Natural Forces Wind Inc. 1801 Hollis Street | Suite 1205 | Halifax | NS | B3J 3N4 | T: (902) 422 9663 | F: (902) 422 9780

Shawn Hamilton
Project Manager
Environmental Assessment Section
Marysville Place, P.O. Box 6000
Fredericton, NB
E3B 5H1

Re: Burchill Wind Project. EIA Cover Letter and Table of Concordance

Dear Mr. Hamilton,

Natural Forces would like to submit an Environmental Impact Assessment (EIA) for review of the proposed Burchill Wind Project.

Attached to this document is a Table of Concordance demonstrating how this document has met the requirements for specific project information to be included for registration. The *New Brunswick Guide to Environmental Impact Assessment* and the *Sector Specific Guidelines for Wind Turbines* have been followed in the development of this EIA and provincial regulators have been further consulted for guidance. Natural Forces acknowledges that additional information will be required and submitted for review as it becomes available. We are confident that this document, with the addendums to follow, will sufficiently address the requirements of the Technical Review Committee.

Natural Forces is submitting the assessment on behalf of Natural Forces Development Limited Partnership and is eager to work with Provincial regulators to provide any additional information about the Burchill Wind Project that may be requested.

Should there be any questions, please do not hesitate to contact me at (902) 422-9663 or via email at apellerin@naturalforces.ca. As well, Natural Forces would welcome and appreciate the opportunity to meet and further discuss the comments and responses with individual members of the TRC at a set time and date in a location of their convenience.

Sincerely,

Amy Pellerin, Senior Development Manager
Natural Forces
1 902 422 9663 x210

Legislated Minimum Requirements for an EIA Registration Document, NB Regulation 87-83	Section Addressing Requirements
1.0 The Proponent	**1.0 - Proponent**
(i) Name of Proponent	1.1 – Name
(ii) Address of Proponent	1.2 – Address
(iii) Chief Executive Officer	1.3 – Chief Executive Officer
(iv) Principle Contact Information	1.4 – Principle Contact Person
(v) Property Ownership	1.5 – Property Ownership
2.0 The Undertaking	**2.0 The Undertaking**
(i) Name of the Undertaking	2.1 – Name of the Undertaking
(ii) Project Overview	2.3 – Project Overview
(iii) Purpose and Need of Undertaking	2.2 – Project Need and Purpose
(iv) Project Location	2.4 – Project Location Figure 2-1 – Project Location
(v) Siting Considerations	2.5 – Siting Considerations
(vi) Physical Components and Project Dimensions	2.6 – Physical Components and Dimensions
(vii) Construction Details	2.7 – Construction Details
(viii) Operation and Maintenance Details	2.8 – Operation and Maintenance
(ix) Future Modifications, Extensions, or abandonment	2.10 – Future Modifications, Extensions, or Abandonment
(x) Project Related Documents	2.11 – Project Related Documents
3.0 Existing Environment	**4.0 – Existing Environment** Appendix C- Avian Survey Report to be submitted as an addendum Appendix D- Bat Survey to be included as an addendum Appendix F – ACCDC Report Appendix G – Fundy Engineering Watercourse/ Wetland Assessment
(i) Physical and Natural Features	4.1 – Existing Physical VECs 4.2 – Existing Biophysical VECs
(ii) Cultural Features	4.3 – Existing Socio-economic VECs
(iii) Existing and Historic Land Uses	4.3.3 – Land Uses and Property Value
4.0 Summary of Environmental Impacts	**5.0 – Predicted Environmental Impacts and Mitigation**
Sector Specific: Biota Impacts	5.2.1 – Avian 5.2.2 – Bats

	5.2.4 – Fish and Fish Habitat 5.2.5 – Wildlife 5.2.6 – Vegetation and Habitat
Sector Specific: Noise Impacts	5.1.5 – Noise Appendix A - Noise Impact Assessment
Sector Specific: Visual Impacts	5.1.6 – Shadow Flicker and Visual Aesthetics Appendix B – Shadow Flicker Assessment
Sector Specific: Impact on Communication Facilities	5.3.2 – Electromagnetic Interference Appendix E will be submitted as an addendum
Sector Specific: Impact on Hydrology	5.1.1 – Ground Water 5.2.3 – Wetlands and Watercourses
Sector Specific: Impact of Electromagnetic Fields	5.3.2 – Electromagnetic Interference
Sector Specific: Impact on Public Safety	5.3.5 – Public Health and Safety
5.0 Summary of Proposed Mitigation	**5.0 – Predicted Environmental Impacts and Mitigation** 7.0 – Follow-up Monitoring and Mitigation
6.0 Public Involvement	**6.0 – Stakeholder Consultation**
7.0 Approval of the Undertaking	**8.0 – Approval of the Undertaking**
8.0 Funding	Natural Forces is funding this project. No outside funding was obtained.
9.0 Signature	**9.0 - Signature**

BURCHILL WIND PROJECT

Environmental Impact Assessment Registration Document

February 2020

naturalforces

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Executive Summary

This Environmental Impact Assessment has been prepared for the proposed Burchill Wind Project by Natural Forces Development Limited Partnership on behalf of the Proponent, Natural Forces Development Limited Partnership. The purpose of this document is to assess the potential environmental impact of the proposed Project on valued environmental components.

The Project is located on Crown Land within the south western boundary of Saint John, New Brunswick. This Project will consist of up to 10 wind turbine generators, a new substation, and an overhead line required to connect the Project to the existing Saint John Energy electrical grid.

Construction activities required for the Burchill Wind Project will include clearing vegetation and grading for access roads, crane pads and concrete turbine foundations, electrical laydown, installation of new collector lines and distribution lines, turbine delivery and erection, turbine commissioning, substation installation and site restoration and clean-up. Pre- construction activities are expected to begin in Q3 of 2020 and turbine commissioning is expected in Q3 2021.

Work completed as part of this Environmental Impact Assessment includes study methodologies as well as desktop and field studies conducted. These studies have gathered background information to identify and assess potential impact to biophysical, physical, and socio-economic VECs. Field surveys completed include avian migration and breeding surveys, raptor surveys, waterfowl survey, wetland and watercourse delineations, and vegetation surveys. With the exception of the avian and bat studies, the results of the studies have been compiled and are included in the assessment of the existing environment. Additional desktop and field surveys completed by the Proponent and third parties include an archaeological predictive model, species at risk potentials, current and future predicted climate comparisons, an electromagnetic interference study, noise and shadow flicker assessments, and visual impact assessments.

Further, a brief description of consultation efforts is provided. However, the Proponent will submit detailed information about their consultation efforts in two stand-alone Public Consultation Summary Report and the Indigenous Consultation Summary during the review period.

Upon completion and compilation of field surveys, a proper assessment of the potential Project impacts on the surrounding environment has been assessed for the following VECs:

- Ground Water
- Geophysical Conditions
- Atmospheric Conditions
- Wind Resource
- Noise
- Shadow Flicker and Visual Aesthetics
- Wildlife
- Vegetation and Habitats

- Wetlands and Watercourses
- Fish Habitat
- Archaeological Resources
- Electromagnetic Interference
- Land Use and Property Values
- Vehicle Traffic and Pollution
- Public Health and Safety

Due to the timing of this submission the following datasets are yet to be compiled and presented and will be submitted as an addendum to the Environmental Impact Assessment:

- Avian Surveys
- Bat Surveys

As recommended by Archaeological Prospects following their survey of the Project site, archaeological test pits will be conducted in the spring of 2020, and a report will be submitted as an addendum to this submission.

To reflect additional field work required in areas of the Project Footprint that have not yet been surveyed, the following studies will be conducted in 2020, and will also be submitted as addendums to the registration document. These studies include:

- Updated wetland, watercourse, and vegetation studies (will include survey results in the small areas previously not surveyed)
- Fish surveys in watercourses that may be impacted by the Project

From the data that has currently been assessed it has been determined that no significant residual effects are predicted. The Proponent is committed to minimizing any potential for environmental impact as a result of the construction, operation and decommissioning of the Proposed Burchill Wind Project and has therefore, outlined any post construction monitoring and mitigation details that may be required given the predicted impacts.

The Proponent believes that the Project Footprint demonstrated reduces many environmental concerns while providing an excellent opportunity to transform a previously disturbed and fragmented site into a productive source of environmentally friendly renewable energy. The Burchill Wind Project will also help to meet provincial goals of providing 40% renewable energy to the Province by 2020 and will support community economic development.

Table of Contents

List of Figures

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*DUE TO THE TIMING OF THIS SUBMISSION BIRD AND BAT MONITORING HAS NOT BEEN INCLUDED IN THIS REPORT. AN ADDENDUM WITH APPLICABLE DATA WILL FOLLOW.

**ARCHAEOLOGICAL TEST PITS HAVE BEEN RECOMMENDED ALONG AREA OF HIGH POTENTIAL. TEST PITS WILL BE COMPLETED IN 2020, AND WILL BE PROVIDED AS AN ADDENDUM.

***THESE PLANS WILL BE SUBMITTED AS AN ADDENDUM

List of Acronyms

AAS	Aboriginal Affairs Secretariat
ACCDC	Atlantic Canada Conservation Data Center
AMO	Abandoned Mine Openings
AMSL	Above Mean Sea Level
ANB	Ambulance New Brunswick
AR5	Assessment Report #5 (IPCC)
ATV	All Terrain Vehicle
BB	Burchill Brook
CCG	Canadian Coast Guard
CLC	Community Liaison Committee
CMA	Census Metropolitan Area
CN	Canadian National Railway
COSEWIC	Committee of the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Services
dB(A)	Decibel A-weighting
DELG	Department of Environment and Local Government
DERD	Department of Energy and Resource Development
DFO	Department of Fisheries and Oceans Canada
DTI	Department of Transportation and Infrastructure
DND	Department of National Defence
EIA	Environmental Impact Assessment
ECCC	Environment and Climate Change Canada
EMF	Electromagnetic Field
EMP	Environmental Management Plan
ESA	Environmentally Significant Area
FC	Frenchman's Creek
GPS	Global Positional System
Ha	Hectare
Hz	Hertz
IBA	Important Bird Area
IDF	Intensity-Duration-Frequency (rainfall curves)
IEC	International Electrotechnical Commission
IPCC	Intergovernmental Panel for Climate Change
ISO	International Standards Organization
Km	Kilometer
LORESS	Locally Owned Renewable Energy that is Small Scale
MA	Managed Area
MB	Marsh Brook
MBBA	Maritime Breeding Bird Atlas
MC	Mill Creek

MCB	Maguire's Cove Brook
MET	Meteorological Tower
MW	Megawatt
NBP	New Brunswick Power
NBSR	New Brunswick Southern Railway
OHS	Occupation Health and Safety (Act)
PC	Point Count
PH	Paddy's Hill
PID	Property Identification
PLE	Pipeline East
PLW	Pipeline West
PNA	Protected Natural Area
PPA	Power Purchase Agreement
Project	Burchill Wind Project
Proponent	Natural Forces
RABC	Radio Advisory Board of Canada
RDC	Regional Development Corporation
RoW	Right of Way
SAR	Species at Risk
SARA	Species at Risk Act (Canada)
SCADA	Supervisory Control and Data Acquisition
SJE	Saint John Energy
SJPF	Saint John Police Department
SJMFC	Saint John Model Flying Club
SOCC	Species of Conservation Concern
SPL	Sound Pressure Level
STP	Standardized Test Pits
SVA	Subtended Vertical Angle
TRC	Technical Review Committee
VEC	Valued Environmental Component
WAWA	Wetland and Watercourse Alteration
WC	Watercourse
WESP-AC	Wetland Ecosystem Services Protocol – Atlantic Canada
WMO	World Meteorological Organization
WTG	Wind Turbine Generator
ZVI	Zone of Visual Influence

1 Proponent

1.1 Name

The Proponent for the Burchill Wind Project (BWP or Project) is Natural Forces Development Limited Partnership (Natural Forces or the Proponent) a company registered in Nova Scotia. For clarification throughout this document, Natural Forces is also the developer for the BWP.

1.2 Address

The address for the Proponent is the following:

1205-1801 Hollis Street,
Halifax, NS, B3J 3N4

1.3 Chief Executive Officer

John Brereton – President of Natural Forces – jbrereton@naturalforces.ca – (902) 422-9663

1.4 Principal Contact Person

Amy Pellerin – Senior Development Manager at Natural Forces – apellerin@naturalforces.ca– (902) 422-9663

1.5 Property Ownership

The lands on which the project will reside are Crown Lands owned by the Province of New Brunswick. An Option agreement and Investigative License of Occupation were obtained by Saint John Energy (SJE) from the province to study the wind resource in this area in May, 2019. This License will be transferred to Natural Forces in the coming months. Prior to construction, a License of Occupation to Construct and Operate will be obtained.

The Project will make use of the following existing roads:

- King William Road – a municipal road maintained by the City of Saint John;
- Burchill Road – a non-maintained municipal road; and,
- Paddy's Hill Drive – a municipal road maintained by the City of Saint John.

1.6 Proponent Qualifications

This Environmental Impact Assessment (EIA) report is being submitted to the Department of Environment and Local Government by Natural Forces.

Natural Forces was established in 2001, and has offices located in Halifax, Nova Scotia, Quispamsis, New Brunswick and Dublin, Ireland. Natural Forces has over 75 years of combined local, national, and international experience in the renewable energy sector. Natural Forces is a renewable energy developer, constructor, operator, and long-term asset owner. Currently active in many of the major Canadian renewable energy markets, Natural Forces specifically focuses on wind, solar and small hydro technologies.

Natural Forces has a long and successful history of delivering permitted wind farms to a construction ready stage. By utilizing both third-party professional environmental consultants, and in-house environmental and engineering teams, projects are permitted and delivered on schedule while maintaining an economic competitiveness.

Natural Forces, in partnership with TransAlta Renewables developed, constructed, and co-owns New Brunswick's first wind farm: the Kent Hills Wind Farm which has an installed capacity of 167 MW. As well, Natural Forces, acting on behalf of the Oinpegitjoig Wind Limited Partnership, have recently commissioned the 3.8 MW Richibucto Wind Project in partnership with Pabineau First Nation. Additionally, Natural Forces have recently received an approval for the EIA on its Wocawson Energy Project developed and owned in partnership with Tobique First Nation.

In addition to these New Brunswick Projects, Natural Forces developed, constructed, owns and operates ten wind farms in the Maritimes in partnership with community groups or stakeholders as shown in Table 1-1.

Table 1-1: Natural Forces operational wind energy projects.

Project Name	Partnerships	Number of turbines	Rated Capacity
Fairmont Wind Farm	Wind4All – a CEDC	2	4.6 MW
Hillside Boularderie Wind Farm	Wind4All Communities – a CEDC	2	4 MW
Pictou Landing Wind Farm	Pictou Landing First nation and Wind4All Communities lll – a CEDC	1	1.6 MW
Gardiner Mines Wind Farm	Cape Breton University	3	5.4 MW
Gaetz Brook Wind Farm	Wind4All Communities – a CEDC	1	2.3 MW
Barrachois Wind Farm	Wind4All Communities IV	2	4 MW
Aulds Mountain Wind Farm	Wind4All Communities ll	2	4.6 MW

Project Name	Partnerships	Number of turbines	Rated Capacity
Amherst Community Wind Farm	The Assembly of Nova Scotia Mi'Kmaq Chiefs and Wind4AllCommunities lll	2	6 MW
Richibucto Wind Project	Oinpegitjoig Wind Limited Partnership	1	3.8 MW
Kent Hills Wind Farm	TransAlata Renewables	55	167 MW

Natural Forces has successfully permitted all of their wind projects in both Nova Scotia and New Brunswick. Eight of the sites were required to follow provincially legislated EIA processes under their respective provincial *Environmental Assessment Acts*. Natural Forces has worked closely with Provincial regulators, stakeholders, and First Nations on all previously approved projects, and are well versed in existing New Brunswick EIA legislation and guidelines. In addition to environmental and engineering teams, Natural Forces also possesses construction management, and operation teams who carry projects through to completion. With Natural Forces' experience permitting and constructing wind farms, the Proponent is confident the BWP can be constructed and commissioned with minimal environmental impact following expected timelines and budgets.

2 The Undertaking

2.1 Name of the Undertaking

The name of the undertaking is the Burchill Wind Project (Project or BWP).

2.2 Project Need and Purpose

The Project is located in an extensively industrialized area within the southwest boundaries of the city of Saint John. The project is within the jurisdiction of SJE where there is an increased energy demand to power the city and nearby town centres, industrial activities and populated residential areas. Therefore, there is a need to provide additional safe, clean energy sources to help offset and meet increasing energy demands. The purpose of this Project is to help SJE fulfill their sustainability policy through the generation of clean, renewable energy, and reduce SJE's reliance on imported energy sources through the development of a localized renewable energy source (Saint John Energy, 2017; Saint John Energy 2019).

The New Brunswick *Energy Blueprint* (DERD, 2011) sets out clear requirements regarding the source of electricity to be supplied to the province. The Project will continue the momentum of the *Energy Blueprint,* which required the province of New Brunswick to achieve 40 percent renewable energy by 2020.

The Energy Blueprint was developed in response to the growing knowledge base and action required toward reducing greenhouse gas emissions and mitigating risks associated with climate change. The most recent report by the Intergovernmental Panel on Climate Change (IPCC) states that energy accounts for a significant 25% of global greenhouse gas emissions. Continued emissions of green house gasses will amplify existing risks and create new risks for natural and human systems; the risk of abrupt irreversible changes increase as the magnitude of warming increases. Mitigation measures must be used to reduce the greenhouse gas intensity; measures such as reducing energy usage and moving towards decarbonised energy supply should be taken to move towards achieving these goals (IPCC, 2014).

The land on which the wind turbine generators (WTG) are proposed is well-suited for its intended use as the Project will reside on an industrial site that has created highly fragmented habitat. Additionally, during a clear day industrial sounds can be heard throughout the Project site. The Project will offer an opportunity to develop stronger relationships with the local community. The Proponent can transform these industrialized lands into a site that will provide an environmentally friendly, productive source of renewable energy for the local community and SJE.

The Project is also estimated to create full-time jobs throughout its construction and operation while contributing to community economic development. It is expected the Project will bring in revenue to many of the local businesses as Project workers expense food and accommodations to conduct work on site. Where possible, the Proponent will hire local contractors and workers for the completion of different project phases.

There are no alternatives to the Project being proposed as the development of wind energy projects have provided direct contributions, globally, to reducing harmful greenhouse gasses associated with traditional carbon-based energy sources. The Project will help support SJE's goal of developing clean, affordable, local energy sources (Saint John Energy, 2019). The Project supports New Brunswick's Smart Grid eco-system and the Province's Climate Change Action and Renewable Energy Plans. Moving past 2020, in order to increase the renewable energy generation of NB's energy portfolio, the development of wind energy is the most feasible option and can help meet renewable energy goals while providing much needed economic development for the local communities.

2.3 Project Overview

The proposed BWP consists of 5 - 10 wind turbines capable of producing 20 - 42 MW of renewable energy. The BWP will be constructed, owned, operated and maintained by the Proponent.

The Proponent is developing the Project following the successful bid on SJE's Request for Proposal (RFP) to acquire additional renewable energy sources for their energy supply. SJE's sustainability policy seeks to mitigate greenhouse gas emissions of the electricity provided to their customers (Saint John Energy, 2017). An effective means of doing so is investing in renewable energy infrastructure. The project proposed under the RFP was awarded to provide 20 - 42 MW of renewable energy by 2022.

The Project will be connected to the existing SJE electrical grid via a new substation and a distribution line measuring approximately 300 m that will be constructed, owned, operated and maintained by SJE. This distribution line will then be connected to the existing electrical grid owned by SJE.

The majority of the Project is located on Crown Land approximately 15 kilometers southwest from the City of Saint John near Lorneville and the existing Coleson Cove Generating Station.

A Power Purchase Agreement (PPA) will be signed with SJE in Q2 of 2020. This PPA will dictate the total capacity for the BWP which will range between 20 - 42 MW and can be fulfilled with five (5) to ten (10) turbines as proposed in the EIA.

The ten-turbine layout is utilized throughout the impact assessment to demonstrate all possible turbine locations for the largest project layout. Therefore, all numbers presented in the EIA are reflecting the impact of the ten (10) turbine layout. The Proponent recognizes that not all ten (10) turbines may be required to meet the full capacity of the Project under the PPA. Should the layout require less than ten (10) turbines, the smaller project size will be located within the footprint presented in the EIA.

It is anticipated that the BWP will require approximately 5.1 km of new access roads and can make use of 5 km of existing roads onsite with small upgrades which significantly reduces the Projects clearing footprint. Road widths will be approximately 6 m wide and up to 15 m wide on turns or to accommodate passing lanes. A crane pad measuring approximately 70 m by 70 m will be required at each turbine location. The electricity from the turbines will be collected through approximately 8.6 km of overhead collector lines.

Additionally, SJE will require a new substation to be constructed onsite measuring approximately 60 m by 45 m with an overhead line that will connect the substation to the existing electrical grid owned by SJE. This overhead line will measure approximately 300 m.

The substation and the overhead line required to connect the Project to the existing SJE electrical grid will be designed, constructed, owned, maintained and operated by SJE, however it is being included as of the environmental impact assessed with this EIA.

Table 2-1: An approximate length of Collector Lines and Roads for a 20 MW and 42 MW layout.

	20 MW 5 Turbine Layout	42 MW 10 Turbine Layout
New and Upgraded Roads	5.4 km	10.1 km
Collector Lines	3.8 km	8.6 km

Currently, pre-construction, clearing activities and foundation work are expected to begin in Q3 of 2020. The construction activities are expected to slow down over the winter months and resume at the end of Q2 2021. The Project will be commissioned by the end of 2021 as per the PPA with SJE. The Project will have an operational phase of up to 25 years.

2.4 Project Location

The Project is located within the boundaries of the City of Saint John between the communities of Lorneville and Prince of Wales, New Brunswick (Figure 2-1). The proposed WTG locations are situated on existing crown land located approximately 15 km southwest of the City of Saint John. The location for the proposed BWP centroid is 19T 720037m E; 5005963m N (66° 11’ 59.13” W 45° 10’ 22.12” N).

Figure 2-1: Project Location Map.

2.5 Siting Considerations

The Proponent has extensive knowledge with respect to site finding and development of community-based wind farms. There are many considerations to take into account while developing these types of projects and a detailed assessment of these considerations have led the Proponent to determine the location of the BWP, which presents the best opportunity to provide efficient renewable energy to the local community with the least impacts to the community and environment. Specifically, the BWP is an attractive site due to the wind resource, elevation, proximity to the SJE transmission system, and industrial nature of the surrounding lands.

The following is a list of factors that have been considered during the site finding and development process. The project location and layout from a regional and local context are shown in Figure 2-1 and Figure 2-2.

