H1	NB Department of Public Safety 20 McGloin Street Fredericton, NB E3B 5H1
NB Department of Energy and Resource Development Hugh John Flemming Forestry Centre P. O. Box 6000 Fredericton, NB E3B 5H1	NB Department of Agriculture, Aquaculture and Fisheries Hugh John Flemming Forestry Centre P. O. Box 6000 Fredericton, NB E3B 5H1
NB Department of Transportation and Infrastructure Kings Place P. O. Box 6000 Fredericton, NB E3B 5H1	City of Fredericton 397 Queen Street Fredericton, NB E3B 1B5
Hanwell Rural Community Hanwell Place 5 Nature Park Drive Hanwell, New Brunswick E3E 0G7	David Coon (Green Party) Member of the Legislative Assembly Fredericton South, Electoral District 40 Departmental Building, West Block P. O. Box 6000 Fredericton, NB E3B 5H1

Jenica Atwin (Green Party of Canada) Member of Parliament, Fredericton 138 Dundonald St Fredericton, NB E3B 1W8	Fredericton Chamber of Commerce 364 York Street, Suite 200 Fredericton, NB E3B 3P7
Conservation Council of New Brunswick 180 St. John Street Fredericton, NB E3B 4A9	Regional Service Commission 11 860 Prospect Street Fredericton, NB E3B 2T8

Upon Registration of the Project with NBDELG, a public notice will be issued in the local newspapers and on the NB Power website, and the public will be encouraged to forward comments and concerns to Project personnel.

7.2.2 Issues Tracking and Reporting

NB Power maintains a database that is used to track issues and concerns raised during the public involvement process. The database provides Project personnel with the ability to conduct queries, print specific reports, and review the status of all issues, concerns, or commitments.

Issues or concerns raised by, or commitments made to, affected landowners and stakeholders are entered into the database and monitored regularly during Project meetings until appropriate actions have been taken to address them.

Based on the methods described above, NB Power is able to monitor potential issues and concerns associated with the Project.

7.3 RESULTS OF PUBLIC INVOLVEMENT PROGRAM TO DATE

7.3.1 Open House

Table 7.2 Notice Dates and Frequencies for Fredericton Open House

Location where Notices Appeared	2019 Dates
Daily Gleaner (bilingual notice)	Sept. 14, 16 & 17
Local radios French: CJPN English: Capital FM, KHJ & FOX	Sept. 13-17 (three times per day on each station)
Twitter and Facebook posts (bilingual)	Sept. 16-17

Table 7.3 Summary of Key Comments Heard and Addressed During the September 17, 2019 Open House

Topic of Interest	Details of Concerns	Response
Deerwood Substation	Residents of that Hanwell/Silverwood area asking why the Deerwood Substation wasn't included in project and will not be connected to the new transmission line	• An explanation for excluding the Deerwood Substation from this project was provided by phone and by email to customers who requested a response after the open house. The substations that will get a doubled transmission line feed (Rainsford Lane, Priestman, and Vanier) were previously constructed to accept two 138 kV transmission lines and also have two substation transformers in place, with each transformer able to back up the other. Therefore, the planned doubled transmission line feed combined with the two substation transformers already in place provides full transmission supply redundancy to customers at these subs. • NB Power's planning criteria considers the loss of substation transformers. As such, a service restoration plan currently exists for the loss of the Deerwood substation transformer. In the event that there is a failure, service to the affected customers can quickly be restored by switching them over to Kingsclear and Rainsford Lane substations. A loss of transmission feed can utilize the same plan developed for a loss of substation transformer.
Tree cutting	Tree cutting to make room for new line in right of way/adjacent landowners concerned about view/impact to their properties.	
Construction near farmland	One farmer in the area asked for a two-week notice to allow cutting of hay before construction starts.	
Neighborhoods	Will construction work impact some neighborhoods in Rosewood/Deerwood area? If so, how?	

7.3.1.1 Future Engagement

NB Power will publish a one-day notice in local newspapers and online informing the public that the Project has been registered with NBDELG and identify locations where the EIA registration document can

be reviewed. The public will be asked to forward comments or concerns about the proposed Project to NB Power. Following the registration of this Project with the NBDELG, and during the Determination Review process, NB Power will track, respond to and report on key issues raised by the public, First Nations, stakeholders, property owners, and elected officials.

7.3.1.2 Land Acquisition

No additional land acquisition is anticipated for this Project as current easement encompasses the right of way for the proposed transmission line.

8.0 ABORIGINAL CONSULTATION AND ENGAGEMENT

NB Power initiated Aboriginal engagement activities to inform First Nations communities and groups regarding the Project. Aboriginal engagement used a multi-faceted approach to ensure that Project information reached as many First Nation persons as possible. The approach includes maintaining a Project mailing list, distributing printed information, placing information on the website, meeting with Aboriginal groups, providing presentations or briefings and incorporating Aboriginal monitoring within field studies.

NB Power's First Nations Affairs Department maintains communications with the First Nations communities through their respective Consultative Bodies:

- The Wolastoqey communities are represented by *The Wolastoqey Nation of New Brunswick (WNNB)*
- The Mi'kmaq communities are represented by *Mi'gmawe'l Tplu'taqnn Incorporated (MTI)*
- The Peskotomuhkati community is represented by *The Peskotomuhkati Nation at Skutik*.

The Government of New Brunswick is currently working with the Peskotomuhkati Nation at Skutik towards their official recognition as a First Nation community. Although the Peskotomuhkati are not yet officially recognized in Canada, NB Power carries out their consultative duties as if they were.

8.1 OBJECTIVES

As with the Public Involvement Program, the objectives of Aboriginal engagement activities are as follows:

- Provide information directly to First Nations communities
- Address issues and concerns raised during this process
- Identify measures that will mitigate or resolve First Nations issues or concerns proposed during future consultation initiatives.

8.2 ABORIGINAL ENGAGEMENT ELEMENTS

NB Power is committed to sharing information with First Nations communities and organizations throughout the regulatory, construction, operation and maintenance phases of the Project. The following section describes elements of NB Power's Aboriginal Engagement as they relate to the Project.