- Technical Considerations:
    - Sufficient wind resource;
    - Regional topography;
    - Proximity to transmission system; and
    - Turbine technology.
- Environmental Considerations:
    - Proximity to wetlands;
    - Proximity to residential dwellings or other noise/shadow sensitive areas;
    - Sensitivity of flora & fauna;
    - Proximity to provincial or national parks and nature reserves; and
    - Risk of archaeological resource disturbance.
- Land use considerations:
    - Known culturally significant areas;
    - Available access to the land;
    - Communication corridors;
    - Current land use;
    - Future land use; and
    - Proximity to residential properties, communities and towns.
- Planning Considerations:
    - The City of Saint John Zoning By-law Amendment for Green Energy.

2.5.1 *Technical Considerations*

The BWP is located at an elevation of 58 m to 77 m. As a result of the elevated topography, relative proximity to the Bay of Fundy coastline and prevailing winds coming from the coastline (southwest), the Project site provides an attractive wind resource for a wind energy project.

Natural Forces has been in discussion with SJE since 2019 regarding developing a renewable energy project in Saint John and together have identified that there is a suitable electrical infrastructure located approximately 300 m east of the Project site.

SJE is currently undergoing the Feasibility Review with NB Power to assess any technical issues that will need to be addressed for the interconnection of the Project to the SJE grid and subsequently to the existing new Brunswick Power grid.

The point of interconnection, collector lines, and location of the new proposed substation is demonstrated in Figure 2-2.

The Proponent will be using the services of a third-party consultant to conduct a geotechnical investigation to determine geophysical conditions for turbine design and construction. This assessment will be completed in the first quarter of 2020.

Lastly, the turbine selection will be made based on site specific measured wind data, the turbine availability, and the capacity available on the grid. This decision will also be influenced by certain environmental considerations.

2.5.2 *Environmental Considerations and Setbacks*

Environmental impacts associated with the construction and operation of a wind project can be reduced or eliminated through proper screening during the development phase. The Proponent has consulted with regulators and conducted desktop and field studies to locate wetlands, watercourses, sensitive habitats, endangered species, and residential dwellings in an effort to design the project to avoid as many of these sensitive features as possible. The Project layout allots for setbacks from the following sensitive features:

- 1 km from all residential dwellings and cabins;
- Important Bird Area (IBA) (Saint's Rest Marsh & Beach and Manawagonish Island);
- Provincial Park (New River Beach);
- >5 km to known bat hibernacula;
- nearby pipelines and water lines;
- regulated and unmapped wetlands and watercourses;
- nearby designated roadways;
- communication corridors;
- communication tower; and
- Environmentally Significant Area (ESA) (Musquash Estuary).

Due to close proximity to Ecologically Significant Areas (ESAs) such as the Musquash Estuary, elevated avian study methodology was used for the Project. A thorough desktop review of available data for flora and fauna species in the area has been conducted in order to identify species at risk and species of high importance that may be impacted by the proposed development. Flora and Fauna species at risk or of high importance identified are discussed in Section 4.2.5 and 4.2.6.

Desktop and field studies conducted in consultation with New Brunswick's Archaeological Services did not identify evidence of significant past human use on site. However, turbines 5-10 are located in areas that have a high potential for significant archeological remains. Archaeological test pits were recommended and details on the archeological assessment is further discussed in Section 4.3.1.

2.5.3 *Land Use Considerations*

The BWP requires consideration of current land uses within the proposed Project site. As provincial crown lands, these lands are open to a variety of uses. Currently, there are several industrial and recreational land users where consultation and further consideration is required in addition to First Nation land users.

Through an initial site visit with Wolastoqey Nation in New Brunswick (WNNB) elders and land users it was identified that the lands are regularly used by WNNB for medicinal plant picking and berry picking. Further discussions with WNNB are ongoing to fully understand the use of the land by First Nations. This information will be included in a Land Use and Knowledge Study that will be completed at a later date.

This land is used for several recreational purposes. The Lorneville All Terrain Vehicle (ATV) club use and maintain the onsite ATV trial network year-round, including a warming shelter. Additionally, the Saint John Model Flying club operates a 0.4 km^2 runway within the site area.

There are multiple industrial land uses on and nearby this site. There is an operational quarry owned by Debly Resources Inc within the boundaries of the Project lands but on a separate PID (55193908). Irving Oil Limited Pipeline has an easement across Project lands for a Bunker C pipeline between the Canaport Crude Receiving Terminal at Mispec Point and the Coleson Cove Generating Station. Saint John Water also owns a pipeline that extends along the inner western boundary of the Project lands. Perpendicular to the northwest boundary of the site, the Lorneville Liquified Natural Gas (LNG) pipeline runs along NB Route 1. NB Power Transmission lines run along this same trajectory, and extend further outside the south east boundary of the Project Lands connecting to the NB Power Coleson Cove Generating Station.

There are various land uses to consider on the Project lands. Consultation with these land users will be ongoing to ensure safe use and enjoyment of these lands.

2.5.4 *Planning Considerations*

The City of Saint John Municipal Plan amendment approved in November 2019 communicates clear support for renewable energy projects within the city limits on lands designated as Heavy Industrial or Rural Resource.

According to *The City of Saint John Zoning By-law*, the land on which the BWP is being developed are zoned Medium Industrial (IM), Heavy Industrial (IH), and Rural (RU). *The City of Saint John Zoning By-law* amendment approved in November 2019 stipulates that the lands on which renewable energy projects will be developed need to be re-zoned to the Green Energy (GE) zone. The proponent has been in correspondence with the City of Saint John Growth and Community Development Services and has applied for this re-zoning. As the BWP is on Crown lands, the Director of Crown Lands of the Department of Energy and Resource Development of New Brunswick, who is a designated signatory for the Minister, has authorized this application.

Ongoing consultation with the City of Saint John Growth and Community Development Services will continue and a development permit will be obtained prior to construction.

2.5.5 *Previously Considered Locations*

As previously mentioned, the general project lands were selected by SJE due to the initial assessment of the aforementioned technical, environmental, land-use and planning considerations.

The locations of the turbines, roads and collector lines were initially selected by Natural Forces within the project lands by using available desktop data. While the location of the substation was initially selected by SJE.

Field survey results, predicted modeling of noise and shadow flicker and discussions with members of the TRC created several iterations of the proposed Project Footprint.

The turbine locations initially selected prior to the field studies were relocated to minimize any potential impacts of the project on the environment and local community. It is understood that there are additional environmental field surveys that will be required in the spring of 2020 due to the change in location of the turbines.

2.5.5.1 Prior to field surveys

The turbine locations were originally considered in part due to the available desktop studies, expected wind resource estimates for the project lands and the avoidance of mapped wetlands.

After field surveys and site visits conducted during the fall of 2019, it was determined that the project infrastructure was located near or within unmapped wetlands that are found throughout the project site.

Due to these factors, further micro-siting was undertaken which led to the proposal of the new infrastructure locations.

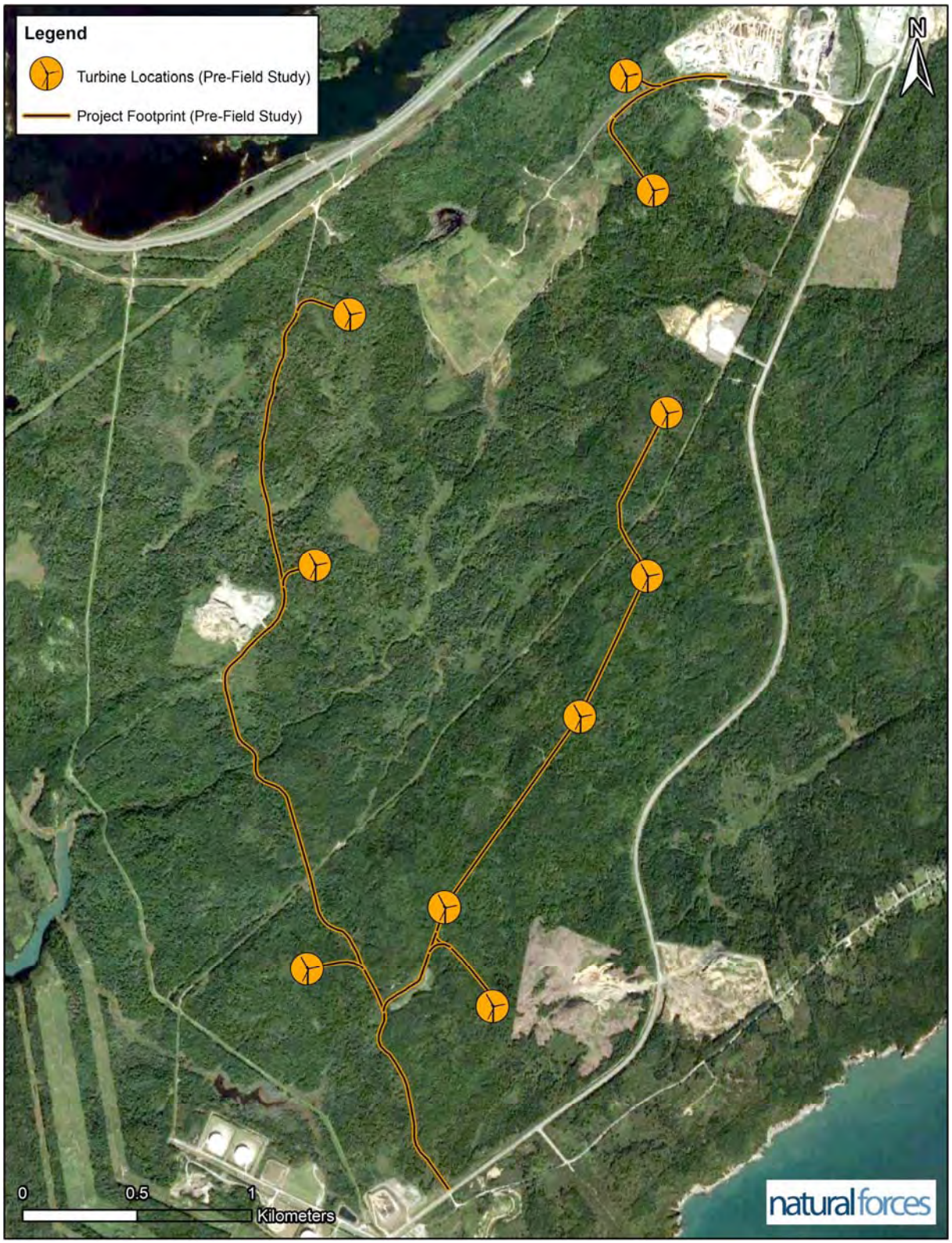

Figure 2-2: Original Project layout prior to micro-siting.

2.5.5.2 Subsequent to field surveys

As mentioned, the location of the project's infrastructure was revised following field surveys. The figures, discussions and assessments in the following sections of the EIA have been revised with the current Project Footprint that was created subsequent to the field surveys.

2.5.5.3 Current layout

The currently proposed layout successfully minimizes impacts to mapped and unmapped wetlands while respecting the technical, environmental, land use and planning considerations required for a suitable wind energy project.

The current layout is presented in Figure 2-3 below.

Figure 2-3: Current Project layout and Footprint, post field studies and micro-siting.

2.6 Physical Components and Dimensions

2.6.1 *Property*

The parcel identification (PID) number on which the WTGs will be located is 412189 which encompasses a total area of 1,029 ha. The Option to Lease obtained by SJE in 2019 includes an area of 1,029 ha within the aforementioned PID. Once the project becomes operational, Leases will be obtained by Natural Forces for the lands on which each turbine sits and a License of Occupation be obtained to encompass the access roads and collector lines. SJE will obtain a Lease and License of Occupation for their infrastructure which includes the substation and the distribution line connecting to their existing infrastructure.

The footprint of the Project is estimated to cover 27 hectares of the project lands. This includes the following:

- 10 hectares for the turbine bases and crane pads;
- 1 hectare for the substation;
- 12 hectares required for the access road (includes 10.1 km of new and upgraded roads);
- 3 hectares for the collector lines that are not parallel to the roads; and
- 1 hectare for the proposed transmission line and 30 m cleared right of way.

The Project infrastructure can be viewed in Figure 2-3.

2.6.2 *Surveying, Siting and Logistic Activities*

Prior to the construction of the access roads, foundations, transmission and collector lines and, turbine installations, a number of enabling works need to be undertaken. These will include:

- Engineering site visits to evaluate the Project land and soil conditions;
- Improvement of land drainage as required to facilitate construction; and
- Widening and improvement of the site entrance for safe vehicle access.

The Proponent, or appropriate contractor and the turbine manufacturer will coordinate transportation of the turbine components that will require overweight special move permits. Service New Brunswick, the Department of Transportation and Infrastructure (DTI) and the local Municipalities in which the transportation will occur will be consulted by the appropriate party to ensure any other potential permits (i.e. over-dimensional and overweight vehicle permits) are obtained and transportation regulations are followed. Although the exact WTG transportation route has yet to be planned, the Proponent is aware of certain road weight restrictions during spring conditions that may be applicable. Roads used for the construction phase of the Project will comply with maximum weight road restriction lists (Transportation and Infrastructure, 2017).

2.6.3 *Wind Turbine Generator*

It is anticipated that 5 - 10 WTGs will be installed on site for the duration of the Project. The turbine model is still to be determined; however, the current turbine models being considered include those by Vestas, Siemens, and Enercon.

Though the turbine model has yet to be selected, the turbine with the maximum total height has been used throughout this assessment to study a worst-case assessment. From base to blade tip the E-141 WTG has a maximum height of approximately 205 m.

All turbines being considered are designed and certified according to the latest international standards. Currently the basis for design is the International Electrotechnical Commission (IEC) standards of the IEC-61400 series.

This IEC standard uses assumptions and conditions to define the loads that a WTG can withstand. The safety system of the turbines includes control sensors that protect the turbine and its components from damage. In the case that one or more of these sensors detect conditions outside its design limits, the main control of the WTGs will take the appropriate measures, which range from small power limitations to complete stop of the turbine. These reactive measures can protect the turbine from high and low temperatures, vibrations, oscillations and strain.

Table 2-2: Turbine specifications being utilized for the EIA

Characteristic	**E-141**
Rotor diameter	141 m
Swept area	15, 615 m^2
Rotations per minute	4.0 – 11.0 min^{-1}
Cut out wind speed	28 – 34 m/s
Hub height	99, 129, 135, 159
Max sound pressure level	105.5 dB(A)
Tower material	Steel and/or concrete pre-cast sections

All turbines will be monitored 24-7 in real-time by a team of technicians from the manufacturer. Natural Forces' operations team will also monitor the turbine from Halifax, Nova Scotia and Saint John, New Brunswick. The operation technicians will have the ability to shut off the turbine should they observe conditions that could pose a risk to the turbine's proper functioning or risk to people near the turbine.

Ice may form on the rotor blades of the WTGs in specific weather conditions. The ice build-up poses the risk of ice fragments detaching and creating safety hazards to the surrounding area. All turbines considered will be equipped with a reliable ice detection system. Once ice has been detected, the turbine rotor stops spinning, and the de-icing system will activate and effectively melt the ice on the WTG blade in order to reduce the risk of ice throw.

2.6.3.1 Turbine Lighting Requirements

A Lighting Plan for the turbines will be developed and approved by Transport Canada and Canadian Wildlife Services (CWS) to minimize impacts on migrating birds and to ensure aviation safety. The lighting plan will comply with Transport Canada recommendations and Standard 621 – Obstruction Marking and Lighting (Transport Canada, 2017). Chapter 12 of the standard outline's regulations for wind turbines greater than 150 m. The current standard requires two CL-864 (medium intensity, flashing red – 20-40 flashes per minute) lights installed on the nacelle with one operating and one as a back-up. At least three CL-810 (low intensity, flashing red in sequence with nacelle) lights are also required mid way up the tower and are to be visible in all directions. These types of lights are likely to be used for the BWP but will be adjusted as per Transport Canada recommendations.

The standard requiring lighting midway up the tower has come into effect in 2016 and follows European practices for tall structures. This standard has been improved from the European practice by implementing flashing, instead of steady burning lights. This change was recommended from the Federal Aviation Administration's technical report on Evaluation of New Obstruction Lighting Techniques to Reduce Avian Fatalities (Patterson, 2012).

2.6.4 *Crane Pad & Turbine Foundation*

2.6.4.1 Crane Pad

The installation of the WTGs will require crane pads that will be approximately 70m by 70m in size. Its purpose is to safely accommodate the weight of the large crane necessary for turbine installation and maintenance. An initial arrangement of the crane pad has been designed to suit the specific requirement of the turbine and the surrounding topography of the Project site.

Construction of the main crane pads will involve the removal of soil to a depth of between 0.25 – 0.5 m, depending on the ground condition encountered during the geotechnical investigation. The subsoil would be covered by layers of graded crushed stone. Total construction depth is between 0.25 – 0.5 m, also dependent on the characteristics of the underlying soil formations.

The crane pads may be retained throughout the operation life of the wind farm to allow for periodic WTG maintenance, and to accommodate any crane necessary for the replacement of large components should they require replacement during the operational phase of the Project.

2.6.4.2 Turbine Foundation

Concrete foundations approximately 20 m in diameter will be required for the WTGs. A detailed geotechnical investigation will be undertaken to establish the nature of the soil at the WTG locations. A registered Engineer will design the foundations to match the soil conditions. Foundations will most likely be a gravity (inverted "T") design, designed by Enercon, similar, but larger than that shown in Figure 2-4 and Figure 2-5.

Figure 2-4: Construction of a concrete foundation at Natural Forces' Fairmount Wind Farm.

The construction of the reinforced concrete foundations will include excavation to a depth of several meters, the placement of concrete forms and steel reinforcement, and the pouring of concrete within the forms. The upper surface of the base will lie approximately 1 m below ground level. Rock chipping and blasting may be required to facilitate excavation. The central support pedestal would extend 0.20 m above existing ground level to receive the bolted bottom tower section. Suitable excavated material would be compacted in layers on top of the concrete foundation to terminate in line with the existing ground level, leaving room to allow sufficient topsoil reinstatement for vegetation growth.

The soils removed would be stored in accordance with provincial regulations and best practice guidelines, outside of provincially regulated wetland buffers, and replaced during the restoration phase in consultation with the Crown Lands department. Soil material needed for backfill would be stored temporarily in a designated area adjacent to the excavation location until needed. Any remaining

excavated material will likely be recycled to another site needing clean fill material or removed from site and sent to an approved landfill as deemed appropriate.

Figure 2-5: Finished concrete foundation for Natural Forces' Fairmont Wind Farm in Nova Scotia.

2.6.5 *Civil and Electrical Works*

Each wind turbine has a small pad mount transformer located inside the wind tower which initially steps up the voltage to designated and required by SJE.

A bare copper earthing (grounding) cable will be laid alongside the WTG foundation for lightning protection; grounding will also be installed at other areas as determined by the electrical design.

The electrical, communications and grounding cables will leave the WTG foundations below grade. This will be installed according to the design engineer's specification. Typical design would require the cables to be installed by the direct buried method consisting of excavation of a trench just over one meter in depth, placement of a layer of sand, then the collection system cables and fibre optic cable which are then covered by another layer of sand. Clean aggregate, as specified by the design engineer, is then placed on top of the sand and the trench is filled back in. Caution tape, stating "Danger Underground Electrical cable" is placed along the full length of the trench at approximately 30 cm below the finish grade.

Any buried electrical cable will likely be marked with permanent safety signs to warn of potential hazards from excavation. The size, type and location of the marker signs will be determined in consultation with the Crown Lands department and be in accordance with applicable safety standards.

2.6.6 *WTG assembly and installation*

The main WTG components include the tower sections, nacelle, hub and blades. Towers are typically delivered in four large sections if using steel towers or numerous smaller sections if using the pre-cast concrete or modular steel section varieties.

Once delivered, the tower sections will be erected in sequence on the WTG foundations using a 150-tonne tailing crane and a large 800 - 1000 tonne main lift crane. The smaller crane will erect the base and lower-midsection of the towers and then assist the main crane with the erection of the upper-midsection, the tower top section, the nacelle, the rotor and the blades. The main erection crane will also lift heavy internal components such as the generator.

For the nacelle and blades, the assembly will involve the use of a small 135 tonne rough-terrain crane for vehicle off-loading, a 150 tonne tailing crane for preliminary assembly, and a main erection crane of approximately 800 - 1000 tonnes for the main lift. The blades are attached one at a time on the hub which will already be installed on the nacelle. The tailing crane helps to control the orientation of the blades during this lift, while the main crane lifts the weight.

2.6.7 *Access Road*

The access roads for the BWP will be approximately 6 - 7 m wide with a maximum width of 15 m in areas to facilitate moving large turbine components. The access road will be used to move workers and equipment about the site during construction, operation and decommissioning phases.

2.6.7.1 New Access Roads

The new access roads will likely involve the removal of soil to a depth of between 0.25 – 1.0 m (depending on the ground conditions encountered during the geotechnical investigations) and placing layers of crushed stone. The stone is usually compacted, with a finished construction depth between 0.25 – 0.5 m, again dependent on the strength of the underlying ground formation. The internal site roads would be maintained in good condition during construction and throughout the lifetime of the Project to facilitate maintenance and on-going environmental studies.

The removed topsoil would be stored in accordance with best practice guidelines, and later used for site restoration. Soils needed for backfill would be stored temporarily in bunds adjacent to the excavations until needed. Any remaining excavated material would be shaped into fill slopes in the road bed, or removed from site to an approved landfill.

2.6.7.2 Upgraded Existing Access Roads

The Project site has many existing roads currently used by local industry and by recreational users. It is anticipated that 5 km of existing roads can be used with minor upgrades. Existing roads will need to be widened to support large truck and material movements and turning radii. The process for upgrading roads is similar to that of constructing new roads, however, clearing and grading is only required where roads need to be widened which will greatly minimize the new disturbance from the proposed Project.

2.6.8 *Interconnection to Grid*

Natural Forces has been in discussion with SJE who have been undergoing the Feasibility Study for the interconnection of the BWP to its existing electrical infrastructure. As it stands, SJE will design, build and own a substation adjacent to the Project and King William Road. The Project's collector lines will be connected to the substation. In order to have the electricity flow into the existing distribution lines owned by SJE, a new distribution line will be built between the substation and King William Road as shown in Figure 2-3.

The substation is currently planned for 19T 721353m E; 5007762m N (66° 10' 55.93" W 45° 11' 18.92" N). As previously stated, the substation and the distribution line will be designed, constructed, owned and operated by SJE. Natural Forces has included the infrastructure as part of the EIA as it is part of the overall Project.

The purpose of the Project's electrical infrastructure is to collect the energy generated by the wind turbines and deliver the energy to SJE's distribution grid.

The Project substation will consist of a fenced yard, approximately 70 m x 70 m, which will include a small pre-fab control building containing all the instrumentation for the protection & control panels, revenue metering panels, AC/DC charger, UPS system, and Supervisory Control and Data Acquisition (SCADA) system. In the substation yard will be outdoor equipment and structural steel supports for the circuit breaker & disconnect switches, grounding transformer, station transformer (for power to the control building), a main step-up transformer, a second circuit breaker & disconnect switches, lightning protection, ground grid, and PTs & CTs for protection & control & revenue metering.

2.7 Construction Details

The approximate proposed schedule for the construction activities is presented in Table 2-3. Pre-construction activities and clearing are expected to start in Q3 of 2020 and it is expected that the Project will be operational in Q4 2021.

The pre-construction activities for the site include tree clearing, clearing lands of grub and general leveling of the lands as possible with an excavator.

After the initial tree and land clearing activities are complete, the following main construction activities will occur:

- Construction of access roads, lay down areas and crane pads;
- Pouring of turbine foundations;
- Installation of power poles, power lines and underground electrical;
- Installation of the substation;
- Turbine erection;
- Commissioning of the WTGs; and
- Removal of all temporary works and restoration of the site.

Construction activities will be limited to daytime hours when feasible. The overall erection process for the WTGs will take approximately two to six days each, depending on the wind conditions, and would not start until suitable wind conditions prevail. Turbines cannot be erected when wind speeds exceed 4 m/s, and the optimal time for assembly often occurs during the early evening. As a result, some construction in the early evening is possible during this stage of construction, however, it will be minimized to the extent possible.

Table 2-3: Anticipated schedule of construction activities.

Construction Activity	Estimated Timeline
Pre-Construction Activities	Q3 2020
Tree Clearing and Grubbing	Q3 2020
Construction of access road and crane pad	Q3/Q4 2020
Construction of turbine foundation	Q4 2020
Construction of Substation	Q2/Q3 2021
Construction of electrical works	Q2 to Q4 2021
Wind turbine assembly and installation	Q3 2021
Removal of temporary works and site restoration	Q4 2021

2.7.1 *Site Access*

There are multiple access points for the site from King William Road which is located by taking exit 112 from Hwy 1 in the direction of Lepreau. From King William Road, the site will be accessed through Paddy's Hill Drive and Burchill Road, both are under the jurisdiction of the city of Saint John.

The majority of the access roads will make use of existing designated roadways and private roads that will require upgrades to support oversized vehicle movements as described in Section 2.6. Using existing roads allows the Project to significantly minimize its footprint. Minor temporary road widening may be required along specific portions of the road allowing for wider turn width. This road widening would be coordinated with New Brunswick DTI and the City of Saint John Growth & Community Development Services and all necessary permits will be acquired before commencing work. King William Road will be the entry point for all workers, construction equipment and WTG components for the duration of the construction phase.

2.7.2 *Clearing and Grubbing*

Clearing and grubbing activities will be planned to occur outside of the breeding bird season where possible. If clearing is required during this time, a qualified biologist will be onsite to conduct monitoring to identify possible breeding birds in the area and their active nests. These monitoring efforts will follow Environment and Climate Change Canada's (ECCC) specific considerations related to determining the presence of nests. A biologist will observe the bird species in the area and determine if there is presence of suitable nesting habitat within the proposed clearing area. As well, they will observe bird behaviour including, but not limited to, territorial males and individuals carrying food to determine the potential for active nests in the area.

Additionally, the results of the bird surveys will be assessed to identify species of ground nesters at the project location. A large portion of the Project lands has been previously cleared during forestry activity and should ground nesters be found to reside in the project area, nest searches will be conducted prior to construction activities that may impact ground nesters during the breeding bird season.

Any unwanted, merchantable timber cleared onsite will either be transported to the nearest sawmill upon obtaining appropriate permits or the timber will be left on site for pickup. As a result of construction, compaction of the topsoil will be minimized to the extent possible and any topsoil removed from the site will be disposed of at an appropriate facility.

2.7.3 *Fill Material*

Fill material will likely be sourced from a local supplier and will be coordinated by the Project's construction manager. Some construction will involve crossing mapped regulated, and unmapped wetlands. The Proponent will engage in ongoing consultation with the Department of Environmental and Local Government (DELG) to determine the proper alteration applications required and applicable wetland compensation. The Proponent is committed to following the proper measures as indicated by DELG. Details on the Projects interactions with wetlands and watercourses is further discussed in Section 4.2.3 and 5.2.3.

2.7.4 *Site Restoration*

After construction, turbine erection, and commissioning are completed and the Project is in the operation phase, all temporary works will be removed and the land re-graded. The stored topsoil will be replaced fine graded and given an aesthetically pleasing appearance.

2.8 Operation and Maintenance Details

2.8.1 *Site Access and Traffic*

Once the wind farm is operational, minimal vehicle activity will be required. The internal site roads will be used for periodic maintenance and safety checks. A comprehensive SCADA system will be installed within the turbines for remote monitoring and control of the wind turbines, which will minimize the need

for on-site personnel. The SCADA system ensures safe efficient operation of the turbines and of the overall Project site.

2.8.2 *Project Safety Signs*

A Project sign will be located at the entrance to the site. This sign will provide essential safety information such as emergency contacts and telephone numbers. As well, the sign will provide information about the wind project and the companies involved in the Project. Safety signs and information will also be installed throughout the Project Site as required. These signs will be maintained throughout the operational life of the wind project.

2.8.3 *Maintenance Plans*

Scheduled maintenance work will be carried out several times each year throughout the operational phase as well as routine site visits. Unscheduled maintenance is minimal, as the SCADA system allows 24 hour monitoring of the turbines by the manufacturer and the operations team at Natural Forces. Maintenance procedures may require the use of small or large cranes for brief periods of time, for replacement of blades or other turbine components as well as vegetation management around the collector lines.

2.9 Decommissioning

The BWP will be in operation for up to 25 years. The lifetime is based on the duration of the PPA that will be signed between SJE and the Proponent as well as the operational life of the turbine.

Decommissioning will commence within six months after the PPA has been terminated. The WTG components will be dismantled and removed from the site. Similar traffic movements to those experienced during the delivery of the turbine components are anticipated. The decommissioning phase will require considerably lower vehicular support than during the construction phase. The following four steps are anticipated in the decommissioning phase:

1. The WTGs will be dismantled and removed from the site for scrap or resale. The base will be removed to below plough depth, and the top soil will be reinstated so that the land may be returned to its former use.
2. The internal site roads and site entrance may be removed if required. After removal, the land will be reinstated to its former use.
3. The underground cables will be below plough depth and contain no harmful substances. They may be recovered if economically attractive or left in the ground. Terminal connections will be cut back below plough depth.
4. All other equipment will be dismantled and removed, and the land will be returned to its former use.

2.10 Future Modifications, Extensions, or Abandonment

There are no future phases planned for the BWP at this time. The Proponent will sign a PPA with SJE for up to 25 years which is consistent with the WTGs life expectancy of approximately. Prior to the end of the PPA agreement, decommissioning and site reclamation plans will begin or a new PPA may be signed with significant maintenance occurring to extend the life of the wind project.

2.11 Project Related Documents

All project related documents have been placed in their corresponding appendices as follows:

Appendix A: Noise Impact Assessment
Appendix B: Shadow Flicker Impact Assessment
Appendix F: ACCDC Report
Appendix G: Watercourse/Wetland Assessment
Appendix H: Archaeological Resource Assessment
Appendix I: Complaint Resolution Plan

The results for the Avian and Bat Surveys are currently being compiled, and will be submitted as an addendum to this submission. In addition, the Environmental Management Plan will also be submitted as an addendum following the results of the surveys.

3 Approach to the Assessment

This section outlines the Project scope by identifying Valued Ecosystem Components (VECs) relevant to the current development determined through consultation with local stakeholders, the Technical Review Committee (TRC), and provincial regulators. For each VEC, the study methodology is outlined to provide a clear understanding of how the state of the existing environment was collected. For clarification through this assessment document the following definitions are provided:

Local Study Area – refers to the Licensed Land Area on property (PID 00412189) being considered for the construction and operation of the BWP (Figure 3-1).

Project Study Area – refers to the land surrounding the Project Footprint to include wildlife and hydrologic movements. The Project study area has been used for all survey activities.

Project Footprint – refers to the land that will directly interact with project activities.

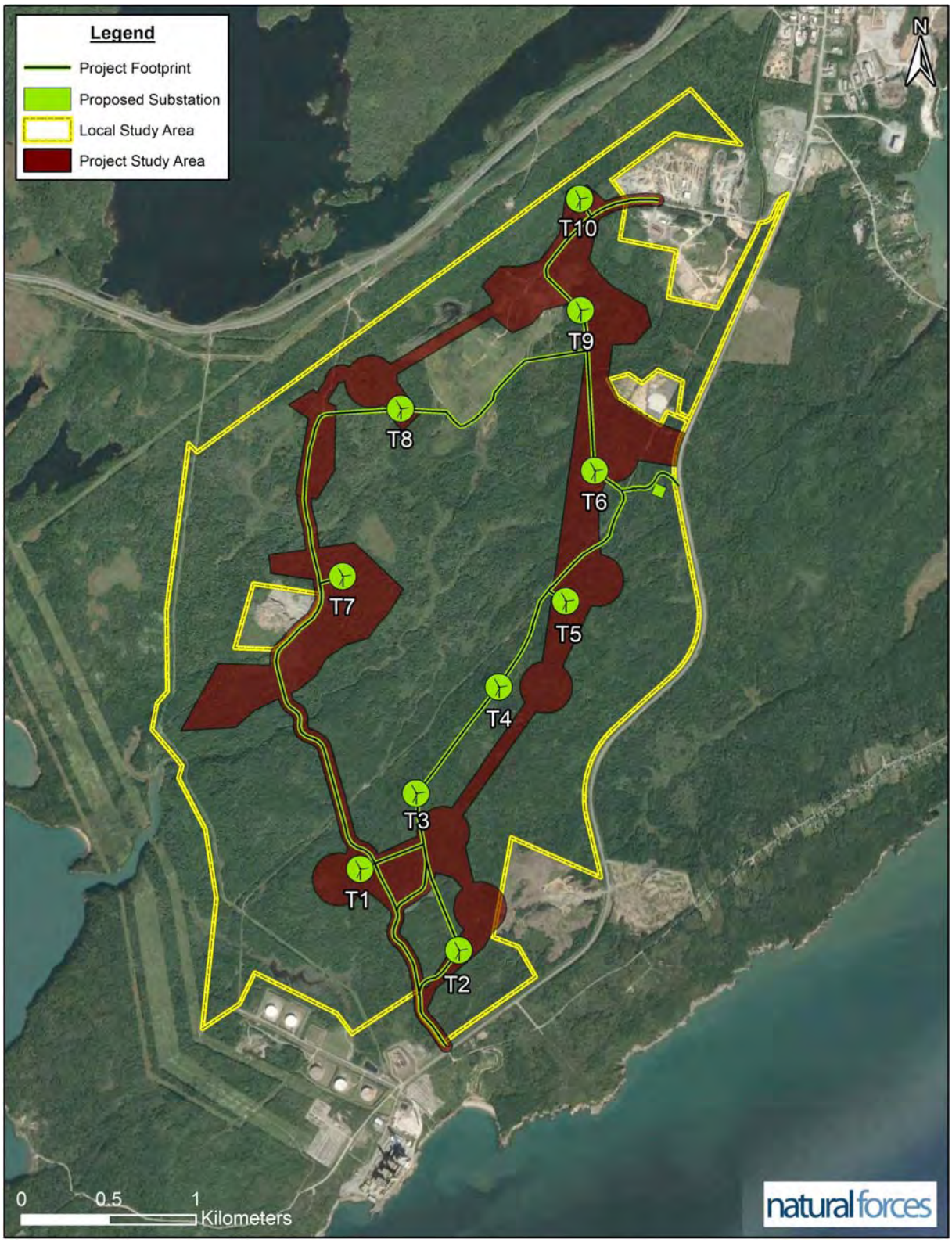

Figure 3-1: Visual representation of the Project Footprint and components inside the Project Study Area.

3.1 Scoping and Bounding

The scoping process identifies the physical, biophysical and socio-economic VECs that may be subject to impact given the work proposed. The proposed work is composed of the construction, operation, and maintenance phases of the Project conducted by the Proponent including any accidents and malfunctions that may occur. The decommissioning of the BWP will also be included as part of the assessment. The identification of the VECs is based on the potential interaction of the Project within the environmental and socio-economic settings described herein. Additionally, any concerns from stakeholders and the general public as identified through the consultation process were taken into consideration when identifying the VECs.

The scope of the assessment is formed by the potential interaction of the project activities with the VECs. The scoping was completed to define the appropriate desktop and field studies that would be relevant to the Project. The scoping is continually refined as the Project progresses, the environmental setting is studied, and consultation activities are held. While it is difficult to assess all the potential effects of a project, properly defining a scope reduces the risk of overlooking important project impacts.

The Proponent has identified physical, biophysical and socio-economic VECs that were subject to assessment based on knowledge and experience, pre-registration consultation with TRC members and a review of the regulatory requirements. The VECs are listed in Table 3-1 and addressed throughout this report.

Table 3-1: Identified Valued Environmental Components.

Physical	Biophysical	Socio-economic
Ground Water	Avian	Archaeological Resources
Geophysical	Bats	Electromagnetic Interference
Atmospheric Conditions	Wetlands and Watercourses	Land Use & Property Value
Wind Resource	Fish and Fish Habitat	Vehicular Traffic
Noise	Wildlife	Public Health and Safety
Shadow Flicker and Visual Aesthetics	Vegetation and Habitat	Community and Local Economy
	Significant and Sensitive Habitat	

Spatial and temporal boundaries must be determined for each component in the assessment process to properly evaluate the Project's impacts on the aforementioned VECs. Spatial boundaries are the physical bounds in which the Project facilities and activities are located, as well as zones affected by project

activities. Temporal boundaries are the time frame in which the activities will occur within the spatial boundary.

The Project study area includes a spatial boundary that encompasses the Project Footprint of all activities associated with the construction, operation, and decommissioning of the proposed Project as well as a buffer area around the footprint to include the surrounding environment as wildlife and hydrology are not confined to the Project Footprint itself.

The temporal boundaries include, a short-term temporal boundary for construction and decommissioning activities and a long-term temporal boundary for the 25 year operational phase of the project. The specific temporal and spatial boundaries will be identified for each VEC in the impact analysis in Section 5.

3.2 Approach to Physical VEC Surveying

3.2.1 *Ground Water*

Management of ground water quality is important as it is an integral aspect of a diverse ecosystem and functional ecology. A desktop analysis using the GeoNB Data Catalogue to identify protected wellfields on the project land and adjacent area was conducted. The DELG's Online Well Log System was also searched to identify potential wells within 3 km of the local study area.

3.2.2 *Geophysical*

A desktop analysis of the geology found onsite has been conducted using available literature and the GeoNB Geological layer. Additionally, a geotechnical field survey will be conducted by a third party consultant to identify appropriate construction materials and processes required for the construction of the BWP. The geotechnical survey is estimated to be completed in the Spring of 2020 and will consist of Borrow Pit exploration and a Test Pit program. Borrow Pit exploration will include the excavation of approximately twelve test pits within the Project Footprint, sampling and laboratory testing of the borrow to identify its quality/suitability for road building. A Test Pit program is intended to investigate subsurface conditions at the proposed substation and crane pad footprint areas. Test pits are also anticipated along the proposed access roadway.

3.2.3 *Atmospheric Conditions*

A desktop review of historical climate data has been conducted by consulting the Saint John, New Brunswick Environment ECCC weather station and the New Brunswick's Future Climate Predictions based on the Intergovernmental Panel for Climate Change (IPCC) 5th Assessment Report (AR5) (Roy & Huard, 2016). Data collected includes maximum, minimum, and average temperatures, and rainfall and snowfall amount to get a sense of the weather regime to be expected near the Project study area. Future climate predictions and intensity-duration-frequency graphs (IDFs) were used to compare current and future expected rainfall amounts and intensities to determine appropriate storm water management techniques that may be required.

Visibility and fog data have also been compiled with the nearest weather station that collects fog and visibility data. Those data were obtained from Saint John, New Brunswick.

3.2.4 *Wind Resource*

Initially, a desktop review of the wind atlas for the project region was conducted to determine preliminary wind speeds in the Project study area. Additionally, data measured from wind monitoring sensors attached to a telecommunications tower located on an adjacent property to the Project site was utilized to understand wind speed and direction from 2003 through to 2008.

To further understand the current wind regime at the project location, a Light Detection and Ranging (LiDAR) unit, a Sound Detection and Raging (SoDAR) and a meteorological mast were installed on or near the site lands. These instrumentations were installed in the summer and fall of 2019. While the LiDAR was removed from site, the SoDAR and meteorological mast will remain on and near the project site throughout for the majority of 2020.

3.2.5 *Noise Impact Assessment*

A noise impact assessment was conducted for the proposed BWP to assess the impact of the Wind Turbine Generator (WTG) noise on houses and buildings near the project site during the operational phase of the project. The City of Saint John does not have any noise guidelines or by-laws pertaining to maximum noise levels from wind turbines. However, the *Additional Information Requirements for Wind Turbines Guidance Document* (DELG, 2019) states noise impact studies must include all noise sensitive locations within one kilometer of the nearest turbine and must demonstrate compliance with Ontario guidelines and criteria demonstrated in Table 3-2 (HGC Engineering, 2007).

Table 3-2: Recommended Sound Criteria for Wind Turbines.

Wind Speed (m/s)	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***
Wind Turbine Noise Criteria [dBA]	*40*	*40*	*40*	*43*	*45*	*49*	*51*	*53*

The noise assessment was completed with the use of the windPRO software; the software uses models that follow ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors standards to assess the predicted noise levels at each receptor included in the assessment. A worst case and a realistic scenario were modelled using this software. The worst case was modelled using conservative values for the environmental factors that contribute to the propagation of the sound pressure levels (SPL) created by the WTGs. The realistic case was modelled using more realistic values for the environmental factors.

As the turbines to be installed on site are yet to be determined, the E-141 EP4 turbine model has been used in this assessment. This turbine model has a hub height of 135 m hub height with a 70 m blade length. Based on the calculated sound power levels provided by the manufacturer, the loudest SPL at the hub height of the E-141 will be 105.5 dB(A).

In this noise assessment, all receptors within 4.0 km of the turbines were included in the model to predict the maximum noise level that could be expected when the turbines are operational. The input parameters and the assumptions for the assessment are included in the full noise impact assessment attached in Appendix A.

Construction noise can also be a source of temporary noise impact. Construction noise is not always constant and can produce impulsive and variable sounds at different noise levels, which could create heightened annoyance levels in the surrounding community. A construction noise assessment has been conducted and considers the maximum noise levels produced by various construction equipment to determine maximum sustained noise levels when all equipment is running and at what distance the noise attenuates to ambient levels. The construction noise assessment and the sound levels predicted for each piece of equipment were conducted in accordance with the guidelines in the *Biological Assessment Preparation for Transportation Projects – Advanced Training Manual for Noise Impact Assessments document* (WSDoT, 2017). This document specifies guidelines for decimal addition and noise attenuation in a soft forested environment.

3.2.6 *Shadow Flicker and Visual Aesthetics Assessment*

3.2.6.1 Shadow flicker

A worst case shadow flicker impact assessment has been completed for the BWP to assess the potential impact of shadow flicker on the regional area within a 4.0 km radius. Shadow flicker is the change in light received by a receptor due to a WTG blade impeding the light path between the sun and the receptor resulting in a flicker of light on the receptor from the moving blades.

There are two factors that naturally limit the shadow flicker effect, due to optic conditions in the atmosphere:

1. The angle of the sun over the horizon, which must be at least 3 degrees; and
2. The blades of the WTG must cover at least 20% of the sun.

The City of Saint John does not have any guidelines or by-laws pertaining to shadow flicker. However, the requirements outlined in the New Brunswick's *Additional Information Requirements for Wind Turbines Guidance Document* (DELG, 2019) adhere to the Ontario guidelines, which recommend the following acceptable levels of shadow flicker at a receptor if mitigation is not feasible:

- No more than 30 hours per year of astronomical maximum shadow flicker; and
- No more than 30 minutes on the worst day of astronomical maximum shadow flicker.

Receptors exposed to no more than 30 minutes per day on the worst affected day or a total of 30 hours per year from the WTG are considered unlikely to require technical mitigation.

The model uses conservative assumptions to produce a maximum expected duration of shadow flicker, or a worst case scenario. The assessment was carried out a second time to incorporate more realistic environmental conditions for the receptors found to be most impacted by shadow flicker in the worst

case scenario. Details on input parameters are included in the full shadow flicker impact assessment provided in Appendix B.

3.2.6.2 Photomontage

ReSoft Ltd WindFarm software was used to create photomontages of the BWP. Two locations were chosen in the vicinity of the local study area to present a predicted view of the WTG using a 135 m hub height. This software has provided insight on how the wind turbine may alter views of the landscape from different locations of interest to the community.

3.2.6.3 Zone of Visual Influence

The Zone of Visual Influence (ZVI) was calculated using the windPRO v.3.1 software and considers the topography of the surrounding environment and the height of the proposed turbine. The ZVI is the area of land in which any part of the WTG (tower-or blade tip) could be visible. With land elevation and turbine height the software can predict the distances at which the WTG will be visible on the landscape. The ZVI calculation assumes no vegetation barrier or obstructions, and therefore is modeled as a worst case scenario.

3.3 Approach to Biophysical VEC Surveying

The Proponent engaged the expertise of Fundy Engineering & Consulting Ltd. (Fundy Engineering) and Boreal Environmental (Boreal) to complete the biophysical surveys for the BWP. Fundy Engineering and Boreal completed the wetland and watercourse assessments, while Boreal completed the avian, bat, wildlife, habitat, and vegetation surveys.

Fundy Engineering is one of the largest employee-owned, full-service multi-disciplinary engineering-consulting companies headquartered and managed in Atlantic Canada. Fundy Engineering is headquartered in Saint John and since 1989, has provided professional services in environmental, engineering, and project management sectors locally, nationally and internationally.

Boreal, established in 2011, is based in Saint John, New Brunswick and provides environmental consulting services throughout Atlantic Canada. Boreal specializes in focused projects. However, Boreal has extensive experience supporting large-scale projects through collaboration and partnering with other consulting firms. Boreal's clients include engineering consulting firms, energy sector, governmental/non-governmental agencies, construction companies, and land developers.

Extensive desktop and field surveys were conducted for each biophysical VEC. In order to properly scope the field surveys many resources and departments were consulted to obtain baseline information about species, habitats, and ecological features that are likely to be found onsite. The following resources and departments were consulted on one, or all of the biophysical VECs:

- Atlantic Canada Conservation Data Centre;
- New Brunswick Department of Natural Resources and Energy Development Species at Risk Reports (DNRED);

- The Committee on the Status of Endangered Wildlife in Canada (COSEWIC);
- Department of Fisheries and Oceans (DFO);
- New Brunswick Department of the Environment and Local Government (DELG);
- Publicly available GIS map layers (e.g., ecological land classification, forest and non-forest inventory, wetland inventory, PNAs, Wildlife Management Zones);
- Atlas of Breeding Birds of the Maritime Provinces;
- Important Bird Areas (IBAs) of Canada;
- Ramsar (Wetlands of International Importance) Sites Database;
- Atlas of Canada Migratory Bird Sanctuaries;
- Bird Studies Canada;
- Available aerial photography;
- Local naturalist/interest groups prior to conducting the field activities;
- ECCC Species at Risk Reports;
- Province of New Brunswick's Mine Opening Inventory Map;
- The General Status of Wildlife in New Brunswick publication;
- New Brunswick Light Detection and Ranging (LiDAR) mapping projections;
- GeoNB wetland and watercourse mapping;
- Forest Watershed Research Center Cartographic Depth to Water Index (Arp, 2018);
- The federal Species at Risk Registry;
- High resolution aerial photography;
- Environmentally Significant Areas database; and,
- Ecological Reserves in the Maritimes.