8.2.1 Communication Methods

The methods employed to communicate with First Nations communities and groups are described below:

- **First Nations Open House**- NB Power's First Nations Affairs Department reached out directly to the Resource Development Consultation Coordinator (RDCC) of the Kingsclear First Nation. Date, venue and invitee list was developed and circulated through the community by the RDCC, with a successful turnout for discussion with NB Power on August 27, 2019.
- **Web Postings –** The NB Power website (www.nbpower.com) will serve as an electronic method for members of the communities to access Project documents, view maps, and send comments.

- **Viewing of the EIA Registration -** In addition, an electronic or paper copy of the EIA Registration document will be provided to WNNB for their review and comment in accordance with the Capacity and Funding Agreement signed April 25, 2017. A brief summary report on the First Nations engagement initiatives carried out, and the key issues raised during the EIA review, will be provided to NBDELG within 60 days following registration. In addition, once a consultative body completes its review of the EIA Registration document, NB Power will provide NBDELG with any specifics in this regard.
- **Project Telephone Number –** A toll-free Project Information Line (1-866-754-7727) will appear on all communications and will provide an easy-to-access mean of contacting Project personnel without requiring computer capability, subscription to a newspaper, or attendance at an Open House.
- Aboriginal **Field Monitoring-** Through NB Power's ongoing engagement with the New Brunswick First Nations communities, Aboriginal monitoring has become a standard practice when an Environmental Impact Assessment has been triggered by a project. The Aboriginal field monitor assists Project staff in carrying out their duties, provide insight into traditional First Nations practices / resource use, and compile detailed reports to be shared with the First Nations communities.

A list of First Nations communities and groups that were engaged as part of the Project is presented in Table 8.1 below.

Table 8.1 List of First Nation Communities and Groups*

Bouctouche First Nation Chief: Ann Mary Steele 9 Reserve Road Bouctouche Reserve, NB E4S 4G2 Tel.: (506) 743-2520	**Eel Ground First Nation** Chief: George Ginnish 47 Church Road Eel Ground, NB E1V 4E6 Tel.: (506) 627-4600	**Eel River Bar First Nation** Chief: Sacha Labillois 11 Main Street, Unit 201 Eel River Bar, NB E8C 1A1 Tel.: (506) 684-6277	**Elsipogtog First Nation** Chief: Arren Sock 373 Big Cove Road Elsipogtog First Nation, NB E4W 2S3 Tel.: (506) 523-8200
Esgenoôpetitj First Nation Chief: Alvery Paul 620 Bayview Dr. Burnt Church, NB E9G 2A8 Tel.: (506) 776-1200	**Fort Folly First Nation** Chief: Rebecca Knockwood PO Box 1007 Dorchester, NB E4K 3V5 Tel.: (506) 379-3400	**Indian Island** Chief: Kenneth Barlow 61 Indian Island Drive Indian Island, NB E4W 1S9 Tel.: (506) 523-8110	**Kingsclear First Nation** Chief: Gabriel Atwin 77 French Village Road Kingsclear First Nation, NB E3E 1K3 Tel.: (506) 363-3028
Madawaska Maliseet First Nation Chief: Patricia Bernard 1771 Main Street Madawaska Maliseet First Nation, NB E7C 1W9 Tel.: (506) 739-9765	**Metepenagiag Mi'kmaq Nation** Chief: William (Bill) Ward PO Box 293 Metepenagiag Mi'kmaq Nation, NB E9E 2P2 Tel.: (506) 836-6111	**Oromocto First Nation** Chief: Shelley Sabattis PO Box 417 Oromocto, NB E2V 2J2 Tel.: (506) 357-2083	**Pabineau First Nation** Chief: David Peter-Paul 1290 Pabineau Falls Road Pabineau First Nation, NB E2A 7M3 Tel.: (506) 548-9211

Table 8.1 List of First Nation Communities and Groups*

St. Mary's First Nation Chief: Alann Polchies Jr 150 Cliffe Street Fredericton, NB E3A 0A1 Tel.: (506) 458-9511	**Tobique First Nation** Chief: Ross Perley 13156 Route 105 Tobique First Nation, NB E7H 5M7 Tel.: (506) 273-8439	**Woodstock First Nation** Chief: Timothy (Tim) Paul 3 Wulastook Court Woodstock, NB E7M 4K6 Tel.: (506) 328-3303	**Mi'gmawe'l Tplu'taqnn Incorporated (MTI)** Jennifer Coleman, Government Relations 40 Micmac Road Eel Ground, NB E1V 4B1 Tel.: (506) 455-1881 or (506) 627-4696
Passamaquoddy Nation (now known as Peskotomuhkati Nation at Skutik) Chief: Hugh Akagi 3 Prince of Wales Street St. Andrews, NB E5B 3W9 Tel.: (506) 529-4657	**Wolastoqey Nation of New Brunswick (WNNB)** Acting e Director of Consultation: Gillian Paul 150 Cliffe Street, 2nd Floor, Box 14 Kchikhusis Commercial Centre St. Mary's First Nation, NB E3A 0A1 Tel.: (506)-459-6341	**Kopit Lodge** 33 Riverside Dr Elsipogtog First Nation NB E4W 2Y6 506-338-0125	
* As of October 25, 2019			

Members of First Nations communities and groups will be encouraged to forward comments and concerns to Project personnel.

8.2.2 Issues Tracking and Reporting

NB Power will maintain a log that is used to track issues and concerns raised during the Aboriginal engagement process. The log will provide Project staff with the ability to conduct queries, print specific reports, and review the status of all issues, concerns or commitments.

Issues or concerns raised by, or commitments made to, Aboriginal groups will be entered into the log and monitored regularly during Project meetings until appropriate actions have been taken to address them. During the meetings, outstanding items will be reviewed and updates provided to the Project Team. Upon completion of each outstanding item, the necessary information will be forwarded to administrative support personnel in order to identify the item as "complete". Results of the Aboriginal engagement activities conducted will be reported to DAA as part of their assessment.

8.3 RESULTS OF ABORIGINAL ENGAGEMENT TO DATE

8.3.1 Initiation of Aboriginal Engagement

The Project was first introduced conceptually in June 2018 during routine project update meetings between NB Power and the Consultative bodies representing the Nations. Letters to the Chiefs of all New Brunswick First Nation communities were sent on January 15, 2019.