Throughout this report, we define species at risk (SAR) as those species that are listed as 'extirpated', 'endangered', or 'threatened' on the federal SARA or the NB SARA. We also define species of special conservation concern (SOCC) as those species that are not SAR but are listed in other parts of SARA, NB SARA, the COSEWIC, or as regionally rare or endangered by the Atlantic Canada Conservation Data Center (ACCDC).

3.3.1 *Avian Survey*

3.3.1.1 Site Sensitivity

The proposed project is a 5 – 10 turbine project which, according to the "Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds" (CWS, 2007a), is considered to be a small to medium sized facility. In determining the "Potential Site Sensitivity", with an understanding of the Project site in relation to regionally and locally significant areas for birds, the site was ranked as "Very High" sensitivity.

Following the specifications outlined in the Canada Wildlife Service (CWS) guidance document (CWS 2007b), the proposed Project was considered to be "Category 4".

Natural Forces understands that one of the most significant environmental concerns associated with wind projects is the potential impacts to birds. As such and with consideration for the ecological setting of the

site and the nearby important bird habitats, a study design was proposed and discussed with DELG and NDRED prior to being implemented.

3.3.1.2 Scope of Work

Based on the recommended ECCC and CWS protocols, and feedback from the consultation process, the following scope of work was completed as part of the bird and bird habitat surveys for the proposed project. As field work progressed, and as more information became available, the surveys were refined based on the available habitat types and expected species diversity within the Project study area. The scope of work was designed to answer the following questions:

- What species use the site for breeding?
- Are there Species of Conservation Concern (SOCC) present that are sensitive to the proposed changes to the habitat or operation of the development?
- What is the migratory activity near or over the site?
- What is the seasonal use of the site?
- At what height are the birds moving through or flying over the site?
- How close are the proposed turbine sites to important feeding or staging locations, and are these likely to be disrupted by construction?

Due to the study timeframe for the avian studies, the methodologies used for the scope of the desktop analysis and field surveys will be outlined and further discussed in an addendum to this registration document.

3.3.1.3 Field Survey Methodology

The field survey methodology will be discussed in an addendum to this registration document.

3.3.2 *Bat Survey*

The 2009 Pre-Construction Bat Survey Guidelines for Wind Farm Development in New Brunswick (DERD, 2009) require, acoustic bat surveys for a minimum of one year prior to construction during both the breeding season (June 1 to June 30) and the late summer – early fall migratory period (August 15 to September 15).

The guidelines require additional pre-construction bat acoustic survey effort if the proposed wind facility and surrounding areas contain high risk habitat features (*i.e.*, within 5 km of a known hibernacula, or potential cave or abandoned mine; within 500 m from a coast line or other major water bodies; or located on or near forested ridge habitats). A review of existing information indicates that there are no known hibernacula, caves or abandoned mines (based on the Province of New Brunswick's Mine Opening Inventory Map) within 5 km of the project area and it is not within 500 m of a coast line or major water body (ECCC, 2015).

For the purpose of this assessment, the spatial boundaries (*i.e.*, the assessment area) have been identified as the area encompassing the access roads, each turbine location (plus a 150 m radius surrounding each

turbine), and the transmission/connection lines (consisting of a 150 m wide corridor), extending between the proposed project location to the existing power infrastructure.

3.3.2.1 Scope of Work

Based on the Pre-Construction Bat Survey Guidelines (DERD, 2009), a background and desktop analysis followed by one year of pre-construction survey including the summer and fall season is required. A minimum of 40 hours of survey distributed over a minimum of 10 nights with a minimum of 4 hours per night starting 30 minutes after sunset is required for the early summer breeding (June 1st – June 30th) and late summer/fall migration (August 15th – September 15th) periods. Additional surveys during the summer breeding (July 1st – July 31st) and fall migration (September 15th – October 15th) periods are recommended in high risk areas with 40 hours of survey over a minimum of 5 nights. Surveys were designed to commence prior to the breeding season and extend through the late fall migration period (June 1st until October 31st, 2018 inclusive). This approach allowed for collection of data which could capture bat activity levels during the vulnerable periods (*i.e.,* breeding and migration) while considering seasonal and environmental fluctuations. Methodologies used for the scope of the desktop analysis and field surveys listed above will be outlined in an addendum to the registration document to follow.

Natural Forces understands that one of the key environmental concerns associated with wind projects is the potential for effects to bats. As such Boreal undertook consultation with DERD regarding the level of effort for the acoustic survey program.

3.3.2.2 Field Survey & Analysis

The field survey methodology and analysis will be discussed in an addendum to this registration document.

3.3.3 *Wetland and Watercourse Survey*

Based on preliminary turbine sighting studies, Natural Forces identified lands where watercourse and wetland surveys were required (i.e., the survey area). Initially, this included the following:

- 30 m buffers along roads required to access turbine sites during construction and operation;
- 30 m buffers along powerline easements;
- 30 m buffers around substations and ancillary equipment; and,
- 150 m buffers around turbine bases.

Following discussions with the Regulatory Authorities (i.e., representatives with the DELG, DNRED, and CWS), the buffers around the proposed turbine bases were increased from 150 m to 300 m; however, this was done late in the field season. Therefore, this work involved ground-truthing delineation exercises within the initial survey area and aerial photo interpretation and LIDAR interpretation with spot ground-truthing delineation exercises within the expanded survey area (i.e., from 150 m to 300 m from the turbine bases). It is expected that additional ground-truthing delineation exercises will be done in spring 2020 to confirm the aerial interpretation with spot ground-truthing delineation exercises, and to identify additional wetland and watercourse features on areas not previously ground-truthed.

The New Brunswick "Guide to Environmental Impact Assessment in New Brunswick" (DELG, 2018) requires that physical and natural features of the land be described. In relation to the aquatic environment, the guide recommends consideration of the following features:

- Aquatic or wetland features that could affect the project;
- The type or significance of any fish populations or habitat;
- Any known presence of aquatic species at risk or their habitat; and
- Any known presence of critical, sensitive or protected aquatic or wetland habitat.

Furthermore, the DELG's "Additional Information Requirements for Wind Turbines" sector guideline (DELG, 2019) requires that a description of habitat types (including the components above) be obtained at and surrounding each turbine site.

The scope of work included a desktop and field assessment of mapped and unmapped watercourses and wetlands within the assessment area. The goal of the desktop evaluation was to identify where wetlands, watercourses, or waterbodies may be located based on mapped systems, topography, forest cover type and satellite imagery, while also identifying where the Project study area lies within primary and secondary watersheds.

The aquatic environment for the purposes of this EIA considers watercourses and wetlands, which herein includes descriptions of the following:

- **Watercourses** – Watercourses in New Brunswick are defined as: "*A feature in which the primary function is the conveyance or containment of water, which includes: a) the bed, banks and sides of any watercourse that is depicted on the New Brunswick Hydrographic Network layer (available on GeoNB Map Viewer); b) the bed, banks, and sides of any incised channel greater than 0.5 metres in width that displays a rock or soil (mineral or organic) bed, that is not depicted on New Brunswick Hydrographic Network layer (available on GeoNB Map Viewer); water/flow does not have to be continuous and may be absent during any time of year; or c) a natural or man-made basin (i.e. lakes and ponds).";*
- **Wetlands** – Wetlands in New Brunswick are defined as *"land that either periodically or permanently has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of hydric soils, hydrophytic vegetation and biological activities adapted to wet conditions*" (DELG, 2012).

3.3.3.1 Field Survey

The aquatic habitats and wetlands field survey included the assessment of mapped and unmapped watercourses and the delineation and functional assessment of regulated (mapped) and non-regulated (unmapped) wetlands as per the GeoNB Map Viewer. Field surveys of the aquatic habitats and wetlands in the assessment area were conducted between August 19 and October 15, 2019 by either Fundy Engineering or Boreal biologists/scientists experienced in aquatic/fish habitat surveys and certified in wetland identification, delineation and ecology as well as Wetland Ecosystems Services Protocol - Atlantic

Canada (WESP-AC) functional assessment methods. The detailed methods used for both watercourse and wetland assessments are summarized in the following sections.

3.3.3.2 Watercourse Assessment

The watercourse assessments were conducted within the assessment area in concert with other targeted field surveys including: rare plants and vegetation, wetlands, and terrestrial wildlife and wildlife habitat. Using the DNRED and DFO standard aquatic assessment forms, fish habitat and aquatic features were assessed.

Assessment criteria included:

Description of aquatic habitat type:
Habitat types within each watercourse were described as riffle, run, pool or flat, where possible in the area of the proposed project;

Dominant substrate type and embeddedness:
Dominant substrate types were described and documented by percent of relative abundance. Substrate type (*e.g.,* gravel or silt) is especially important for fish spawning habitat;

Stream channel characteristics:
Stream channel characteristics including average wet width, approximate bankfull width, average wetted depth and maximum wetted depth were measured in the field;

Instream cover and overhead canopy cover ratings:
Instream cover such as submerged woody debris, cobble, boulders, aquatic vegetation was documented, and overhead canopy cover ratings (percent covered by shrubs and trees) were scored;

Environmental Conditions and Water Level:
Environmental conditions (*e.g.,* drier than normal seasonal conditions) were noted during the assessment and water level was rated as "low, moderate or high". Hotter and drier environmental conditions resulting in lower water levels will stress salmonid fish populations;

Bank stability:
Bank stability and presence of eroding banks (potential for natural and anthropogenic sources) was assessed within the area of the project; and,

Riparian vegetation community:
In addition to recording each vegetation species the riparian vegetation community was described by percent trees, shrubs grasses and bare ground.

3.3.3.3 Wetland Assessment

The methods of wetland determination and delineation are based upon established protocols for wetland delineation, which are outlined in the US Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987/2008). Wetland determination and delineation is primarily focused

upon establishing the wetland-upland edge, and is based upon the presence of positive indicators for three parameters, including:

- Hydric (wet) soil conditions;
- Hydrophytic (wet adapted) vegetation; and
- Wetland hydrology.

Where soils within the local study area are extremely shallow and sit atop bedrock, it was agreed upon with DELG and DNRED that test pits would not be required for soil assessment; therefore, a two parameter system was established at representative locations within the field identified wetlands. Upon positive wetland determination (i.e., positive indicators for hydrology and vegetation), a wetland edge condition was established and georeferenced using a handheld Global Positioning System (GPF) (3 to 5 m accuracy).

Functional Assessment: Wetland Ecosystem Services Protocol-Atlantic Canada (WESP-AC)

WESP-AC represents a standardized approach to the way data is collected and interpreted to indirectly yield relative estimates of a wide variety of important wetland functions and their associated benefits.

WESP-AC generates scores (0 to 10 scale) and ratings (Lower, Moderate, Higher) for a variety of wetland functions using visual assessments of weighted ecological indicators. The number of indicators that is applied to estimate a particular wetland function depends on which function is being assessed. The indicators are then combined in a spreadsheet using logic-based, mathematical models to generate the score and rating for each wetland function and benefit. Together they provide a profile of "what a wetland does."

For each function, the scores and ratings represent a particular wetland's standing relative to those in a statistical sample of non-tidal wetlands previously assessed in the Province (98 for New Brunswick) (Adamus, 2018). Table 3-3 provides a list of various functions, their definitions, and potential benefits.

Table 3-3: Benefits of Wetland Functions Scored by WESP-AC.

Function	Definition	Potential Benefits
Hydrologic Functions:		
Water Storage and Delay	The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods.	Flood control, maintain ecological systems
Stream Flow Support	The effectiveness for contributing water to streams especially during the driest part of a growing season.	Support fish and other aquatic life
Water Quality Maintenance Functions:		
Water Cooling	The effectiveness for maintaining or reducing temperature of downslope waters.	Support cold water fish and other aquatic life

Function	Definition	Potential Benefits
Sediment Retention & Stabilisation	The effectiveness for intercepting and filtering suspended inorganic sediments thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilizing underlying sediments or soil	Maintain quality of receiving waters. Protect shoreline structures from erosion.
Phosphorous Retention	The effectiveness for retaining phosphorus for long periods (>1 growing season)	Maintain quality of receiving waters.
Nitrate Removal and Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas while generating little or no nitrous oxide (a potent greenhouse gas).	Maintain quality of receiving waters.
Organic Nutrient Transport	The effectiveness for producing and subsequently exporting organic nutrients (mainly carbon), either particulate or dissolved.	Support food chains in receiving waters.
Ecological (Habitat) Functions:		
Fish Habitat	The capacity to support an abundance and diversity of native fish (both anadromous and resident species)	Support recreational and ecological values.
Aquatic Invertebrate Habitat	The capacity to support or contribute to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	Support salmon and other aquatic life. Maintain regional biodiversity.
Amphibian and Reptile Habitat	The capacity to support or contribute to an abundance or diversity of native frogs, toads, salamanders, and turtles.	Maintain regional biodiversity
Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	Support hunting and ecological values. Maintain regional biodiversity.
Waterbird Nesting Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region.	Maintain regional biodiversity.
Songbird, Raptor, and Mammal Habitat	The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water	Maintain regional biodiversity.
Native Plant Habitat and Pollinator Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups, as well as the pollinating insects linked to them	Maintain regional biodiversity and food chains.
Public Use and Recognition*	Prior designation of the wetland, by a natural resource or environmental agency, as some type of special protected area. Also, the potential and actual use of a wetland for low-intensity outdoor recreation, education, or research.	Commercial and social benefits of recreation. Protection of public investments.

*Considered a benefit rather than a function of wetlands

Source: Adamus (2018)

3.3.4 *Fish and Fish Habitat*

While reviewing the resources for the wetland and watercourse surveys the information was reviewed to evaluate the potential for aquatic SOCC and/or aquatic SAR within the general area of the proposed project and to assist in scoping the field programs.

During the wetland and watercourse survey, fish habitat suitability was also recorded. Habitat suitability for fish is assessed (based on the evaluation of habitat type, substrate type, instream cover, overhead cover and other ecological observations made during the watercourse assessment).

A fish presence or absence visual survey was conducted where fish habitat was present within the proposed project area. Representative photos and GPS points (using a handheld GPS unit and Arc Geographic Information Systems (ArcGIS) applications) were collected for each watercourse during the field assessments.

At this time, electrofishing has not been conducted to confirm fish presence or absence surveys.

3.3.5 *Wildlife and Wildlife Habitat*

The scope of work for the wildlife and wildlife habitat surveys is based upon an understanding of the nature of the proposed project and project area, as well as the field biologist's experience in assessing similar landscapes. For the purposes of this report, Wildlife and wildlife Habitat (excluding bats and birds) – includes all terrestrial wildlife species and their habitats that have the potential to be affected by the Project activities.

Field studies of terrestrial habitats were conducted between August 19, 2019 and October 15, 2019, in concert with other targeted field surveys (i.e., wetlands, watercourses, baseline vegetation and rare plants). Biologists focused on the general characterization of available terrestrial habitats within the survey area, as well as the potential for sensitive species or their critical habitats occurring in the survey area. The following criteria were documented:

- Occurrence of species at risk/species of conservation concern;
- Potential habitat for species at risk/species of conservation concern;
- Potential habitat for wildlife species;
- Unique or limiting wildlife habitat;
- Representative or typical wildlife habitat;
- Incidental observation and documentation of observed wildlife (regardless of conservation status); and,
- Wildlife sightings from previous studies.

3.3.6 *Vegetation and Habitat Survey*

This section details the scope of assessment of vegetation within the proposed project area and the methods that were used to conduct the surveys. The ACCDC maintains a comprehensive list of plant and

animal species for New Brunswick. That list includes a conservation status rank and legal status. The conservation status rank is assessed by the ACCDC in collaboration with other experts.

A rare plant survey is done to determine the presence and locations of any rare plant species and rare vegetation communities. Random meander searches are typically conducted throughout a growing season because the best time to identify specific plants varies (e.g., budding stage, flowering stage, moisture conditions, maturity, etc.). During the searches, a complete list of vegetation in the area is compiled.

The conservation ranks for species identified in the field are obtained from the ACCDC database. Those ranks are then used to assess the rarity of the species observed. The locations of any rare plants observed in the field are recorded along with their approximate density. Under the New Brunswick Environmental Impact Assessment Regulation 87-83 (EIA Regulation) under the Clean Environment Act, areas of sensitive habitat and legally listed SAR should be avoided to the extent possible. As such, to better understand the types and quality of habitat in the area of the proposed project, a baseline study of available vegetation and vegetation communities is required to be conducted within the proposed project area. This assessment can identify the potential for occurrences of vegetation species at risk or of conservation concern within the location of the proposed project.

The New Brunswick "Guide to Environmental Impact Assessment in New Brunswick" (DELG, 2018) requires that physical and natural features of the land be described. In relation to the terrestrial environment, the guide includes the following features:

- Existing vegetation;
- Any known presence of species at risk; and
- Any known presence of critical or sensitive habitat.

Furthermore, the DELG's "Additional Information Requirements for Wind Turbines" sector guideline (DELG, 2019) requires that a description of vegetation (including the components above) be obtained at and surrounding each turbine site. For the purposes of this EIA, the vegetation assessment includes the following:

Vegetation Identification – includes an assessment of identified vegetation species along with their regional rarity ranking that have the potential to be affected by the Project activities;

Species at Risk and Species of Conservation Concern – includes those species listed by the federal and provincial authorities as well as regionally sensitive by the ACCDC; and

Vegetation of Cultural or Traditional Importance – includes vegetation species identified by a member of First Nations as culturally significant from a traditional knowledge/use perspective.

The primary focus of the vegetation assessment was to identify the potential occurrence of SAR (listed on the SARA, by the COSEWIC, or on the New Brunswick SARA or SOCC listed as S1 or S2 by the ACCDC).

3.3.6.1 Field Surveys

Field studies of vegetation species were conducted between June 10 and October 15, 2019 in concert with other targeted field surveys (i.e., wetlands, watercourses, and wildlife and wildlife habitat). Vegetation observation, areas of potential unique or pristine vegetation communities within the survey area, and forest habitat characterization was recorded.

3.3.7 *Sensitive and Significant Habitat*

During field surveys, any sensitive or significant habitat was identified including any wetlands, watercourses, IBAs, endangered fauna and/or flora, and associated critical habitat. The ACCDC was consulted to determine any ESAs, bat hibernacula, and wood turtle habitat near the proposed project. The GeoNB Data Catalogue was also searched for relevant data and the following data layers were reviewed:

- Aboriginal Lands;
- Federal Parks and Protected Areas;
- ESAs;
- IBAs;
- Protected Watersheds;
- Protected Wellfields;
- Provincial Parks; and
- Wildlife Refuges.

3.4 Approach to Socio-economic VEC Studies

3.4.1 *Archaeological Impact Assessment*

A desktop archaeological review was initiated by the Proponent. A request to New Brunswick's Archeological Branch to complete a review of the Project site on the Archaeological Spatial Database was submitted and a predictive model provided in November, 2019. The work was completed in November 2019 by Jason Jeandron of the firm Archaeological Prospectors with information gained through research of relevant documents from Archaeological Services in Fredericton and published materials, including topographic and surficial geology maps & reports, aerial photographs, LiDAR data, and the New Brunswick Register of Historic Places. The field component was conducted using intensive visual inspection through pedestrian surveying. Each turbine area was assessed, along with select areas of the collector line/roads.

An archaeological Field Survey Permit was obtained and field surveys occurred on November 5th, 2019. The field surveys were conducted using intensive visual inspection through pedestrian surveying. Approximate turbine area, the substation and along select areas of the approximate collector line were surveyed. Archaeological excavations were recommended by Archaeological Prospectors on some areas of elevated risk along the collector line and near several of the turbine locations.

Based on the potential for the presence of archaeological resources after reviewing the spatial database predictive model, initial documentary research, and the pedestrian survey, there are indications that a portion of the footprint has a high potential for the presence of archaeological remains further discussed in Section 5.3.1.

In order to avoid the impact of archaeological resources a testing strategy will be developed based on the Provincial Guidelines And Procedures For Conducting Professional Archaeological Assessments In New Brunswick (2012). The accepted testing strategy will include the excavation of standardised test pits (STP) (STP's = 50 cm x 50 cm), which will be hand excavated with trowel and shovel and all material passed through 6 mm bi-pedal screens. Each STP will be placed at the approximate location of the planned ground disturbance in the areas of elevated potential.

3.4.2 *Electromagnetic Interference Study*

An impact assessment of the proposed BWP was completed on the performance of existing telecommunication towers and microwave radio links following the recommended Radio Advisory Board of Canada's (RABC) *Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar System (RABC & CanWEA, 2018)*. The desktop study was conducted by MacNeil Telecom Inc. by first identifying all radio systems that could be impacted by the BWP from the Innovation, Science and Economic Development Canada database and verifying the locations by consulting with the system owners.

Based on the electromagnetic infrastructure and radio links that were identified, an assessment of the potential impact was completed by calculating the consultation radii and the recommended clearance zones for telecommunication towers and microwave radio links using the RABC protocol and expertise of a Radio Frequency Engineer. The recommended clearance zones for the microwave radio links were determined based on the Fresnel zone calculation for each link crossing near the Project site and the proposed WTG blade length. These results were used to determine which system owners should be consulted to further understand whether a proposed turbine could cause interference.

An Aeronautical Assessment application has been submitted to and approved by Transport Canada. A Land Use Proposal application has been submitted to and approved by Navigation Canada. The DND and RCMP have both been notified about the proposed Project.

3.4.3 *Land Use and Property Value*

Current and historical uses of the project lands have been identified through consultation with regulators, First Nations resources, the current and local land owners, and surrounding business owners. Additionally, aerial imagery and ground truthing during field surveys provided insight into current and historical land uses.

Service New Brunswick's Real Property Information Registry was reviewed to determine the average value of land and properties (that include a dwelling) to obtain a baseline value prior to construction and operation. Further, a review of published literature on links between wind farms and property value have

been provided. Property value is often a concern to local community members and a review of science-based studies will be beneficial during consultation activities.

3.4.4 *Transportation, Vehicle Traffic and Pollution*

A review of existing transportation infrastructure within the local area is presented within, along with a list of expected vehicle movements and types of vehicles to be used during the construction phase. After further analysis and specific WTG selection, delivery routes will be determined by the applicable party in consultation with the DTI prior to vehicle movements.