8.3.2 Summary of Aboriginal Engagement

8.3.2.1 Consultation Log

Communication with First Nations communities potentially affected by the Project began in June of 2018, with preliminary information being provided on the proposed scope of the Project. Although meetings occur on a regular basis, this Project was first introduced at that time. During subsequent monthly update meetings, more detailed information was provided regarding the need for the Project, regulatory framework, investigative field study updates and schedule. Information exchanged at these meetings helped to improve understanding of how the proposed Project may potentially affect past or current Aboriginal practices, traditions and customs, and how measures could be incorporated into the Project to avoid, mitigate or otherwise address those potential effects. Issues and interests were raised during meetings with both the Wolastoqey Consultation Coordinators, including most notably the need for capacity funding to perform TLRU Studies and technical review of Project-related documents, both of which are funded through the Consultation and Capacity Funding Agreement. This record of consultation will be updated as the EIA process progresses. Neither MTI nor the Peskotomuhkati have raised any interests or concerns regarding the Project while updates were provided.

8.3.2.2 First Nation Open House

An open house session was held on August 27, 2019 from 1:00 to 4:00pm. The event was held at the Kingsclear First Nation Band Office, located at 77 French Village Road on the Kingsclear First Nation. Project information was shared with community members. Table 8.2 below captures questions and concerns that came up during the open house event:

Table 8.2 Questions and Concerns from August 27, 2019, Open House

Comments	Response from NB Power
Will the expansion bring more herbicide spraying, therefore lessening hunting and growing territory along with producing herbicide run off to the Saint John River?	The Application schedule will remain as it is for the current linear corridor as this new infrastructure is immediately adjacent to the existing. We don't spray herbicides, we apply per our Integrated Vegetation Management Program, avoiding wetted areas. Application is only conducted on an "as-needed" basis, not annually.

Table 8.2 Questions and Concerns from August 27, 2019, Open House

Comments	Response from NB Power
Will there be any clear cutting/ silviculture done in the right of way in order to make room for the transmission line?	Yes. Trees will be removed along the existing right of way to allow for the safe construction and future operation of the transmission infrastructure.
Will this project affect the river and/or its ecosystem?	Not as currently defined, but this will be assessed in the upcoming Environmental Impact Assessment Registration.
Will this, in any capacity, prevent the Kingsclear First Nation from expanding its territory in the future?	Not to our knowledge.
Would like a better idea of when and where the construction work will occur	The current schedule has the construction commencing in 2020/2021 with operation in 2022. Further refinement will be understood as the Regulatory and permitting processes proceed. This information will be provided through on-going engagement.

8.3.2.3 First Nation Consultation and Capacity Funding Agreement

Reoccurring meetings have been held with both the Wolastoqey Consultation Coordinators and the MTI organization to provide regular updates on transmission line projects as well as other NB Power projects and initiatives. These meetings led to discussions with both the Wolastoqey and the Mi'kmaq organizations to develop long-term funding agreements to support consultation and provision of capacity for a number of NB Power Projects.

The purpose of the Agreements is to foster a long-term meaningful relationship between the organizations and NB Power. The Agreements also provide funding to promote an effective approach to consultation and build sustained in-house capacity for each organization so as to foster meaningful and cost-effective consultation between the Parties about Projects.

The Agreement between NB Power and five Wolastoqey communities was signed on April 25, 2017. Even though the Woodstock First Nation was not party to the agreement at that time, it could receive benefits from the agreement as though it were. Woodstock First Nation became a part of WNNB in March 2019, and by default a party to the agreement. Since then discussions have been held to establish processes to initiate review of EIA Registration documents and to conduct traditional land use studies in accordance with Schedule B of the Agreement. A TLRU study for the Project is expected to be completed over the next year. The study will be reviewed, and any findings will be incorporated into the EIA Registration document. If there is current use in the area by the Wolastoqey, potential interactions between this use and the activities of the Project will be taken into consideration and additional mitigation will be implemented as applicable.

The Agreement with Mi'gmawe'l Tplu'taqnn's (MTI) was finalized and signed in March of 2018. NB Power will also continue to work with those communities that hold traditional land use information about the

Project area. This information will be important to identify current use of resources for traditional purposes and to mitigate and/or avoid potential effects that arise from routing, construction, and operations.

8.4 FUTURE ENGAGEMENT

NB Power will continue to engage First Nations communities regarding the Project. Concerns identified during engagement with First Nations, particularly those in relation to the practice of traditional activities in the PDA, will be documented and appropriate mitigation measures will be implemented as necessary to minimize any interactions of the Project with the practice of traditional activities.

NB Power will meet regularly and engage the First Nations during the regulatory review of the Project. The purpose of this engagement will be to:

- Maintain on-going engagement with First Nations regarding the Project
- Review the results of environmental studies
- Invite feedback and to identify opportunities to reduce, mitigate, or otherwise accommodate potential adverse effects to First Nations' treaty rights and other interests
- Identify long-term interests in capacity-building opportunities including economic, business, employment, education, and training Aboriginal field monitoring also provides continual engagement throughout the various phases of the Project, providing key information and updates to both NB Power as well as the First Nation Communities of New Brunswick.

9.0 CLOSURE

This report has been prepared by Stantec for the sole benefit of the New Brunswick Power Corporation (NB Power). The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Stantec and NB Power.

This report was undertaken exclusively for the purpose outlined herein and was limited to the scope and purpose specifically expressed in this report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Stantec makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or used in the preparation of this report were assumed by Stantec to be accurate. Conclusions presented in this report should not be construed as legal advice.

The information provided in this report was compiled from existing documents and data provided by NB Power and by applying currently accepted industry standard mitigation and prevention principles. This report represents the best professional judgment of Stantec personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect the any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

This report has been prepared by a team of Stantec professionals on behalf of NB Power.

10.0 REFERENCES

AASNB (Aboriginal Affairs Secretariat of New Brunswick). 2011. Government of New Brunswick Duty to Consult Policy. Government of New Brunswick, Fredericton.

AC CDC (Atlantic Canada Conservation Data Centre). 2019. Understanding Ranks. Available online: http://www.accdc.com/enNew/rank-definitions.html. Last accessed: May 6, 2019.

Adamus, P. 2018. NB WESP-AC Nontidal Calculator. Version available on December 7, 2018. Downloaded from: http://people.oregonstate.edu/~adamusp/Atlantic%20Canada%20Wetland%20Assessment%20Tools/

AER (Alberta Energy Regulator). 2007. Directive 038, Noise Control, revised February 16, 2007. Available online: https://www.aer.ca/documents/directives/Directive038.pdf. Last accessed: April 2, 2019.

Allard, S. and W.F. Gilmore. 2016. Surficial geology of the Fredericton area (NTS 21G/15), New Brunswick. New Brunswick Department of Energy and Mines, Plate 2016-1.

APLIC (Avian Power Line Interaction Committee). 2012. Reducing Avian Collisions with Power Lines. The State of the Art in 2012. Available online at: https://www.aplic.org/uploads/files/11218/Reducing_Avian_Collisions_2012watermarkLR.pdf. Last accessed: May 14, 2019.

Arsenault, M., G.H. Mittelhauser, D. Cameron, A.C. Dibble, A. Haines, S.C Rooney, and J.E. Weber. 2013. Sedges of Maine: A Field Guide to Cyperaceae. University of Maine Press.

AS (Archaeological Services). 2012. Guidelines and Procedures for Conducting Professional Archaeological Impact Assessments in New Brunswick. Archaeological Services Branch, Department of Tourism, Heritage and Culture, Fredericton, NB.

AS. 2018. Archaeological Potential Map for the Project Area. Mapping received on July 5, 2018. Archaeological Services Branch, Department of Tourism, Heritage, and Culture, Fredericton, NB.

Avery, M.L. 2013. Rusty Blackbird (Euphagus carolinus), Version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA. Available online at: https://doi.org/10.2173/bna.200. Last accessed: December 5, 2017.

Avery, M., P.F. Springer, and J.F. Cassel. 1976. The effects of a tall tower on nocturnal bird migration-a portable ceilometer study. The Auk 93(2): 281-291.

Bayne, L.M., L. Habib., and S. Boutin. 2008. Impacts of chronic anthropogenic noise from energy sector activity on abundance of songbirds in the boreal forest. Conservation Biology 22: 1186-1193.

Berneshawi, S. 1997. Resource management and the Mi'kmaq nation. Canadian Journal of Native Studies 17, (2): 115-48.

Bevanger, K. 1998. Biological and conservation aspects of bird mortality caused by electricity power lines: a review. Biological Conservation 86: 67-76.

BirdsFlight. 2019. Bird With largest Wingspan - Bird Wingspan List. Available online at: http://birdsflight.com/bird-largest-wingspan-world/. Last accessed: May 14, 2019.

Brigham, R.M., J. Ng, R.G. Poulin and S.D. Grindal. 2011. Common Nighthawk (Chordeiles minor), version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA. Available online at: https://doi.org/10.2173/bna.213. Last accessed: December 5, 2017.

Buehler, D.A. 2000. Bald Eagle (Haliaeetus leucocephalus), version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA. Available online at: https://doi.org/10.2173/bna.506. Last accessed: December 5, 2017.

Calvert, A. M., C. A. Bishop, R. D. Elliot, E. A. Krebs, T. M. Kydd, C. S. Machtans, and G. J. Robertson. 2013. A synthesis of human-related avian mortality in Canada. Avian Conservation and Ecology 8(2): 11.

Caywood, L. R. 1969. Excavations at Fort Meductic, New Brunswick. Manuscript Report No. 123. National Historic Parks and Sites Branch, Department of Indian and Northern Affairs, Ottawa, Ontario.

CBC News. 2018a. Worst Floods in New Brunswick history: how 2018 compares. Published April 30, 2018. Available online: https://www.cbc.ca/news/canada/new-brunswick/st-john-river-flooding-history-1.4641969. Last accessed: April 10, 2019.

CBC News. 2018b. Flood Recovery costs could hit $80M, minister says. Published May 18, 2018. Available online: https://www.cbc.ca/news/canada/new-brunswick/flood-new-brunswick-2018-1.4668529. Last accessed: April 10, 2019.

CCME (Canadian Council of Ministers of the Environment). 2019. Canadian Ambient Air Quality Standards. Available online: http://airquality-qualitedelair.ccme.ca/en/. Last accessed: April 2, 2019.

CESCC (Canadian Endangered Species Conservation Council). 2016. Wild Species 2015: The General Status of Species in Canada. National General Status Working Group. Available online: https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/reports/Wild%20Species%202015.pdf. Last accessed: March 12, 2019.

Cheng, V.Y., G.B. Arhonditsis, D.M. Sills, H. Auld, T.M.W. Shephard, W.A. Gough, and J. Klassen. 2013. Probability of Tornado Occurrence across Canada. American Meteorological Society. Journal of Climate Vol. 26. Available online: http://utsc.utoronto.ca/~georgea/resources/72.pdf. Last accessed: April 10, 2019.

City of Fredericton. 2005. By-Law No. S-13. A By-Law Respective Disturbance by Noise. Available online: http://www.fredericton.ca/sites/default/files/pdf/1By-lawNoS-13-6.pdf. Last accessed: May 2, 2019.

CRHP (Canadian Register of Historic Places). 2018a. Meductic Indian Village/Fort Meductic National Historic Site of Canada. Available online: http://www.historicplaces.ca/en/rep-reg/place-lieu.aspx?id=14831. Last accessed: December 11, 2018.

CRHP. 2018b. General Search of PDA. Register accessed on December 11, 2018 online at: http://www.historicplaces.ca/en/pages/about-apropos.aspx.

CRI (Canadian Rivers Institute). no date. Mactaquac Aquatic Ecosystem Study (MAES) – Data. https://www.arcgis.com/apps/webappviewer/index.html?id=f4d83a4f66104c36bece0a221d17f832&extent=-7601029.4584,5711697.0634,-7307511.2698,5850812.4549,102100. Accessed March 21, 2019.

Clarke, G. F. 1970. *Someone Before Us* (Second Edition). Brunswick Press, Fredericton, New Brunswick.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2003. COSEWIC assessment and update status report on the Butternut *Juglans cinerea* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.

COSEWIC. 2007a. COSEWIC assessment and status report on the Chimney Swift *Chaetura pelagica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Vii + 49 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2007b. COSEWIC assessment and status report on the Olive-sided Flycatcher *Contopus cooperi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 25 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2008. COSEWIC assessment and status report on the Canada Warbler *Wilsonia canadensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 35 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2009a. COSEWIC assessment and update status report on the Least Bittern *Ixobrychus exilis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 36 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2009b. COSEWIC assessment and status report on the Whip-poor-will *Caprimulgus vociferus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 28 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2010a. COSEWIC assessment and status report on the Bobolink *Dolichonyx oryzivorus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 42 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2010b. COSEWIC assessment and status report on the Skillet Clubtail *Gomphus ventricosus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 32 pp. Available online at: http://www.sararegistry.gc.ca/status/status_e.cfm.