3.4.5 *Public Health and Safety*

A review of existing health and safety resources are listed within, along with comprehensive review of possible health and safety concerns. The wind turbine model has been selected in order to comply with international wind class standards, and to help reduce the risk of ice build-up, lightning strikes and general malfunctions. Natural Forces has an in-house construction manager who oversees construction activities and will encourage safe practices for worker safety. A copy of the Occupational Health and Safety (OHS) Act will also be located on site at all times.

Many of the mentioned assessments are conducted to ensure the construction and operation of the BWP will occur in the safest manner possible and will often reduce many of the concerns and risk before construction begins such as possible noise and shadow flicker annoyance.

3.4.6 *Community and Local Economy*

The latest Statistics Canada data was reviewed to obtain information on the local economy and population of the Saint John region, as well as an overview of the tourism/recreation industry within the area. This allows Natural Forces to determine how the Project may affect the community and local economy.

3.5 Methodology of Impact Assessment

This assessment is designed to focus on the evaluation of the potential interactions between the VECs and the various Project activities. VECs have been determined through consultation with local stakeholders and provincial regulators. The first step of this assessment has been to determine if there is a potential for the VEC to interact with the Project in a way that will cause an adverse environmental impact.

If it has been determined that an interaction between the Project and a VEC occurs, the significance of this interaction and potential impact will be determined and appropriate mitigation and control measures will be proposed and applied.

After applying mitigation measures, further assessments will be completed to determine if the measures have effectively reduced environmental impact. Environmental effects that remain after mitigation and control measures have been applied are considered the residual effects of the Project. The prediction of residual environmental effects follows three general steps.

- Determining any possible adverse environmental impact;
- Determining whether an adverse environmental effect is significant; and
- Determining whether a significant adverse environmental effect is likely to occur.

To determine the significance or residual effects on the VECs following mitigation, the following definitions will be used:

- *Significant:* Potential impact could threaten sustainability of the resource in the Project area and should be considered a management concern;
- *Minor:* Potential impact may result in a small decline of the quality of the resource in the Project area during the life of the Project – research, monitoring and/or recovery initiatives should be considered;
- *Negligible*: Potential impact may result in a very slight decline of the quality of the resource in the Project area during the life of the Project – research; monitoring and/or recovery initiatives would not typically be required;
- *No impact*: the consequences of the Project activity have no effect on the specific VEC; and
- *Beneficial impact*: the consequence of a Project activity enhances the specific VEC.

Further, a review of the effect of the environment on the Project such as climate and extreme weather events will be included in the assessment.

4 Existing Environment

4.1 Existing Physical VECs

4.1.1 *Groundwater*

Approximately 64% of New Brunswick's population is reliant on groundwater for supplying domestic freshwater (Natural Resources Canada, 2005). Some municipalities that supply potable water to residents obtain that water from groundwater sources. The Wellfield Protected Area Designation Order under the New Brunswick Clean Water Act protects many of those groundwater sources. Under the Order, wellfields are delineated and three zones of protection are identified. Protection applied to the various zones of a designated wellfield are not particularly onerous for residential zoned properties; however, they are fairly restrictive for other uses.

There are two Wellfield Protected Areas in the City of Saint John: the Harbourview wellfield in east Saint John near Mispec Point, and the South Bay wellfield in west Saint John (the designation for the South Bay Wellfield is pending). The location of the Project and the South Bay Wellfield is shown in Figure 4-1.

There are no setbacks from wellfield protected areas for wind turbines. Instead, the wind turbines should be sited outside the three wellhead protection areas.

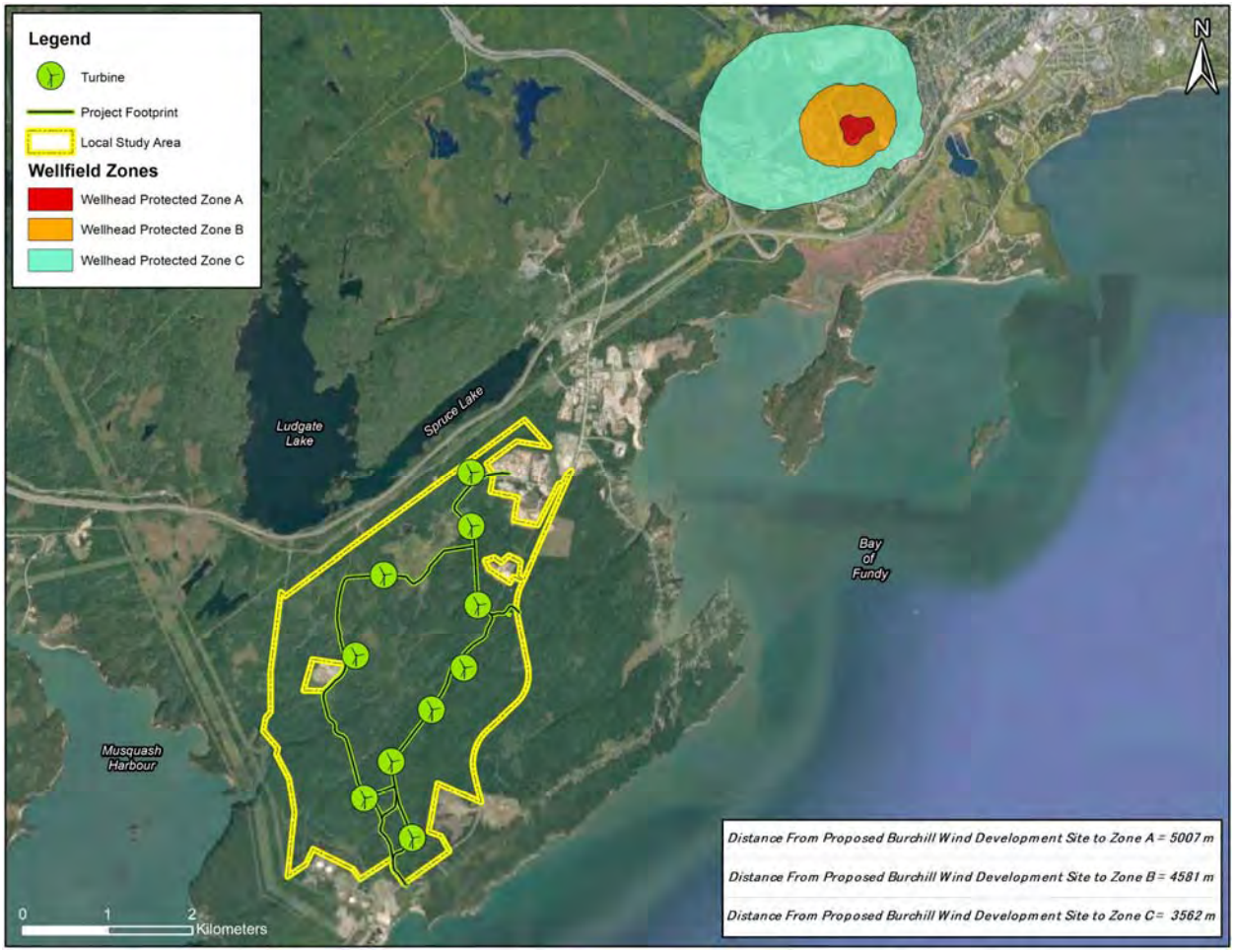

Figure 4-1: Proximity of the three wellhead protection zones of the South Bay Wellfield to the Burchill Wind Project site.

According to the Online Well Log System, there are thirty-one domestic wells within a 3 km radius of the proposed WTGs; three of which are within 1 km of the Project site (Figure 4-2). Water levels range from 1.52 - 259.08 m below ground.

The Geotechnical survey will determine the depth of the bedrock, in addition to other soil conditions, at each of the wind turbine locations. Based on the well logs for the wells in the area, encounters with bedrock ranges from 1.22 - 33.53 m below ground surface. If ground water is detected before the drill reaches bedrock, it will be recorded, otherwise it will not be recorded.

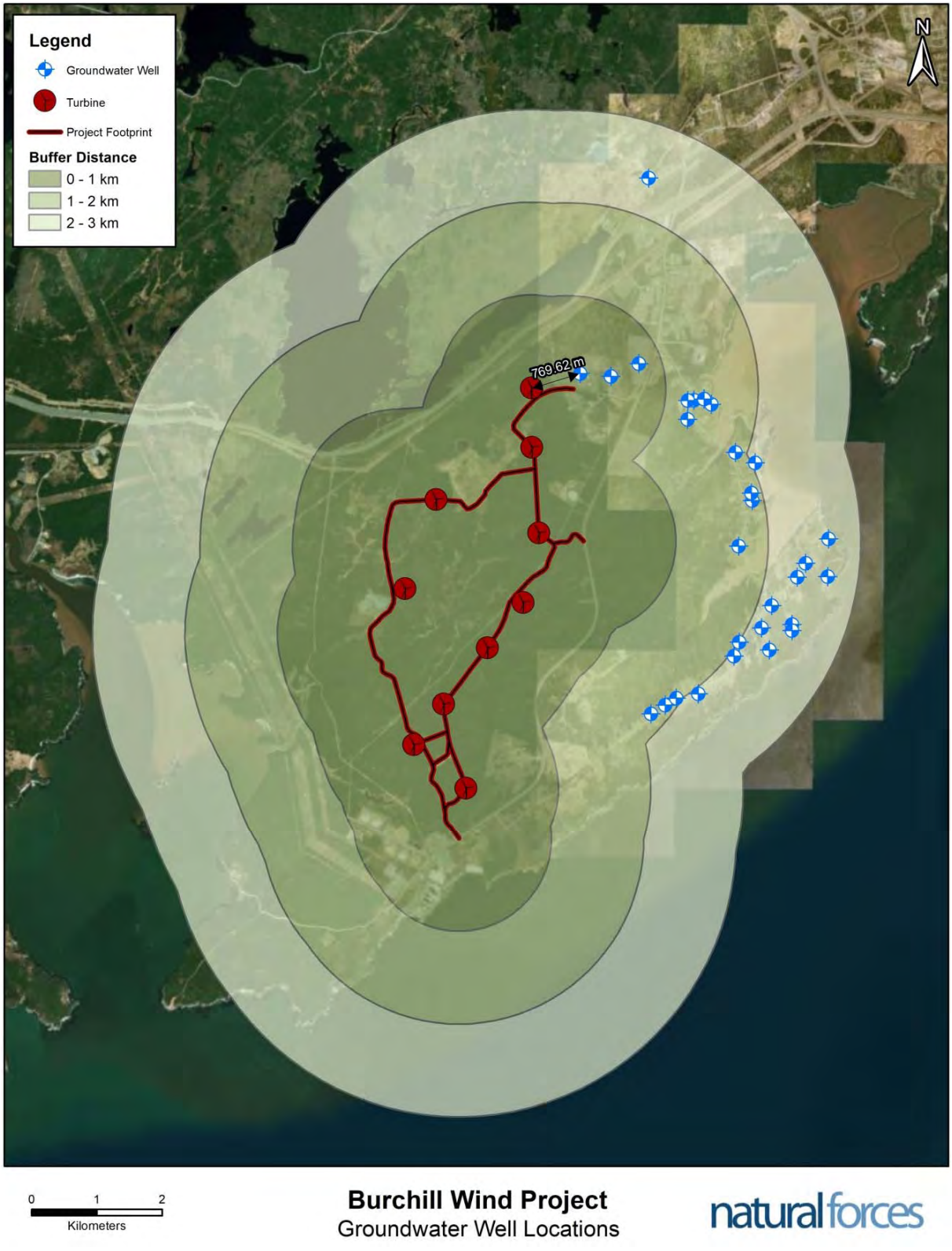

Figure 4-2: Domestic wells located within 3 km of the Burchill Wind Project site.

4.1.2 *Geophysical*

The Project will be located in west Saint John, approximately 15 km away from the City's uptown centre. The property is accessed via Exit 112 of NB Route 1 (i.e., the Saint John Throughway). The City of Saint John's Spruce Lake Industrial Park is located at the at the northeastern end of King William Road and NB Power's Coleson Cove Generating Station is located at the southwestern end. Elevations across the Project site range from 0 m Above Mean Sea Level (AMSL) where watercourses flow into the Bay of Fundy at about 90 m AMSL along Burchill Road (Figure 4-3). As expected, the areas with a higher elevation on the Project site coincide with those areas noted by Gasset et al. (2007) as having modelled annual wind speeds of ≥7m/s at 80 m above ground level.

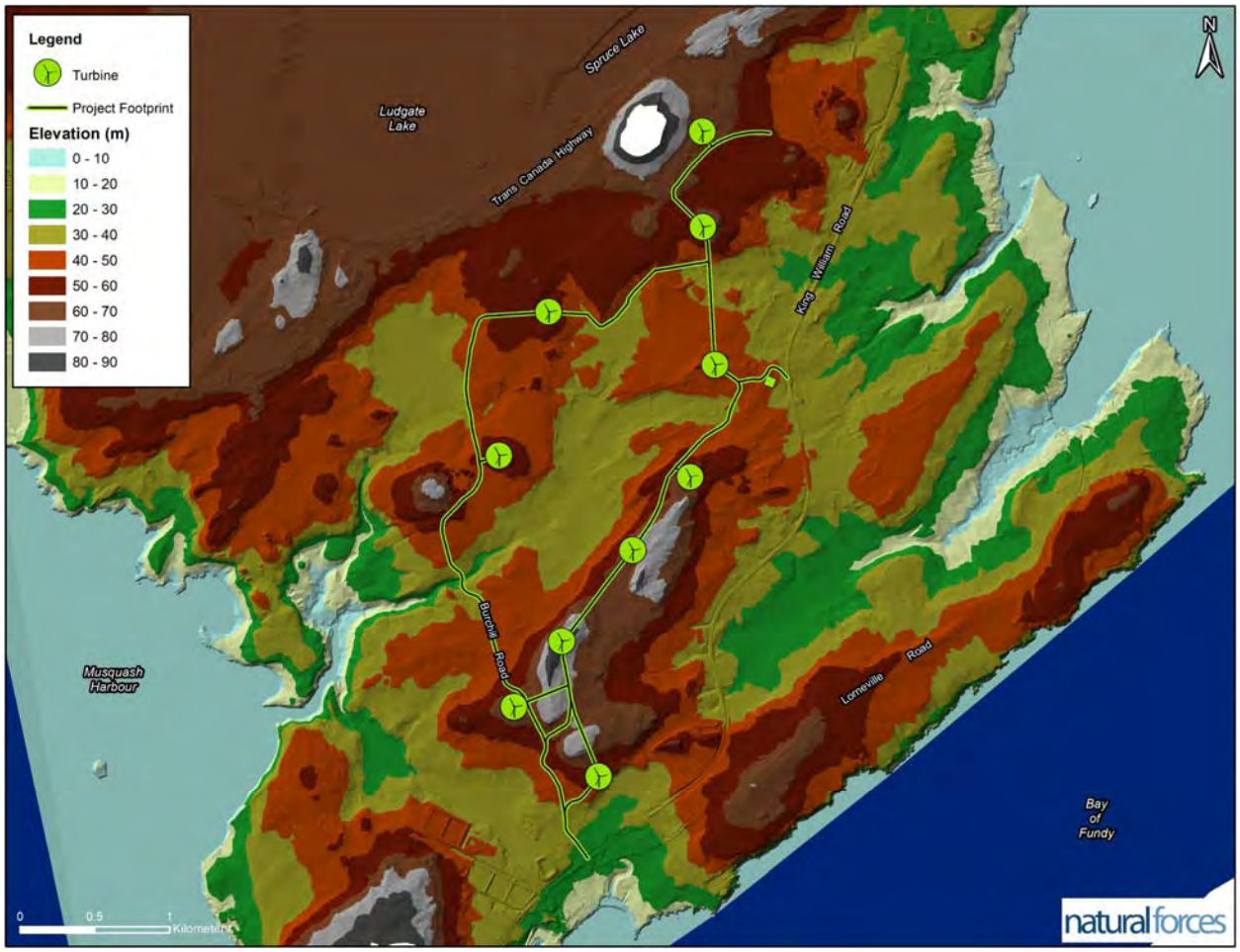

Figure 4-3: Contour map for the Burchill Wind Project site.

A desktop review has determined the geology of the site to be predominantly a mixture of the Saint John Group and the Golden Grove Plutonic Suite (Johnson et al., 2005), which is shown in Figure 4-4. The majority of the project footprint consists of till veneer surficial geology, with smaller areas consisting of pre-quarternary rock, bog deposits, anthropogenic deposits, submarine moraine sediments and organic

veneer [*Rampton*, 1984], and is depicted on Figure 4-5. Additional information on the geophysical environment will be obtained from the geotechnical surveys to be completed in the Spring of 2020.

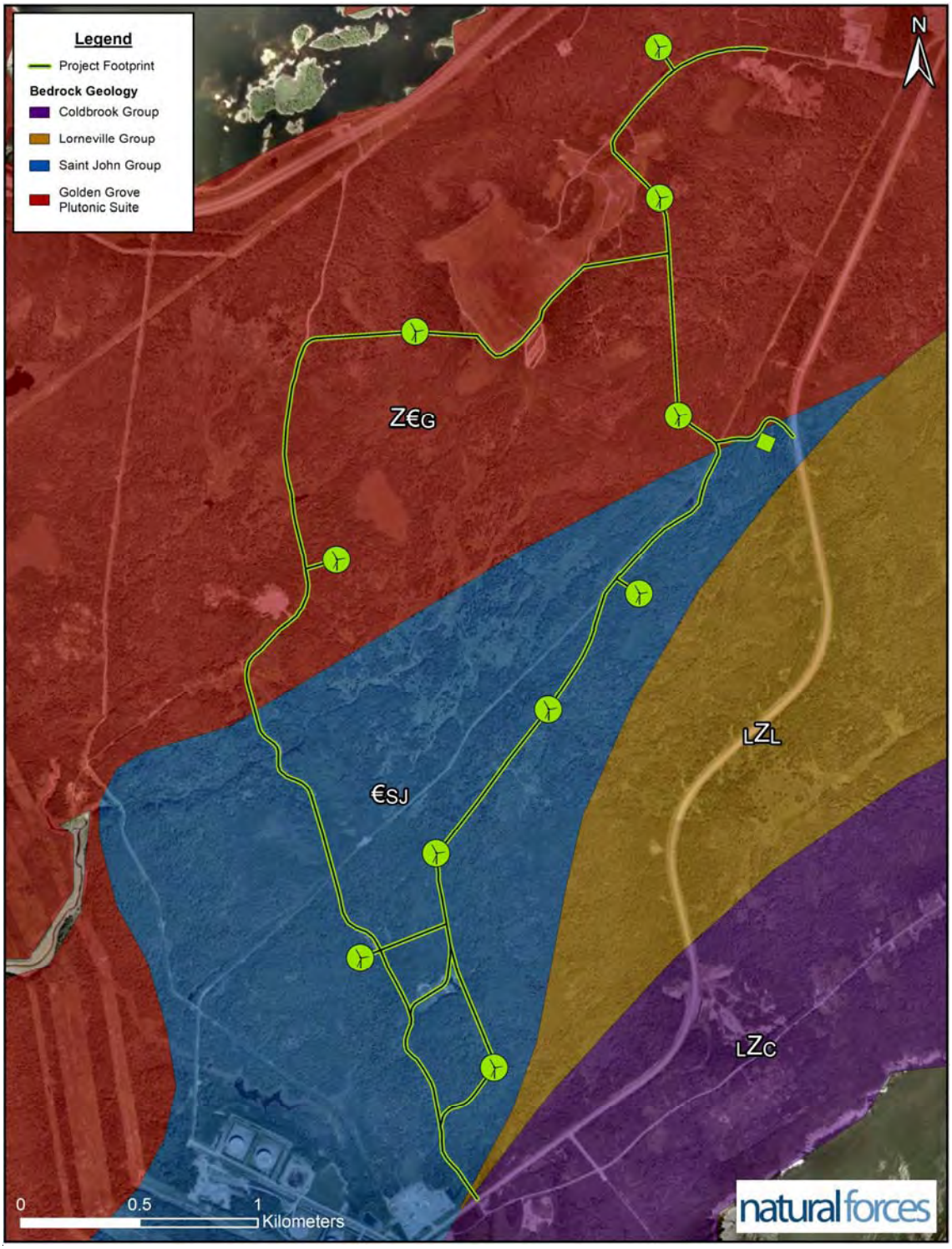

Figure 4-4: Bedrock geology for the Burchill Wind Project site.

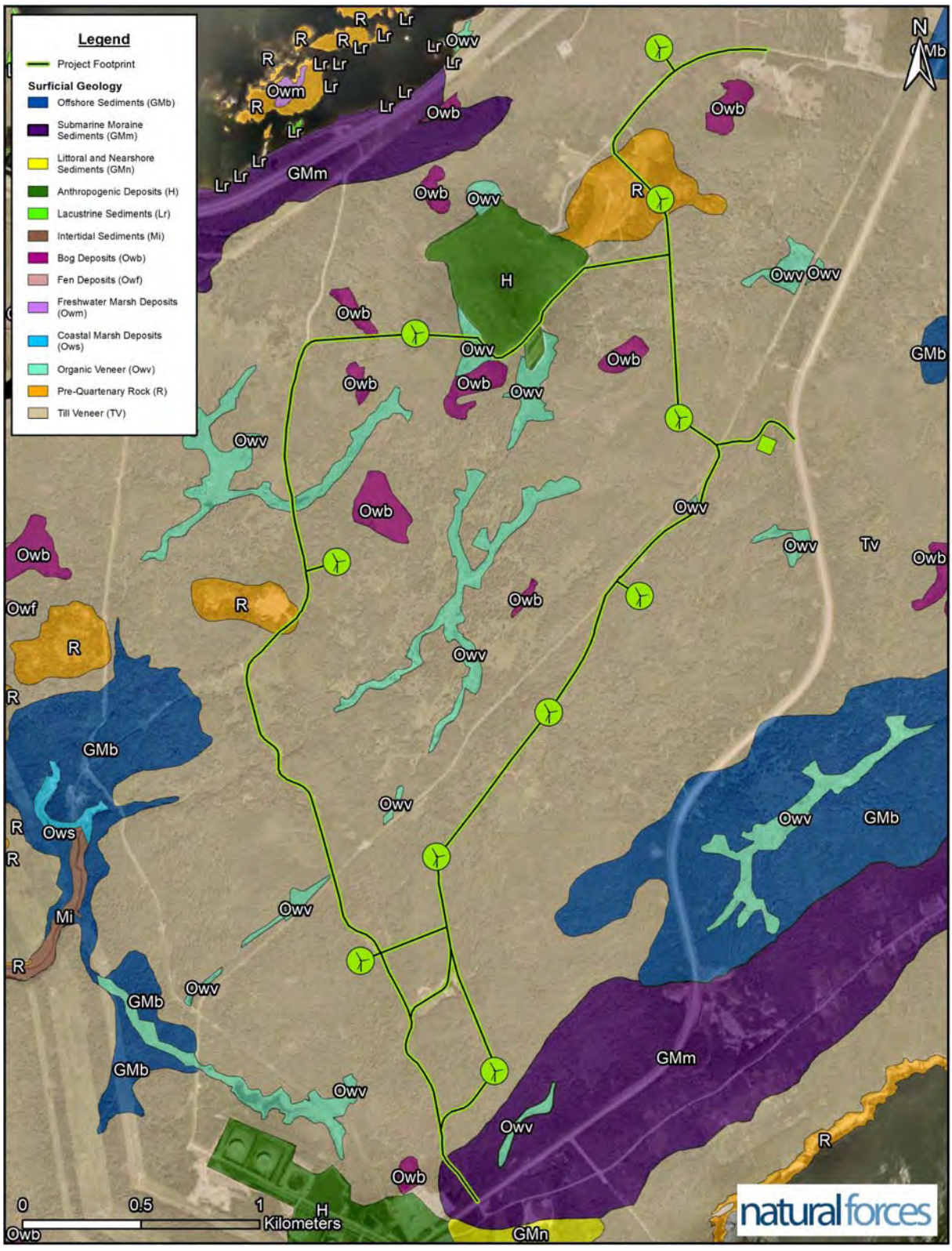

Figure 4-5: Surficial geology for the Burchill Wind Project site.