COSEWIC. 2011a. COSEWIC assessment and status report on the Barn Swallow *Hirundo rustica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 37 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2011b. COSEWIC assessment and status report on the Eastern Meadowlark *Sturnella magna* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 40 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2012. COSEWIC assessment and status report on the Eastern Wood-pewee *Contopus virens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 39 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2013. COSEWIC assessment and status report on the Bank Swallow *Riparia riparia* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 48 pp. Available online at: http://www.registrelep-SARAregistry.gc.ca/sar/assessment/status_e.cfm.

COSEWIC. 2016. COSEWIC assessment and status report on the Monarch *Danaus plexippus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 59 pp. Available online at: http://www.registrelep-sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1.

CWCQ (Canadian Water Quality Guidelines). 2018. CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life. Available Online: https://www.ccme.ca/files/Resources/supporting_scientific_documents/cwqg_pn_1040.pdf. Accessed April 8, 2019.

DFO (Department of Fisheries and Oceans). 1996. Gaspereau Maritime Provinces Overview. DFO Science Stock Status Report. D3-17.

DFO. 2001. Eel Fisheries in the Maritimes (*Anguilla rostrata*). DFO Science Stock Status Report. 14E.

DFO. 2018a. Atlantic Sturgeon (Maritimes Population) *Acipenser oxyrinchus*. Fisheries and Oceans Canada Aquatic Species at Risk. Available Online: http://www.dfo-mpo.gc.ca/species-especes/profiles-profils/atlanticsturgeon-maritimes-esturgeonnoir-eng.html. Accessed March 29, 2019.

DFO. 2018b. Allocations Under Food, Social and Ceremonial Fisheries. Available Online: http://www.dfo-mpo.gc.ca/reports-rapports/afs-srapa/table2_e.pdf. Accessed October 16, 2018.ECCC (Environment and Climate Change Canada). 2018a. Global Greenhouse Gas Emissions. Available online: https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/global-greenhouse-gas-emissions.html. Last accessed: November 15, 2018.

Environment Canada. 1999. Recommendations for the Design and Operation of Wood Preservation Facilities. Prepared for the National Office of Pollution Prevention, Environment Canada, and the Canadian Institute of Treated Wood by G.E. Brudermann, Frido Consulting.

ECCC (Environment and Climate Change Canada). 2018b. National Inventory Report 1990-2016: Greenhouse Gas Sources and Sinks in Canada.

ECCC. 2018c. Progress towards Canada's greenhouse gas emissions reduction target. Available online: https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/progress-towards-canada-greenhouse-gas-emissions-reduction-target.html. Last accessed: April 10, 2019.

Erickson, V.O. 2007. Three Maliseet Artefacts: A Celebration of their Return from the Museum of Civilization. *The Officers' Quarters* 24(2):14–18.

Evans, M., E. Gow, R.R. Roth, M.S. Johnson and T.J. Underwood. 2011. Wood Thrush (Hylocichla mustelina), version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA. Available online at: https://doi.org/10.2173/bna.246. Last accessed: December 5, 2017.

Farrar, J.L. 1995. Trees in Canada. Fitzhenry and Whiteside Ltd. and the Canadian Forest Service. Ottawa.

Flato, G., J. Marotzke, B. Abiodun, P. Braconnot, S.C. Chou, W. Collins, P. Cox, F. Driouech, S. Emori, V. Eyring, C. Forest, P. Gleckler, E. Guilyardi, C. Jakob, V. Kattsov, C. Reason, and M. Rummukainen. 2013. Evaluation of Climate Models. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K.

Global News. 2013. History of tornadoes in Atlantic Canada. Published July 22, 2013. Available online: https://globalnews.ca/news/733662/history-of-tornadoes-in-atlantic-canada/ . Last accessed: April 10, 2019.

GC (Government of Canada). 1991. The Federal Policy on Wetland Conservation. Director General, Canadian Wildlife Service, Ottawa, Ontario. Available online: http://publications.gc.ca/collections/Collection/CW66-116-1991E.pdf. Last accessed: March 11, 2019.

GC. 2018. Get Prepared; Hazards and Emergencies; Regional Hazards: New Brunswick. Available online: http://www.getprepared.gc.ca/cnt/hzd/rgnl/nb-en.aspx. Last accessed: April 10, 2019.

GC. 2019a. Canadian Climate Normals Data 1981 – 2010 Station Data. Fredericton CDA Station. Available online: http://climate.weather.gc.ca/climate_normals/. Last accessed: August 28, 2019.

GC. 2019b. Species at Risk Public Registry. Available online: http://www.sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

GC. 2019c. Committee on the Status of Endangered Wildlife in Canada. Available Online: https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife.html. Last accessed: April 2, 2019.

Gillihan, S.W. and B.E. Byers. 2001. Evening Grosbeak (Coccothraustes vespertinus), version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA. Available online at: https://doi.org/10.2173/bna.599. Last accessed: December 5, 2017.

GNB (Government of New Brunswick). 2017a. Communities in each of the 12 Regional Service Commissions (RSC). Available online at: https://www2.gnb.ca/content/dam/gnb/Departments/lg-gl/pdf/Plan/CommunitiesCommunautes.pdf. Last accessed: May 6, 2019.

GNB . 2017b. Climate Change Secretariat, Department of Environment and Local Government. Available online: http://acasav2.azurewebsites.net/#. Last accessed: April 11, 2019.

GNB. 2018a. Post-Secondary Education, Training and Labour. New Brunswick Regional Profile: Central. Full-version. Available online: https://www.nbjobs.ca/trends/regional. Last accessed: May 2, 2019.

GNB. 2018b. Flooding on the St. John River. Public Alerts. Available online: https://www.gnb.ca/public/riverwatch/historic-e.asp. Last accessed: April 10, 2019.

GNB. 2018c. How is Climate Change Affecting New Brunswick? Available online: https://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/climate_change/content/climate_change_affectingnb.html. Last accessed: April 10, 2019.

GNB. 2019a. Fish 2019 A Part of Our Heritage. Available online: https://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/Fish/Fish.pdf. Accessed: April 2, 2019.

GNB. 2019b. Wildlife Management Zones. Available online: https://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/Wildlife/WildlifeManagementZones.pdf. Last accessed: May 2, 2019.

Gordon, E. and Grant, H. 1972. The Vanished Village: Jewett's Mills, NB, 1804 – 1967. Petheric Press Limited.

HCPMRA (Health Canada Pest Management Regulatory Agency). 2011. Heavy Duty Wood Preservatives: Creosote, Pentachlorophenol, Chromated Copper Arsenate (CCA) and Ammoniacal Copper Zinc Arsenate (ACZA). Health Canada. Re-evaluation Decision RVD2011-06.

Health Canada. 2016. Electric and Magnetic Fields from Power Lines and Electrical Appliances. Available online: https://www.canada.ca/en/health-canada/services/home-garden-safety/electric-magnetic-fields-power-lines-electrical-appliances.html. Last accessed: April 2, 2019.

Health Canada. 2017. Guidelines for Canadian Drinking Water Quality. Available online: https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf. Last accessed: 2019-05-01.

H.G. Acres and Company Ltd. 1969. Design and Construction of the Mactaquac Hydro Electric Development. Electric Power Commission, New Brunswick. W.P. Steadman. Niagara Falls, Ontario, September 1969.

Hinds, H.R. 2000. Flora of New Brunswick. Second Edition. Biology Department, University of New Brunswick. Fredericton, NB.

IESO (Independent Electricity System Operator). 2015. Part 7.6: Glossary of Standard Operating Terms, Market Manual 7: System Operations. Issue 9.0. Available online: http://www.ieso.ca/sector-participants/market-operations/market-rules-and-manuals-library. Last accessed: April 11, 2019.

IPCC (International Panel on Climate Change). 2007. Working Group I: The Physical Science Basis. How do Human Activities Contribute to Climate Change and How to They Compare with Natural Influences? Available online: https://www.ipcc.ch/publications_and_data/ar4/wg1/en/faq-2-1.html. Last accessed: April 10, 2019.

IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp. Available online: https://www.ipcc.ch/report/ar5/wg1/. Last accessed: April 10, 2019.

Kidd, S.D., R.A. Curry, and K.R. Munkittrick. 2011. The Saint John River: A State of the Environment Report. Published by the Canadian Rivers Institute, University of New Brunswick, Fredericton, NB.

Leonard Jr., David L. 2001. American Three-toed Woodpecker (Picoides dorsalis), version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA. https://doi.org/10.2173/bna.588

Lloyd, P., T.E. Martin, R.L. Redmond, U. Langner, and M.M. Hart. 2005. Linking demographic effects of habitat fragmentation across landscapes to continental source-sink dynamics. Ecological Applications 15(5): 1504-1514.

Longcore, T. and C. Rich. 2004. Ecological light pollution. Frontiers in Ecology and the Environment 2: 191–198.

McIntosh, F. No Date. Prelude to Mactaquac. An Historical Sketch by Fraser McIntosh. Mactaquac Land Acquisition Office.

Moss, R.H., J.A. Edmonds, K.A. Hibbard, M.R. Manning, S.K. Rose, D.P. van Vuuren, T.R. Carter, S. Emori, M. Kainuma, T. Kram, G.A. Meehl, J.F. Mitchell, N. Nakicenovic, K. Riahi, S.J. Smith, R.J.

Stouffer, A.M. Thomson, J.P. Weyant, and T. J. Wilbanks. 2010. The next generation of scenarios for climate research and assessment. Nature 463: 747-756 (11 February 2010).

MTRI (Mersey Tobeatic Research Institute). 2012. Invasive Alien Species in Nova Scotia: Identification and Information Guide. Available online: http://www.ap.smu.ca/~lcampbel/NSInvasiveAlienSpeciesGuide.pdf. Last accessed: March 12, 2019.

NBATVF (New Brunswick All Terrain Vehicle Federation). 2019. Trail Maps. Available online: http://nbatving.com/cartes.php. Last accessed: April 26, 2019.

NBDELG (New Brunswick Department of Environment and Local Government). No date. Surface Water Quality Data Portal: Saint John River below Mactaquac Dam, Route 102. Available online: https://www.elgegl.gnb.ca/WaterNB-NBEau/en/SamplingLocation/Details/300. Accessed March 21, 2019.

NBDELG. 2013. Air Quality Monitoring Results 2011. Available online: http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Air-Lair/AirQualityMonitoringResults2011.pdf. Last accessed: April 2, 2019.

NBDELG. 2015. Air Quality Monitoring Results 2012 & 2013. Available online: http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Air-Lair/AirQualityMonitoringResults2013.pdf. Last accessed: April 2, 2019.

NBDELG. 2016. Air Quality Monitoring Results 2014. Available online: http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Air-Lair/AirQuality-QualiteDeLair/AirQualityMonitoringResults2014.pdf. Last accessed: April 2, 2019.

NBDELG. 2017a. Air Quality Monitoring Results 2015. Available online: http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Air-Lair/AirQuality-QualiteDeLair/AirQualityMonitoringResults2015.pdf. Last accessed: April 2, 2019.

NBDELG. 2017b. Watercourse and Wetland Permitting Guidelines. Available online: https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Wetlands-TerreHumides/WatercourseAndWetlandPermittingGuidelines.pdf. Last accessed: April 15, 2019.

NBDELG. 2017c. Working near Wetlands in New Brunswick. Available online: https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Wetlands-TerreHumides/WorkingNearWetlandsInNewBrunswick.pdf. Last accessed: May 8, 2019.

NBDELG. 2018. A Guide to Environmental Impact Assessment in New Brunswick. Available online: https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/GuideEnvironmentalImpactAssessment.pdf. Last accessed: May 8, 2019.

NBDELG. 2019. Online Well Log System. Available online: http://app.elg-egl.gnb.ca/0375-0001/. Last accessed: April 4, 2019.

NBDNR (New Brunswick Department of Natural Resources). No date. Species At Risk Public Registry. http://www1.gnb.ca/0078/SpeciesAtRisk/search-e.asp. Last accessed: April 2, 2019.