4.1.3 *Atmospheric Conditions*

Saint John exists within the Fundy Coast ecoregion of New Brunswick (Hinds, 2000). According to the Köppen-Geiger climate classification, the region is characterized by a humid continental climate (Peel et al., 2007). The Bay of Fundy, which is a large heat sink that never fully freezes or warms (i.e., temperatures average between 8 and 12°C), influences the climate by generally providing cool summers and mild winters compared to inland locations.

4.1.3.1 Temperature

Monthly climate data between 1947 and 2008 are available for the meteorological station at the Saint John Airport (YSJ). That station is part of the World Meteorological Organization (WMO) climate monitoring system (WMO ID 71609; 45.32°N 65.89°W, elevation 108.8 m). During that period, the mean annual temperature was 5.0 ± 0.73°C (Figure 4-6) with a monthly daily minimum of -7.8 ± 2.38°C in January to a monthly daily maximum of 17.0 ± 0.84°C in August (Environment Canada, 2019). The warmest and coolest years on record were 1953 and 1948, respectively, when the mean annual temperature was 6.9°C and 3.8°C. The extreme minimum mean daily temperature of -36.7°C was measured on February 11, 1948. In contrast, the extreme maximum mean daily temperature of 34.4°C was measured on August 22, 1976.

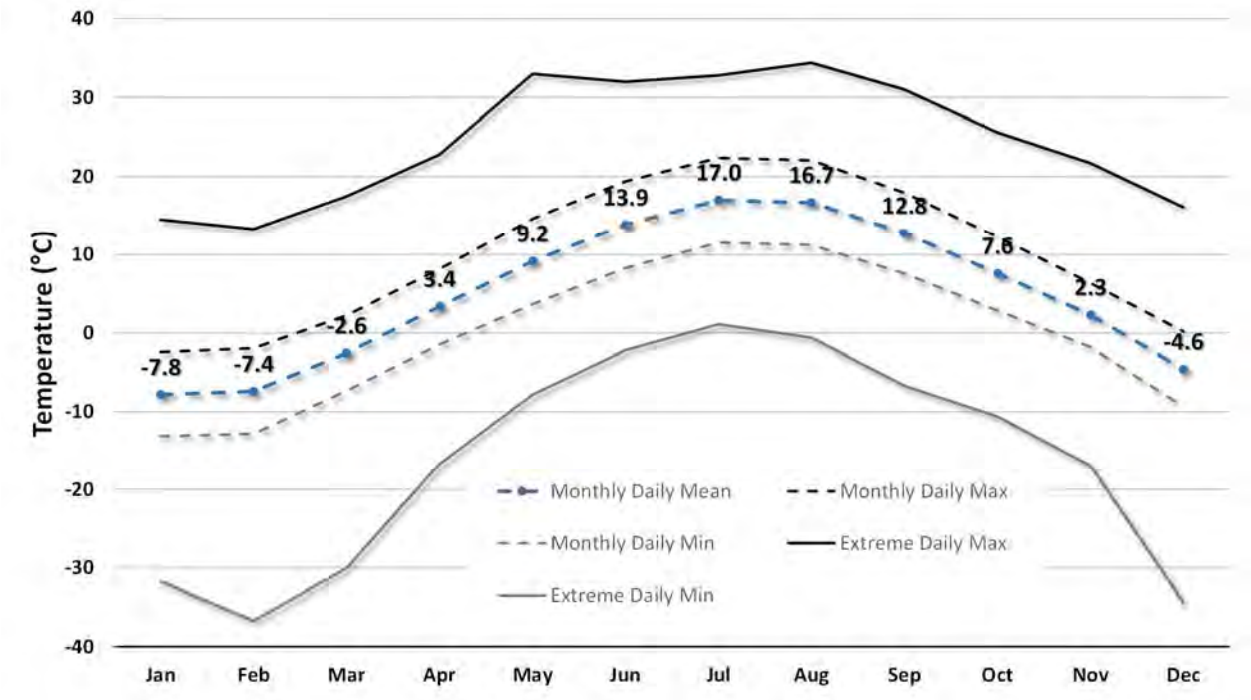

Figure 4-6: Compilation of mean daily temperatures measured at the Saint John Airport meteorological station between 1947 and 2008.

4.1.3.2 Rainfall

Precipitation (i.e., rain, drizzle, freezing drizzle, hail and snow) is generally well distributed throughout all months and the majority (>80%) falls in the form of rain. Mean annual precipitation between 1947 and 2008 (Figure 4-7) was 1379 mm with a mean monthly low of 90 mm in August to a mean monthly high of 148 mm in December (Environment Canada, 2019). The driest year on record was 2001 when there was only 799 mm of precipitation. Conversely, the wettest year was 1979 when 1975 mm of precipitation fell. The most extreme daily rainfall of 154.4 mm was measured on November 13, 1975. The greatest snowfall of 58.2 cm was recorded on December 12, 1960. Snow depth, during the seven months with snowfall, averages 8.6 cm and almost 158 days each year experience some form of precipitation.

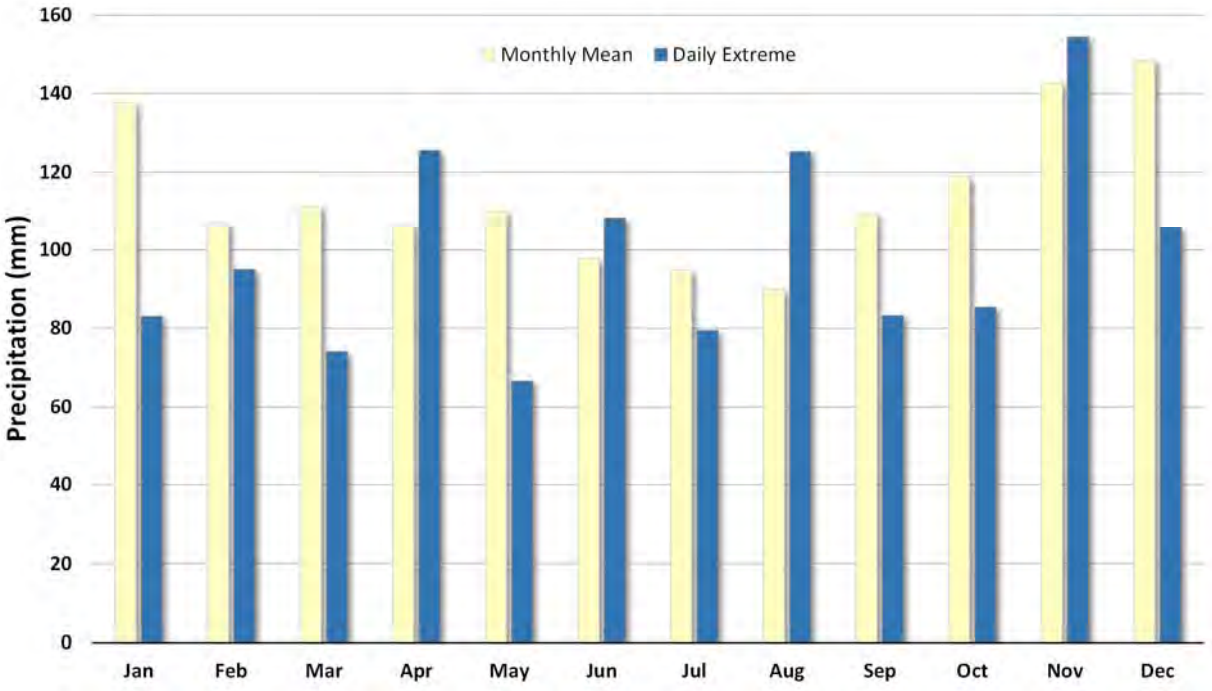

Figure 4-7: Compilation of mean daily precipitation measured at the Saint John Airport meteorological station between 1947 and 2008.

Potential changes in rainfall amounts due to climate change may require additional storm water management techniques. Future predicted climate for New Brunswick based on the IPCC AR5 predictions for future precipitation throughout the province has also been demonstrated for comparison in Figure 4-8.

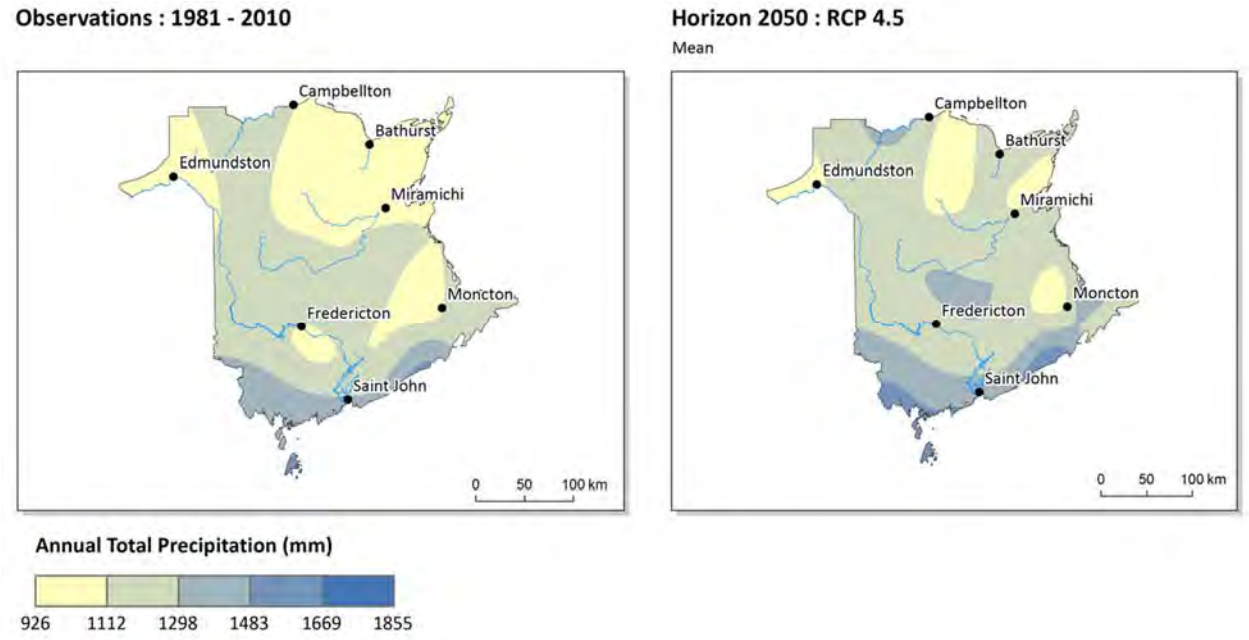

Figure 4-8: Total Precipitation for the province of New Brunswick showing historical data (left) and Predicted 2050 data (right) to show the predicted precipitation near the end of the project lifespan (Roy & Huard, 2016).

Although Figure 4-8 does not show an increase in precipitation within the Project location specifically as a result of climate change, it's conceivable that precipitation amounts will increase on an annual basis. In addition to these predictions, the Proponent researched IDF climate change curves to reflect future trends for extreme rainfall patterns using an IDF tool developed by the University of Western Ontario (2014). When reviewing the IDF tables (Table 4-1 and Table 4-2) and graphs for the Project location, total precipitation and intensity was found to increase by a maximum of 33% over all timeframes and return periods and is predicted to increase, on average, by approximately 26% from historic levels. Though the data for IDF curves at the project location has been extrapolated using the IDF tool from nearby weather stations, the approximate increase in precipitation is within the New Brunswick IPCC Assessment Report #5 predictions.

Table 4-1: University of Western Ontario's IDF Tool for Historic Rainfall Levels from the general Project area (i.e., a 5-minute rainfall intensity of 75.36mm/h typically occurs every 2 years) (UoWO, 2014).

T (years)	2	5	10	25	50	100
5 min	75.36	99.89	116.00	131.85	136.32	151.43
10 min	53.57	72.25	85.66	99.66	103.91	118.50
15 min	44.34	58.61	68.82	79.49	82.72	93.86

T (years)	2	5	10	25	50	100
30 min	30.75	40.92	48.29	56.09	58.47	66.74
1 h	21.08	27.90	32.88	38.17	39.79	45.43
2 h	14.49	18.83	22.35	26.44	27.75	32.61
6 h	7.70	9.86	11.65	13.79	14.47	17.11
12 h	4.93	6.29	7.28	8.35	8.67	9.82
24 h	2.84	3.69	4.31	5.00	5.20	5.95

Table 4-2: University of Western Ontario's IDF Tool for Predicting Future Rainfall Levels from the general Project area during the years 2020-2070 using the moderate Representative Concentration Pathway of 4.5 W/m2 by the year 2100 (i.e., a 5-minute rainfall intensity of 88.79mm/h is expected to occur every 2 years now) (UoWO, 2014).

T (years)	2	5	10	25	50	100
5 min	88.79	120.94	144.15	168.65	179.09	201.94
10 min	63.11	87.48	106.44	127.48	134.23	158.03
15 min	52.23	70.97	85.51	101.68	106.85	125.17
30 min	36.23	49.55	60.01	71.75	75.53	89.00
1 h	24.83	33.77	40.86	48.83	51.40	60.58
2 h	17.07	22.80	27.77	33.82	35.85	43.48
6 h	9.07	11.94	14.47	17.64	18.69	22.82
12 h	5.80	7.61	9.05	10.68	11.20	13.09
24 h	3.35	4.47	5.36	6.39	6.72	7.94

From the historical and predicted rainfall amounts in the general area of the proposed Project, it is evident that rainfall will increase. The predicted increase in precipitation amount and intensity has been considered in the location and design of the WTGs.

4.1.3.3 Visibility & Fog

The presence and frequency of fog events at a wind farm site can have a detrimental effect on migratory birds due to collisions during adverse weather conditions (Kearney, 2012). Artificial lighting, particularly work lights inadvertently left on by turbine maintenance crews are also known to have an adverse effect on migratory birds (Kearney, 2012). During adverse weather events, sporadic artificial lighting during dawn and dusk at a wind farm may attract migrating birds, signaling a potential safe area of refuge.

Fog develops over the Bay of Fundy in warm, moist, southwest winds and is then advected onshore (Robichaud & Mullock, 2001). It tends to be prevalent throughout the entire Bay but will move farther inland on the New Brunswick coast than it will on the Nova Scotia side. Elevated ridgelines and hills such as the project location, have a tendency to act as a barrier and prevent the fog from penetrating inland.

A good indicator as to whether or not fog will develop is to look at the forecast winds at 3,000 and 6,000 feet (Robichaud & Mullock, 2001). When these winds parallel the Bay, fog can usually be expected until the winds shift significantly. A common tool in timing the fog at Saint John Airport is to look at the tide tables for the Saint John Harbour. Fog often moves into the airport 30 to 40 minutes prior to high tide. Another good predictor of fog development is to look at coastal stations along the coast of Maine. If fog is observed at Bar Harbour and Rockland, fog in the bay is almost guaranteed (Robichaud & Mullock, 2001).

Marine fog, which varies seasonally and is more common during the summer, averages 590 hrs/yr in the region; however, visibility is normally good at >9 km about 77% of the time (Environment Canada, 2019). Annual sunshine is approximately 1947 hours ranging from 97 hours in November to 226 hours in July. The extreme amount of daily sunshine (15.2 hours) occurred on June 26, 1978.

ECCC's database of Canadian Climate Normals 1971-2000 was consulted to provide baseline fog data relevant to the Project region (i.e., Saint John, NB). Based on the data presented in Table 4-3 fog can be expected to occur 6.34% of the time throughout the duration of an average year.

Table 4-3: Saint John, New Brunswick fog data average from 1971-2000 (ECCC, 2018d).

Saint John		
Month	**Hours with visibility less than 1 km**	**% of foggy weather***
January	22.2	3.0
February	18.6	2.8
March	21.9	2.9
April	31.2	4.3
May	46.6	6.3
June	72.7	10.1
July	117.1	15.7
August	105.5	14.2
September	57.2	7.9
October	28.1	3.8
November	18.2	3.9
December	16.3	2.2
Annual	**555.4**	**6.34%**

*Based on days/month x 24 hr/day.

4.1.4 *Wind*

Wind speed varies from 12.1 km/hr in August to 18.6 km/hr in March yielding an annual average of 16.1 km/hr (Environment Canada, 2019). The winds predominantly blow from the south off the Bay of Fundy, but are also frequent from the northwest off the land towards the Bay of Fundy. Winds tend to be the strongest in the winter and weakest in the summer (Figure 4-9). The maximum hourly wind speed of 111 km/hr was measured on January 9, 1978. The most extreme wind gusts of 146 km/hr (south winds) were recorded on February 2, 1976 during the Groundhog Day Gale.

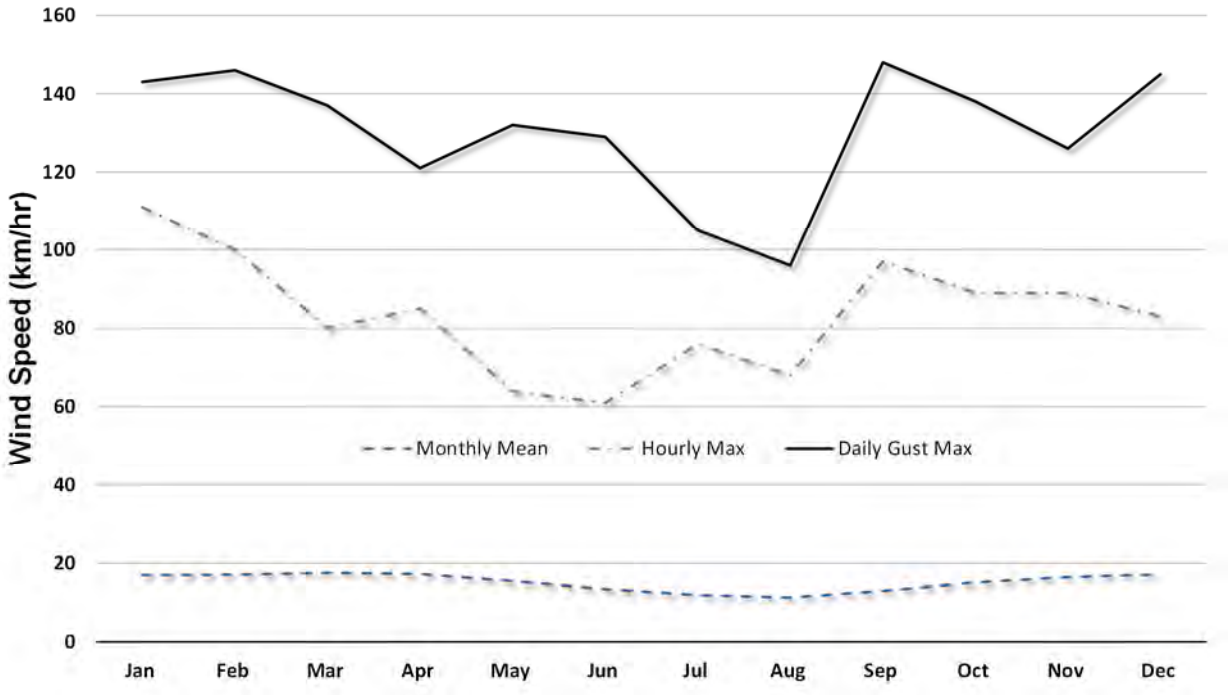

Figure 4-9: Compilation of wind speeds measured for the 30 year period between 1981 and 2010 at the Saint John Airport.

The New Brunswick wind atlas was used in the preliminary site finding exercise and indicates an approximate wind speed of 6.51 – 8.51 m/s at 80 m (NB Wind Atlas, 2017; Figure 4-10) for the Regional area.

Several wind monitoring sensors were attached to a 110 m tall telecommunications tower (elevation of the tower base is 112.1 m above sea level) adjacent to the Project site in 2003. The sensors were placed at three varying heights. The calibrated NRGSystems™ sensors were connected to an NRG Symphonie™ datalogger that recorded measurements every 10 minutes. Recorded data included average values measured over the 10 minutes and values for standard deviation, minimum, and maximum. Based on the data collected, wind roses were created as discussed below.

To obtain an even more accurate understanding of wind patterns, a new meteorological mast was erected at the site in the summer and fall of 2019 as well as a LiDAR unit and SoDAR unit. The data collected from these instruments will confirm a more accurate representation of the wind resource for the Project site.