NBDNR. 1945. Aerial Photography No. 8231-5

NBDNR. 1951. Aerial Photography No. 2238-296

NBDNR. 2003. NR-9. Landscape Map of New Brunswick. Available online: https://www2.gnb.ca/content/dam/gnb/Departments/en/pdf/Minerals-Minerales/nr_9-e.pdf, Last accessed: may 1, 2019.

NBDNR. 2007. Our Landscape Heritage: The Story of Ecological Land Classification. Prepared by New Brunswick Department of Natural Resources, The Ecosystem Classification Working Group. Vincent F. Zelazny, General Editor. 2nd Edition. Originally issued 2003. ISBN 978-1-55396-203-8 in New Brunswick. Chapter 13. Available online: https://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/ForestsCrownLands/ProtectedNaturalAreas/OurLandscapeHeritage/Chapter13-e.pdf. Last accessed: May 1, 2019.

NBDNR. 2013. Old Forest Community and Old-Forest Wildlife Habitat Definitions for New Brunswick 2012. Available online: https://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/ForestsCrownLands/OldForestCommunityWildlifeHabitatDefinitions.pdf. Last accessed: April 9, 2019.

NBDNRE (New Brunswick Department of Natural Resources and Energy) and NBDELG (New Brunswick Department of Environment and Local Government). 2002. New Brunswick Wetlands Conservation Policy. Available online: https://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/Wetlands-TerresHumides.pdf. Last accessed: March 11, 2019.

NBFSC (New Brunswick Federation of Snowmobile Clubs Inc.). 2019. NBSFC Public Trail Map. Available online: https://nbfsc.evtrails.com/#. Last accessed: April 26, 2019.

NBISC (New Brunswick Invasive Species Council). 2012. A Field Guide to 12 Invasive Plants of Concern in New Brunswick. Available online: http://peiinvasives.ca/wp-content/uploads/2016/03/NB-field-guide-en-lowres.pdf. Last accessed: February 22, 2019.

NB Power (New Brunswick Power Corporation). 2012. Environmental Protection Plan for New Brunswick Power Corporation Transmission Facilities. Prepared by: New Brunswick Power Transmission Corporation.

NB Power. 2017. Outages and Weather. Available online: https://www.nbpower.com/en/outages/preparing-for-outages/outages-and-weather. Last accessed: April 11, 2019.

NB Power. 2019. Transmission & System Operator. Available online: https://www.nbpower.com/en/about-us/divisions/transmission-system-operator/. Last accessed: March 13, 2019.

NBRHP (New Brunswick Register of Historic Places). 2018. General Search of PDA. Register accessed on December 11, 2018 online: https://www.rh-prlp.gnb.ca/PublicSearch.aspx?blnLanguageEnglish=True

NCC (Nature Conservancy of Canada). 2018. Invasive Species Gallery. Available online: http://www.natureconservancy.ca/en/what-we-do/resource-centre/invasive-species/. Last accessed: February 22, 2019.

NERC (North American Electric Reliability Corporation). 2017. Available online: http://www.nerc.com/pa/rrm/TLR/Pages/Reliability-Coordinators.aspx. Last accessed: March 13, 2019.

Newby, P., J. Bradley, A. Spiess, B. Shuman, and P. Leduc. 2005. A Palaeoindian Response to Younger Dryas Climate Change. Quaternary Science Reviews 24:141–154.

Newell, F. L. and M. S. Kcstalos. 2007. Wood Thrush nests in dense understory may be vulnerable to predators. Wilson Journal of Ornithology no. 119 (4):693-702.

NRCan (Natural Resources Canada). 2015. 2015 National Building Code of Canada seismic hazard maps. Acailable online: http://earthquakescanada.nrcan.gc.ca/hazard-alea/zoning-zonage/NBCC2015maps-en.php. Last accessed: April 4, 2018.

NRCan. 2016. Butternut Canker. Available online: http://www.nrcan.gc.ca/forests/fire-insects-disturbances/top-insects/13375. Last accessed. April 12, 2019.

NRCan. 2017a. Earthquakes Canada. Frequently Asked Questions about Earthqakes. Available online: http://earthquakescanada.nrcan.gc.ca/info-gen/faq-en.php#What_is_an_earthquake. Last accessed: April 11, 2019.

NRCan. 2017b. Earthquake zones in Eastern Canada. Available online: http://www.seismescanada.rncan.gc.ca/zones/eastcan-en.php#NASZ. Last accessed: April 11, 2019.

Ogden, L.J.E. 1996. Collision Course: The Hazards of Lighted Structures and Windows to Migrating Birds. Fatal Light Awareness Program (FLAP) and World Wildlife Fund Canada. Toronto, ON.

Paul, D. 2007. We Were Not the Savages: First Nations History – Collision Between European and Native American Civilizations. Fenwood Publishing: Halifax

Pearson, R. 1968. Archaeological Sites in the Northern St. John River Area, New Brunswick Canada. Manuscript on file, Canadian Museum of History, Ottawa, Ontario.

Petersen, J.B., and D. Sanger. 1993. An Aboriginal Ceramic Sequence for Maine and the Maritime Provinces. In Prehistoric Archaeology in The Maritime Provinces: Past and Present Research, edited by M. Deal and S. Blair, pp. 113–170. Reports in Archaeology No. 8. Council

of Maritime Premiers Maritime Committee on Archaeological Cooperation, Fredericton, New Brunswick.

Rampton, V.N. 1984. Surficial Geology, New Brunswick. Geological Survey of Canada, "A" Series Map 1594A. Available online at: http://ftp.maps.canada.ca/pub/nrcan_rncan/publications/ess_sst/119/119734/gscmap-a_1594a_b_1984_mn01.pdf. Last accessed: May 8, 2019.

Randall, D.A., R.A. Wood, S. Bony, R. Colman, T. Fichefet, J. Fyfe, V. Kattsov, A. Pitman, J. Shukla, J. Srinivasan, R.J. Stouffer, A. Sumi, and K.E. Taylor. 2007. Climate Models and Their Evaluation. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter8.pdf. Last accessed: April 11, 2019.

Rayburn, A. 1975. Geographical Names of New Brunswick. Toponymy Study 2, Surveys and Mapping Branch, Department of Energy, Mines and Resources, Canadian Permanent Committee on Geographical Names, Ottawa.