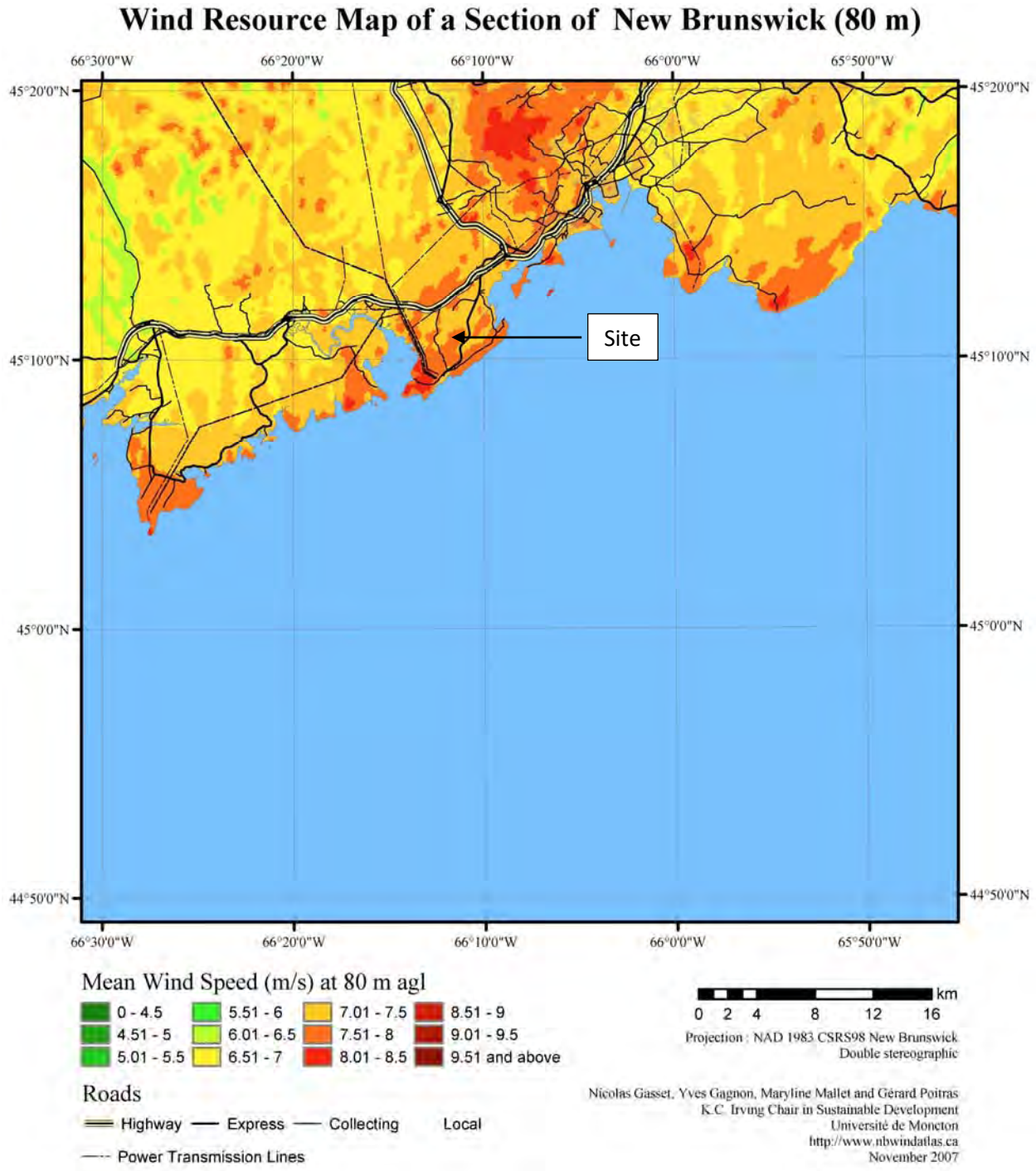

Figure 4-10: The Government of New Brunswick's wind atlas demonstrating the project site is located in an area with wind speeds between 6.51-8.5 m/s.

4.1.4.1 Wind Rose

An annual wind rose was generated from hourly data measured from the instrumentation installed on the communication tower at an elevation of 112.50 m in 2006 is shown in Figure 4-11.

Based on the analysis, winds generally blow from the west and southwest.

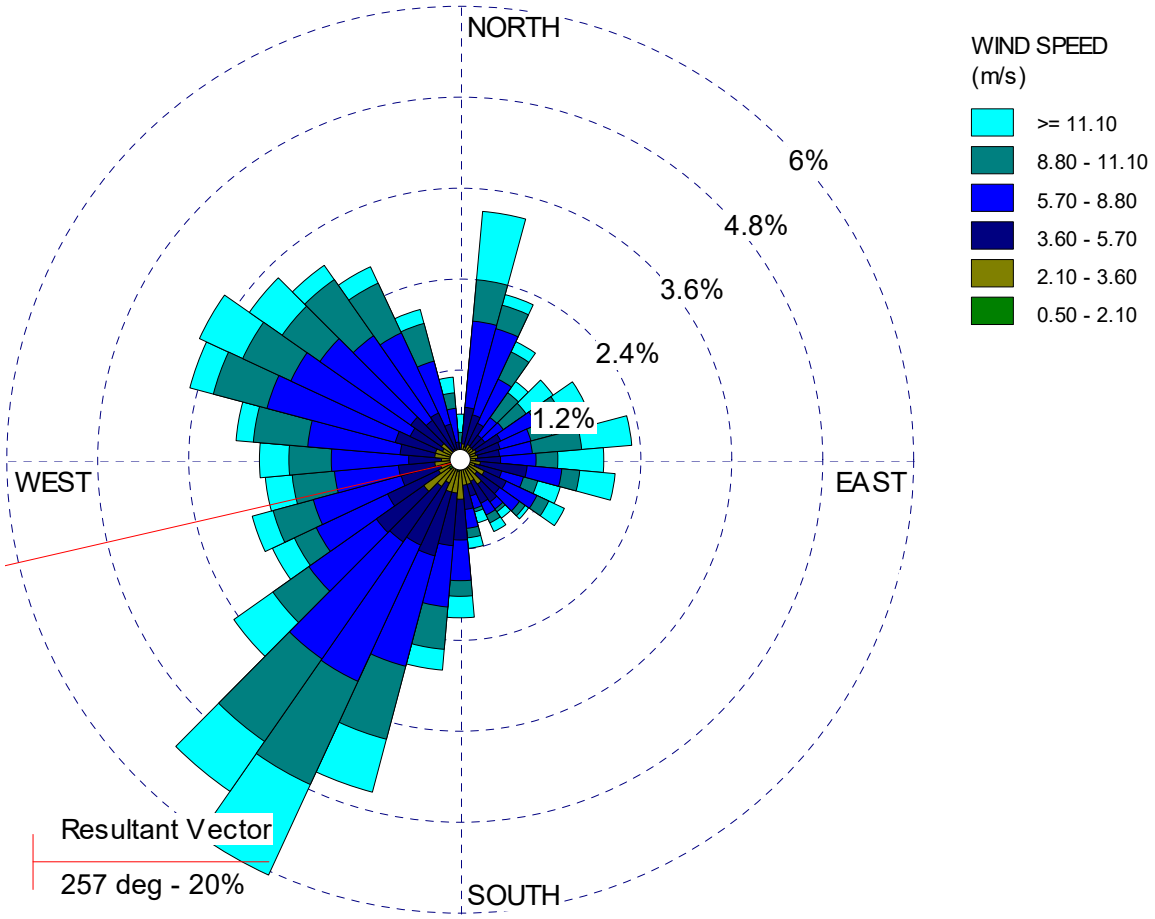

Figure 4-11: Annual wind rose was generated from hourly data measured at an elevation of 112.50 m in 2006.

4.1.5 *Existing Noise*

4.1.5.1 Existing Ambient Noise

The area proposed for the BWP is located in a rural industrial area. The area has extensive industrial disturbances including a waterline, a pipeline, three communication towers, several gravel pits, several transmission lines, and the Coleson Cove Generating facility and its auxiliary buildings. On a site visit on a clear day, industrial sounds can be heard throughout the Project site lands. There is also an active recreational ATV club that uses the lands. Due to the site elevation, wind resource, and industrial and recreational uses, ambient noise levels in the area are generally elevated. As the site was chosen in part due to the wind resource, particularly windy days can greatly increase existing ambient noise levels.

4.1.5.2 Low Frequency Sound and Infrasound

Low frequency sound is defined as sound with a frequency less than 200 Hertz (Hz) or cycles per second. Infrasound, also referred to as low-frequency sound, is sound that is not audible to humans, which is typically below a frequency of 20 Hz (HGC Engineering 2006).

Infrasound levels created by wind turbines are often comparable to the ambient levels prevalent in the natural environment, such as levels created by the wind itself. In terms of health, at sufficiently high levels, infrasound can be dangerous; however, it is grossly inaccurate to conclude that infrasound from wind turbines causes health risks (HGC Engineering 2006).

A study conducted by the Massachusetts Institute of Technology found that infrasound near wind turbines does not exceed audibility thresholds. Epidemiological studies have shown a relationship between living near turbines and annoyance. Annoyance seems strongly related to individual characteristics rather than noise from turbines. However, infrasound and low-frequency sound do not present unique health risks (McCunney et al., 2012).

4.1.6 *Existing Visual Aesthetics*

The landscape surrounding the BWP has many rolling hills and a few small residential neighbourhoods. The current visual aesthetics of the landscape can be viewed in the following photos (Figure 4-12 to Figure 4-13) which are later used to demonstrate how the landscape will change with the proposed turbines.

Figure 4-12: Landscape view in the direction of the turbines from Lorneville Church (Figure 4-14).

Figure 4-13: Landscape view in the direction of the turbines from the Lorneville Community Centre (Figure 4-14).

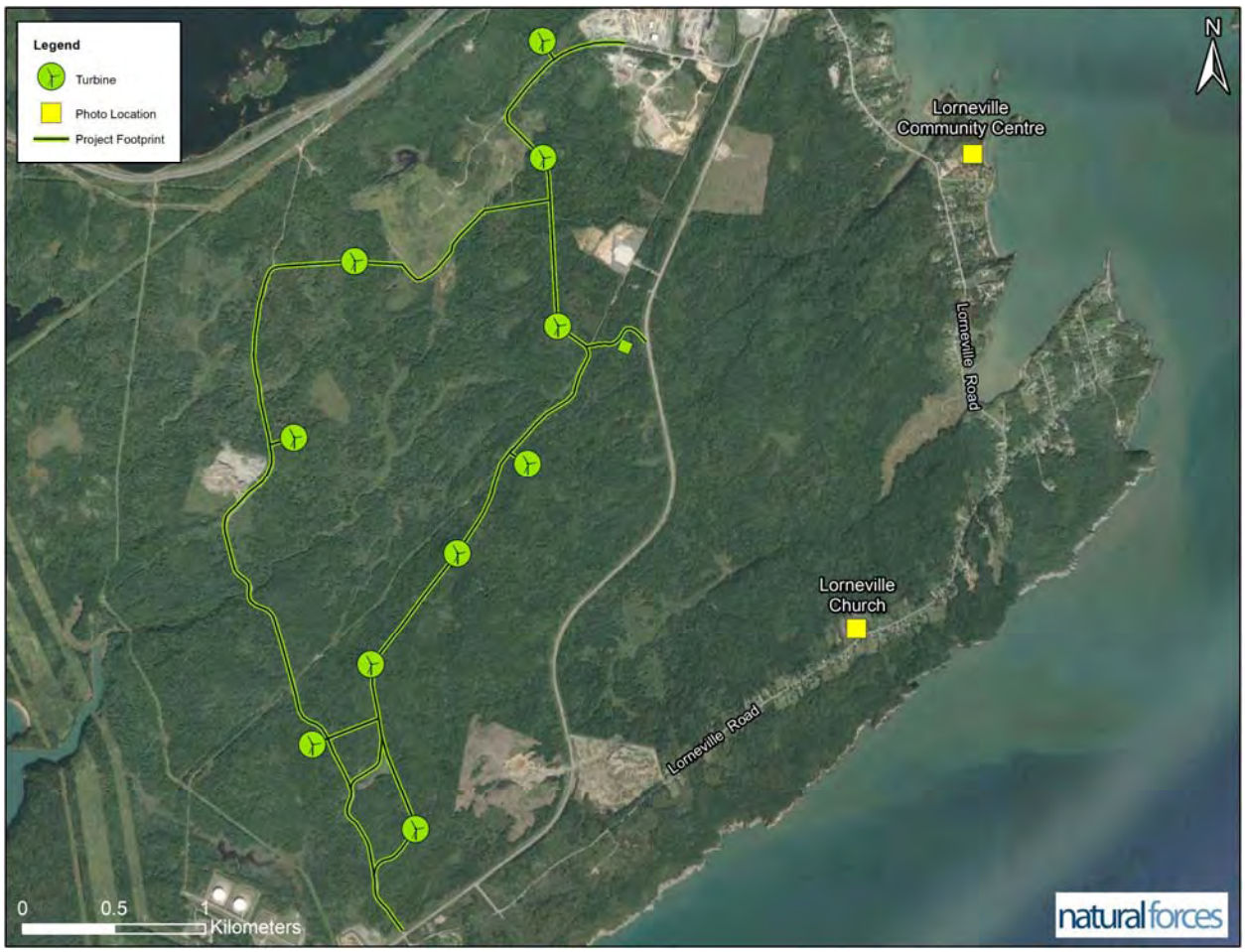

Figure 4-14: Locations where Photographs of existing landscape was taken to later depict the changing landscape with the addition of the turbines.

4.2 Existing Biophysical VECs

4.2.1 *Avian*

4.2.1.1 Previously Recorded Avian Species According to ACCDC Database

The ACCDC databases were queried for known observation data of avian species within close proximity of the Project site. There are observations for several designated species on or within close proximity (i.e., <5 km) to the Project site as shown in Figure 4-15.

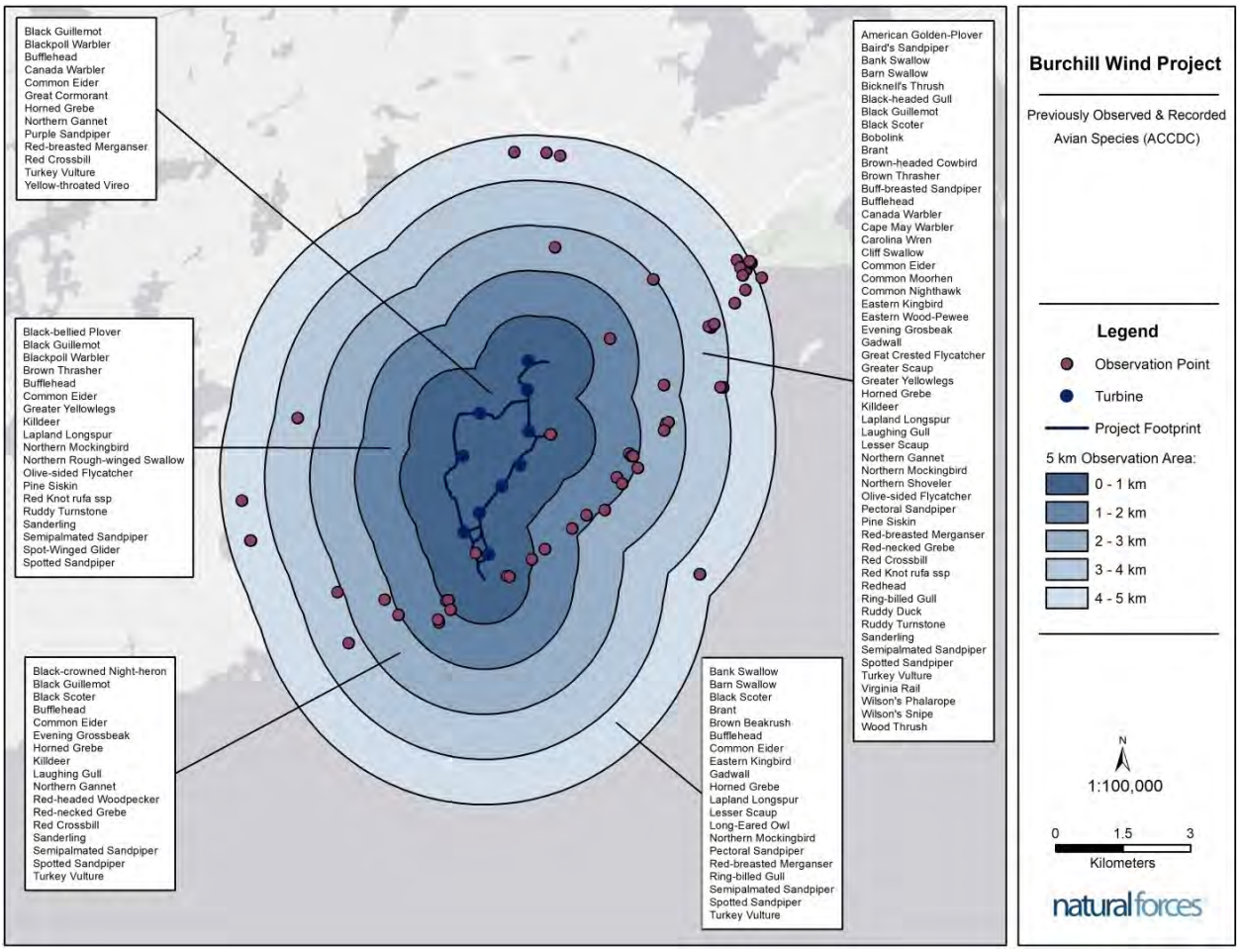

Figure 4-15: Recorded observations of avian species listed by the COSEWIC within a 5 km radius of The Burchill Wind Project site.

4.2.1.2 Observed Avian Species

Avian surveys were conducted within the area of the proposed Project during the spring, summer and fall of 2019. The results of the studies will be submitted in an addendum following the completion of the field surveys.

4.2.1.3 Avian Species at Risk

The ACCDC databases were queried for known observation data of provincial and federal avian species SAR or SOSCC within close proximity of the Project site. A copy of the ACCDC report is included in Appendix F. There are observations for several designated species on or within close proximity to the Project site as shown in Table 4-4 and Figure 4-16. The observations recorded by the ACCDC are not exact, but they do provide an initial understanding regarding the presence of SAR or SOCC. Ground-truthing exercises would be required to confirm/deny species presence/absence.

Table 4-4: Provincial and Federal SAR located in close proximity to the Burchill Wind Project site.

Common Name	Scientific Name	NB SARA Status	Federal SARA Status	COSEWIC
Barn swallow	*Hirundo rustica*	Threatened	Threatened	Threatened
Canada warbler	*Cardellina canadensis*	Threatened	Threatened	Threatened
Eastern wood-pewee	*Contopus virens*	Special Concern	Special Concern	Special Concern
Horned grebe (Western population)	*Podiceps auritus*	Special concern	Special Concern	Special Concern
Olive-sided flycatcher	*Contopus cooperi*	Threatened	Threatened	Threatened
Red knot *rufa* subspecies	*Calidris canutus rufa*	Endangered	Endangered	Endangered

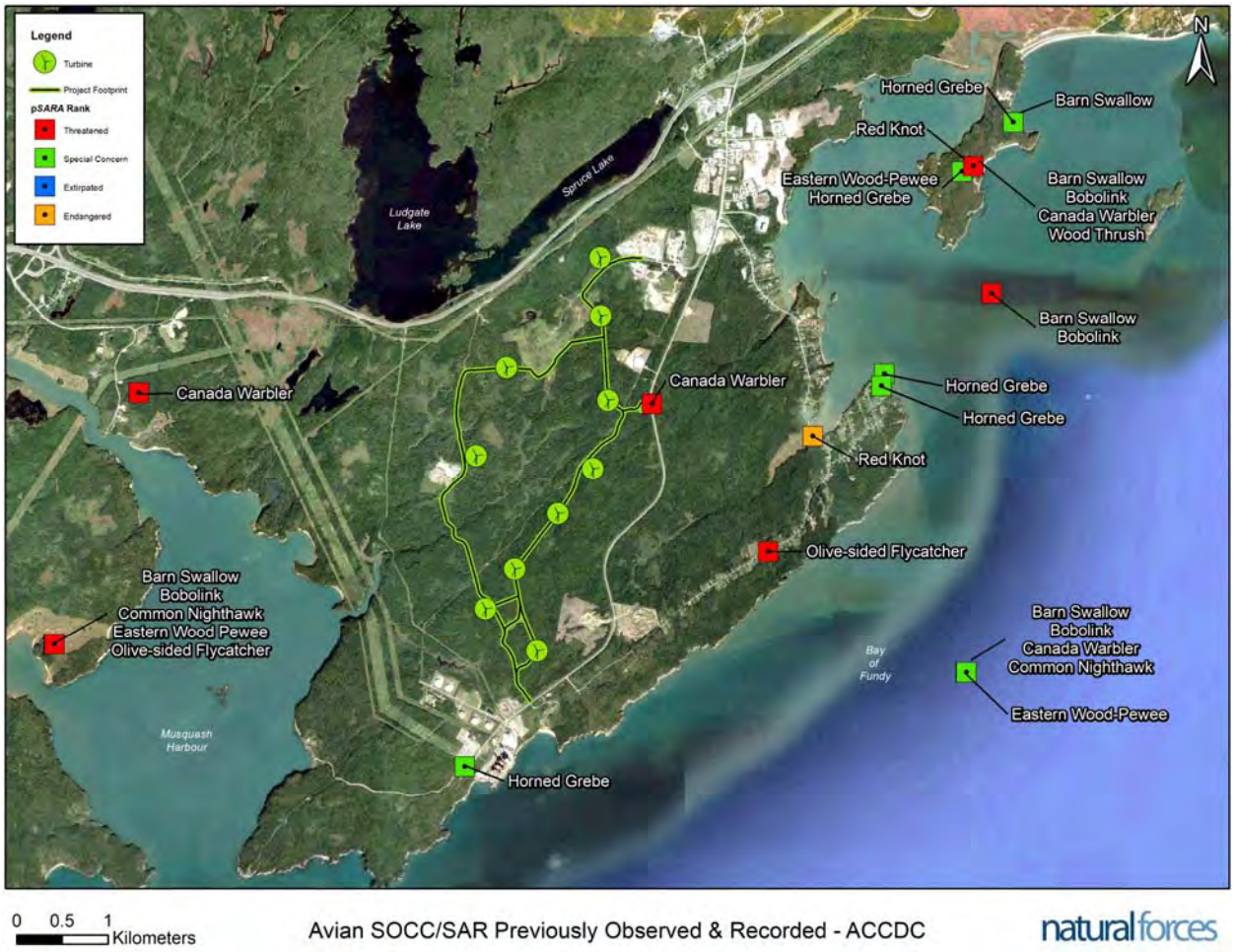

Figure 4-16: Observations of provincial and federal SOCC/SAR on or in the vicinity the Burchill Wind Project site.

4.2.1.3.1 Barn Swallow

The barn swallow is the most widespread swallow species in the world. The population of over 190 million individuals globally is considered stable. Because there have been considerable declines in the presence for the past several decades, the barn swallow is a federally and provincially listed threatened species. It is a distinctive passerine that has blue upperparts, a long, deeply forked tail that is curved, and pointed wings. It is commonly found in open areas with low vegetation, such as pasture, meadows, and farmland. They build a cup nest from mud pellets in barns or other similar structures and feeds on insects caught while in flight.

4.2.1.3.2 Canada Warbler

The Canada warbler is a small, brightly coloured songbird. Their numbers have plummeted in the majority of their nesting areas. Although most abundant in wet, mixed deciduous-coniferous forest with a well-developed shrub layer, it is found in a variety of forest types. It also prefers riparian shrub forests on slopes and in ravines and in old-growth forests with canopy openings and a high density of shrubs, as well as in regenerating forest stands. Because their habitat is being lost and degraded, their numbers continue

to be vulnerable to decline and hence the reasoning for their threatened ranking provincially and federally.

4.2.1.3.3 Eastern Wood-Pewee

The eastern wood-pewee is a small forest flycatcher. It was once thought to be a single species of the olive-sided flycatcher, but was later identified as a separate species. Adults are generally greyish-olive on their upper parts and pale on the under parts with pale bars on their wings. Males and females are similar in appearance. They have a distinctive, clear, three-part song, usually heard as "pee-ah-wee". It is generally found in the mid-canopy layer of forest clearings and at the edges of deciduous and mixed forests. Its habitat is threatened through various land-use activities, which is why it is listed as a species of special concern provincially and federally.