Raymond, W.O. 1897. The Old Meductic Fort and the Indian Chapel of Saint Jean Baptiste. Daily Telegraph Steam Book and Job Print, Saint John.

Resource Development Engineering. 1966. Progress Report: Mactaquac Development, Volume III. February 20, 1966.

Rich, A.C., D.S. Dobkin, and L.J. Niles. 1994. Defining Forest Fragmentation by Corridor Width: The Influence of Narrow Forest-Dividing Corridors on Forest-Nesting Birds in Southern New Jersey. Conservation Biology: 8(4): 1109-1121.

Rioux, S., J.-P. L. Savard, and A. A. Gerick. 2013. Avian mortalities due to transmission line collisions: a review of current estimates and field methods with an emphasis on applications to the Canadian electric network. Avian Conservation and Ecology 8(2): 7. Available online at: http://www.ace-eco.org/vol8/iss2/art7/ACE-ECO-2013-614.pdf. Last accessed: August 31, 2015.

Robbins, C. S. 1979. "Effect of forest fragmentation on bird populations." In Management of north central and northeastern forests for nongame birds., edited by R. M. DeGraaf and K. E. Evans, 198-212. U.S. For. Serv. Gen. Tech. Rep. NC-51.

Robbins, C. S., J. R. Sauer, R. S. Greenberg and S. Droege. 1989. Population declines in North American birds that migrate to the neotropics. Proc. Natl. Acad. Sci. no. 86:7658-7662.

Rutherford, D. E. 1993. The Ceramic Period in New Brunswick. In Prehistoric Archaeology in The Maritime Provinces: Past and Present Research, edited by M. Deal and S. Blair, pp. 101–

111. Reports in Archaeology No. 8. Council of Maritime Premiers Maritime Committee on Archaeological Cooperation, Fredericton, New Brunswick.

SentierNBTrail. 2019. New Brunswick Trail Council. Maps. Fredericton. Available online: https://www.sentiernbtrail.com/sentier-nb-trails. Last accessed: April 26, 2019.

Shaw, J., D. J. W. Piper, G. B. J. Fader, E. L. King, B. J. Todd, T. Bell, B. J. Batterson, and D. G. E. Liverman. 2006. A Conceptual Model of the Deglaciation of Atlantic Canada. Quaternary Science Reviews 25:2059–2081.

SNB (Service New Brunswick). 2011. Wetlands, GeoNB Map Viewer. Available online: http://geonb.snb.ca/geonb/. Data layer downloadable from: http://www.snb.ca/geonb1/e/DC/catalogue-E.asp. Last updated: January 3, 2011.

Southwire©. 2019. ACSR. Aluminum Conductor. Steel Reinforced. Bare. Available online at: https://www.mysouthwire.com/medias/sys_master/product-specifications/product-specifications/h18/hd8/8854083076126.pdf. Last accessed: May 6, 2019.

Stantec (Stantec Consulting Ltd.). 2016. Mactaquac Project Final Comparative Environmental Review (CER) Report. Prepared for New Brunswick Power Corporation, Fredericton.

Stantec. 2017a. Environmental Impact Assessment (EIA) Registration for the Modernization of Electrical Transmission Infrastructure near Kedgwick, New Brunswick.

Stantec. 2017b. Environmental Impact Assessment (EIA) Registration for 138 kV Transmission Line in the Moncton Industrial Park, Moncton, New Brunswick.

Stantec. 2017c. Environmental Impact Assessment (EIA) Registration for the International Power Line Project: Woodstock to Houlton, Maine (Transmission Line 0155).

Stantec. 2017d. 2016 Archaeological Impact Assessment (Walkover) for the Mactaquac Project, York County, New Brunswick. Archaeological Field Research Permit No. 2016NB40.

Stantec. 2018. Environmental Impact Assessment (EIA) Registration for the Modernization of Electrical Transmission Infrastructure near Neguac, New Brunswick

St. Peter, C.J. and L.R. Fyffe. 2005. Bedrock geology of the Fredericton area (NTS 21G/15), York and Sunbury counties, New Brunswick. New Brunswick Department of Natural Resources, Minerals, Policy and Planning Division. Plate 2005-38.

Suttie, B., M. A. Nicholas, J. S. Jeandron, G. R. Aylesworth, A. B. Brzezicki, and A. C. Hamilton. 2013. Recent Research on Four Sites Spanning 13,000 years from Southwestern New Brunswick, Canada. Canadian Archaeological Association Newsletter Vol. 31 Issue 1.

Thomson, A.M., Calvin, K.V., Smith, S.J., Kyle, G.P., Volke, A, Patel,P., Delgado-Arias, S., Bond-Lamberty, B., Wise, M.A., Clarke, L.E. 2011. RCP4.5: A Pathway for Stabilization of Radiative Forcing by 2100. Climate Change (2011) 109:77.

Tims, J. and N. Craig. 1995. Environmentally Significant Areas in New Brunswick (NBESA). New Brunswick Department of Environment and Nature Trust of New Brunswick Inc.

Trail, P. G. 2002. Bear Island: More Than an Island. Print Atlantic, Dartmouth, Nova Scotia.

Turnbull, C. J. 1974. The Second Fluted Point from New Brunswick. Man in the Northeast 7:109–110.

UWO (University of Western Ontario). 2019. IDF_CC Tool 4.0. Available online: https://www.idf-cc-uwo.ca/home. Last accessed: September 24, 2019.

Van Vuuren, D.P, Edmonds, J., Kainuma, M., Riahi, K, Thomson, A., Hibbard, K., and Hurtt, G.C. The representative concentration pathways: an overview. Climatic Change (2011) 109: 5.

Wiese, F.K, W.A. Montevecchi, G.K. Davoren, F. Huettmann, A.W. Diamond, and J. Linke. 2001. Seabirds at risk around offshore oil platforms in the North-west Atlantic. Marine Pollution Bulletin 42(12): 1285-1290.World Resources Institute. 2017. Climate Analysis Indicators Tool (CAIT) Climate Data Explorer. Washington, DC. Available online at: http://cait.wri.org/. Last accessed: February 7, 2017.

Yamazaki, G. (2019, April, 5). Personal communication. Project Manager, Canadian Rivers Institute.

YFC. 2019. Fredericton International Airport. Available online: https://yfcfredericton.ca/. Last accessed: May 2, 2019.