4.2.1.3.4 Horned Grebe

The horned grebe is listed provincially and federally as being of special concern. It is a small duck-like water bird that is not commonly observed in New Brunswick. Horned grebes generally nest in freshwater and occasionally in brackish water on small permanent or semi-permanent ponds, but it also uses marshes and shallow bays on lake borders. They generally winter in marine habitats, mainly estuaries and bays. Their diet consists primarily of aquatic insects and fish in the summer and fish, crustaceans, and marine worms in the winter. It is particularly vulnerable to changes in water quality near its breeding sites.

4.2.1.3.5 Olive-sided Flycatcher

The olive-sided flycatcher is a small, but stout songbird ranked as being threatened provincially and federally. They breed in scattered locations throughout most coniferous and mixed forests of Canada. Considerable declines in population have occurred due to habitat loss and alteration. These birds are most often found in open areas containing tall live trees or snags for perching. Those vantage points are required to suit their foraging habits. Open areas used comprise forest clearings, forest edges located near natural openings, such as rivers and swamps, logged areas, burned forest, or open areas within old-growth forests.

4.2.1.3.6 Red Knot

The red knot *rufa* subspecies is a medium-sized shorebird with a long straight bill, small head, long legs, and long tapered wings. They have an extreme migration route from the central Canadian Arctic to the southern tip of South America. One of the most important areas for these migrants is the north shore of the St. Lawrence. The primary reason for their precipitous decline is the overfishing of horseshoe crabs in Delaware Bay, which they feed upon prior to their final push into the Canadian Arctic. Migratory stopovers include vast coastal zone sand flats and mudflats. Federally and provincially, the red knot *rufa* is ranked as an endangered species.

4.2.2 *Bats*

Little brown bats (*Myotis lucifugus*), northern bats *(M. septentrionalis*), and tri-colored bats (*Perimyotis subflavus*) are known to have been seen in and around the Saint John area. All three are small-bodied bats typical of the plain-nosed bats and all three are listed provincially and federally as being endangered.

These insectivores live in three different roosting sites: day roosts, night roosts, and hibernation roosts. Hibernation roosting populations have been decimated in recent years. It is estimated that about 6.5 million bats of several species, but primarily the little brown bat, have died in eastern Canada and the northeastern US as a result of white-nose syndrome. Populations in some hibernacula have fallen by more than 75%. Species modelling has shown that this species could be extirpated by 2030 if declines continue. Their precipitous declines have resulted in their endangered ranking.

There are at least five recorded caves in the Saint John area: Howes/Olivers, Owen's, Harbells, Greenhead, and Fosters/Lions Den. Dr. Donald McAlpine, head of the Department of Natural Science at the New Brunswick Museum and one of the region's foremost experts on bats, was contacted regarding the use of these caves as hibernacula and to comment on the presence of any other hibernacula in the area. Only two of the nearby caves, Howes and Harbells, are used as hibernacula. Both caves are also deemed ESAs by the Province. A 5 km setback was applied to both of these caves as shown in Figure 4-17. Lastly, no observations of potential bat hibernacula were identified in the Project study area during site visits and field surveys.

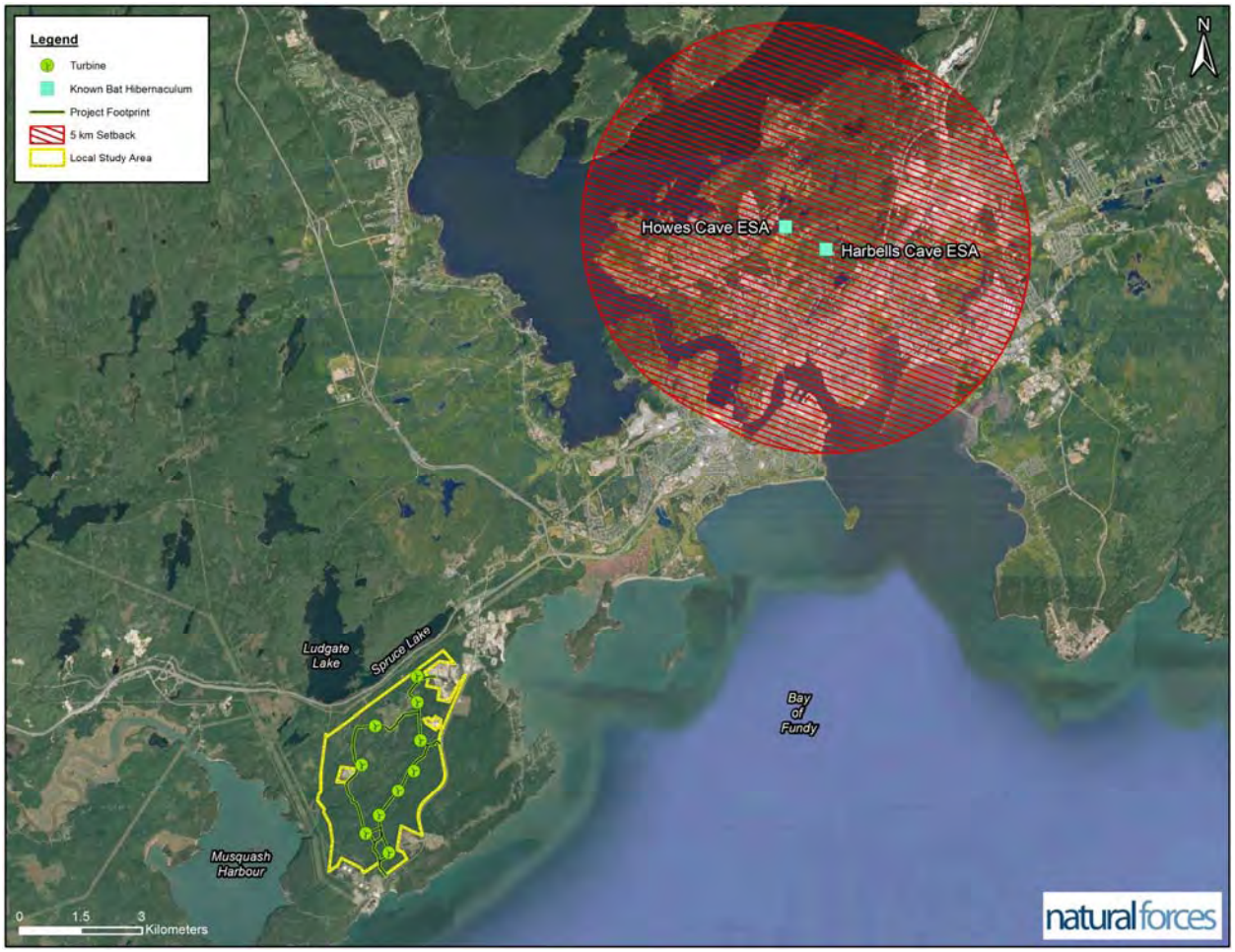

Figure 4-17: Bat hibernacula in the vicinity of the Burchill Wind Project site.

4.2.2.1 Previously Recorded Bat Species According to ACCDC Database

The ACCDC databases were queried for known observation data of provincial and federal bat SAR or SOSCC within close proximity of the Project site. Although the ACCDC reports did not yield any bat observations, as discussed in Section 4.2.2, Little brown bats, northern bats, and tri-coloured bats are known to have been seen in and around the Saint John area.

4.2.2.2 Observed Bat Species

At the time of this report, the acoustic bat surveys were ongoing. The final reported data will identify the mean number of bats passing per detector and per detector period (e.g., breeding and migration). Once analyzed, the data will provide temporal and seasonal peaks in bat activity.

4.2.2.3 Bat Species at Risk

As mentioned previously, little brown bats, northern bats, and tri-colored bats are known to have been seen in and around the Saint John area, and all three are listed provincially and federally as being

endangered. The presence/absence of bat species within the Project study area will be confirmed following the field study results to be submitted as an addendum.

4.2.3 *Wetlands and Watercourses*

The area of lands where ground-truthing delineation exercises were completed is approximately 315 ha while the area of lands where aerial interpretation with spot ground-truthing delineation exercises were completed is about 215 ha (i.e., total survey area ~530 ha). Some delineation work was also completed outside of the survey areas. Figure 4-18 shows the survey areas on the Project lands. It should be noted that ground-truthing primarily followed the anticipated project layout at that time. Following ground-truthing, further micro-siting of the turbines occurred to minimize impact of wetland features identified and delineated in field. Because of that, the ground-truthed areas stray somewhat from some of the turbine locations (e.g., turbine 8, etc.). As previously mentioned, it is expected that additional ground-truthing delineation exercises will be done in spring 2020 to confirm the aerial interpretation with spot ground-truthing delineation exercises.

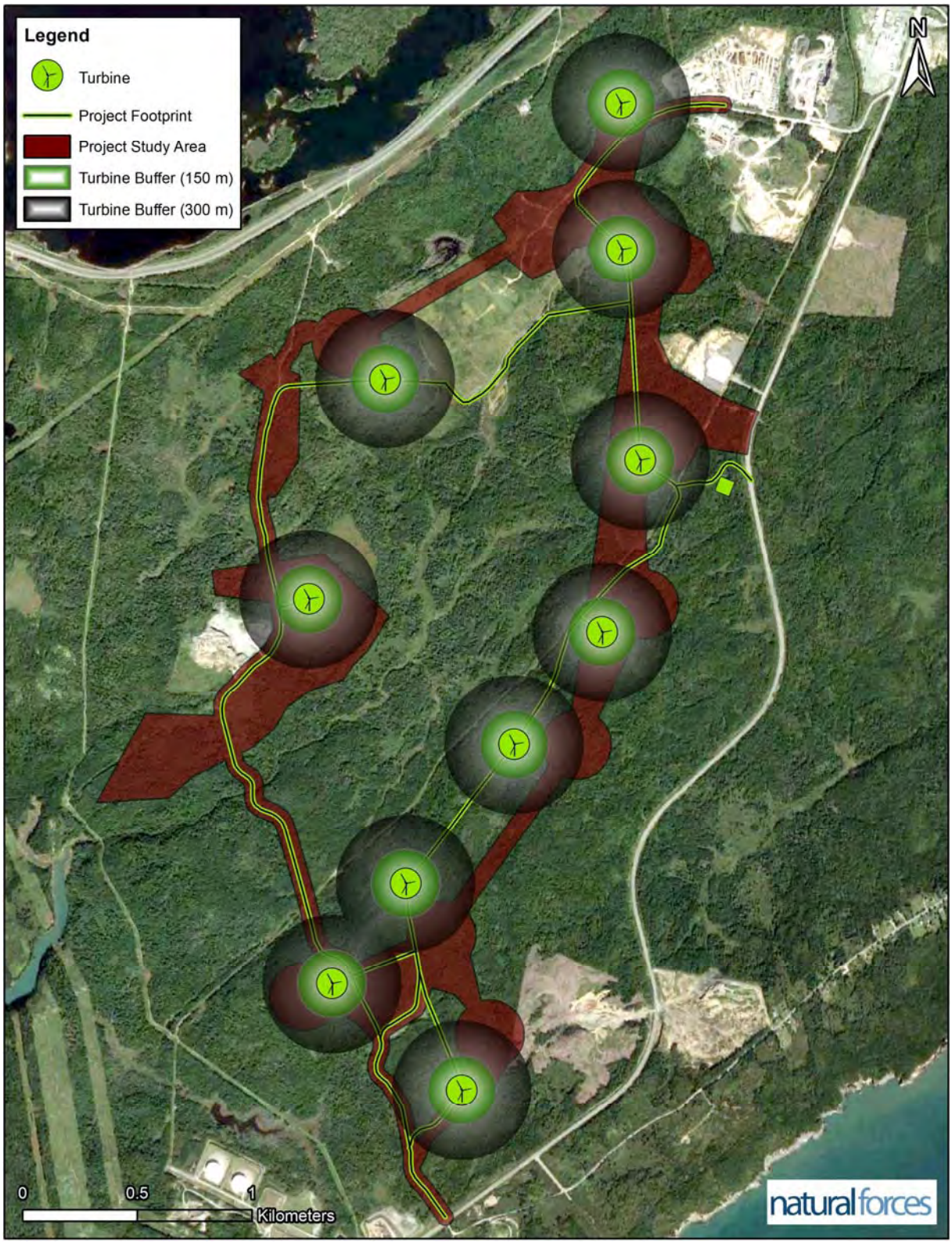

Figure 4-18: Aerial photograph showing the survey areas for the Burchill Wind Project site

4.2.3.1 Habitats Observed

The survey area is located in the Fundy Coastal Eco district of the Fundy Coast Ecoregion (Ecosystem Classification Working Group, 2007). The Fundy Coast Ecoregion spans the entire southern coastline of New Brunswick along the Bay of Fundy from the east side of Passamaquoddy Bay to the east side of Shepody Bay. A mainly coniferous forest, dominated by red spruce, balsam fir, black spruce, white spruce, and tamarack, thrives in the cool, moist climate of the Ecoregion. Cedar is a dominant species in the limestone-derived soils around Saint John. The most common hardwood species include heart-leaved birch, mountain ash, red maple, and some yellow birch. The Fundy Coast Ecoregion also has a rich diversity of wetlands.

4.2.3.2 Watercourse Assessment Results

GeoNB mapping shows four named watercourses within the boundaries of the overall site (Figure 4-19):

- Burchill's Brook;
- Frenchman's Creek;
- Mill Creek; and
- Marsh Brook.

All are second order watercourses. Burchill's Brook and Frenchman's Creek fall within the Musquash River watershed whereas Mill Creek and Marsh Brook drain directly to the Bay of Fundy. Although not confirmed through field assessments, it is believed that the main stems of all these watercourses are salmonid-bearing and support fish habitat. There are also several unnamed watercourses that appear within the GeoNB mapping database (Figure 4-19).

Depth to bedrock across the Project lands is typically only a few centimetres below the surface and the soils atop the bedrock are poorly drained clays. As a result, many watercourses are present on the lands. Watercourses were delineated in the field between August 19 and October 15, 2019. Those watercourses are shown in Figure 4-20. Detailed information for each watercourse is provided in Appendix G, which includes all photographs taken during the field program.

Overall, 74 watercourses were identified and delineated within the survey area. Most of the watercourses delineated are ephemeral and likely do not support fish and/or fish habitat. Other than Burchill's Brook (BB), Frenchman's Creek (FC), Mill Creek (MC), and Marsh Brook (MB), the only watercourse delineated in the field where fish were observed was Maguires Cove Brook (MCB). Several brook trout (*Salvelinus fontinalis*) were observed in pools below the outlet from the wetland connected to MCB.

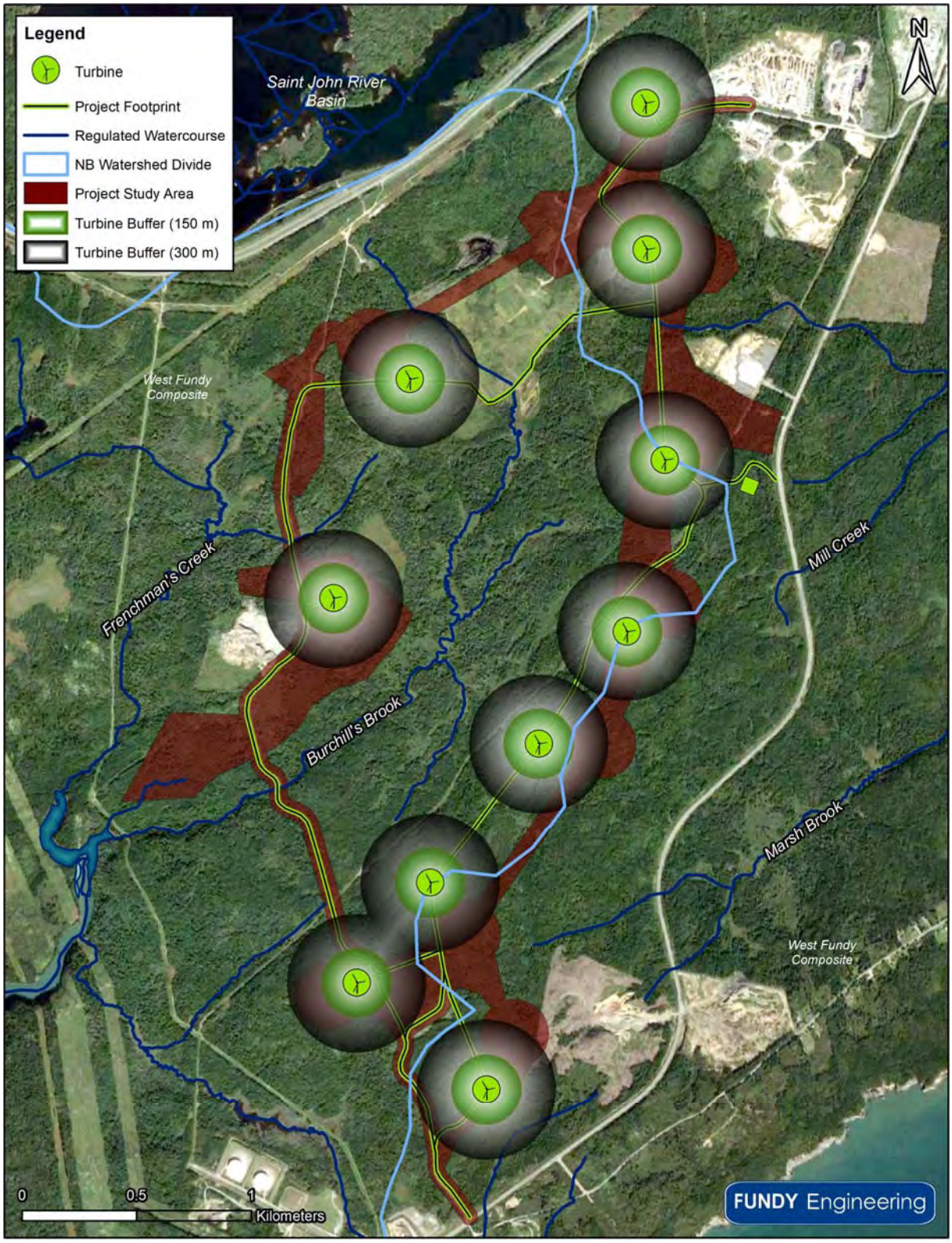

Figure 4-19: Mapped watercourses present on the Burchill Wind Project site.

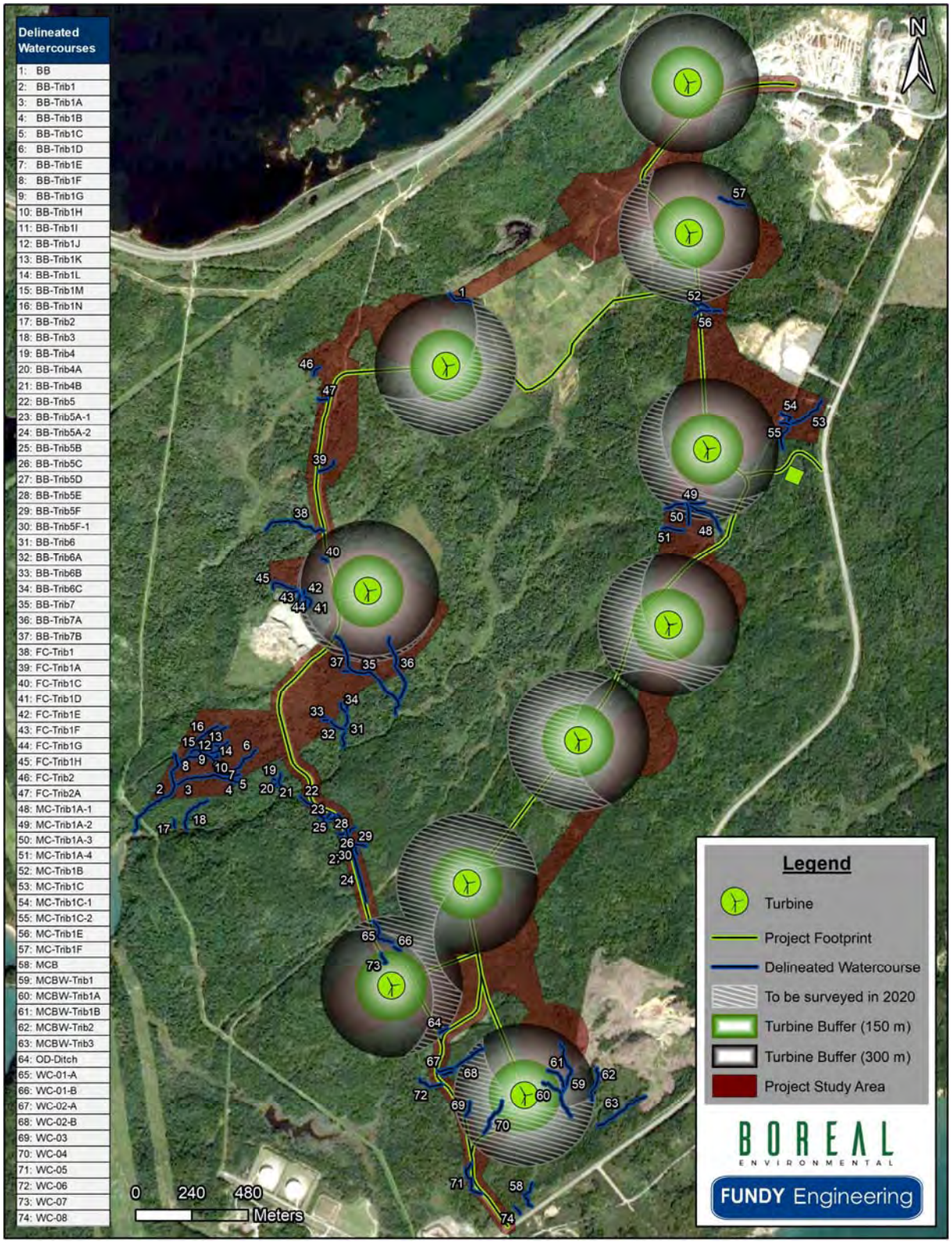

Figure 4-20: Watercourses delineated in the field for the Burchill Wind Project site.

Table 4-5: Characteristics of the watercourses identified within the survey area of the Burchill Wind Project site

Map ID	Unique ID	Width (cm)	Depth (cm)	Substrate	Flow	Streamside Vegetation	Fish Presence (Observed / Possible / Unlikely)	Comments
1	BB	100 to 300	15 to 100+	Cobble with sand and gravel	Perennial	Good	Observed	
2	BB-Trib1	60 to 180	5 to 15	Exposed bedrock and angular cobble to boulders with heavy siltation in between	Perennial	Excellent	Possible	Considerable woody debris
3	BB-Trib1A	15 to 90	5 to 15	Exposed bedrock and angular rocks with heavy siltation in between	Ephemeral	Excellent	Unlikely	Woody debris and overhanging vegetation are extensive
4	BB-Trib1B							
5	BB-Trib1C							
6	BB-Trib1D							
7	BB-Trib1E							
8	BB-Trib1F							
9	BB-Trib1G							
10	BB-Trib1H							
11	BB-Trib1I							
12	BB-Trib1J							
13	BB-Trib1K							
14	BB-Trib1L							
15	BB-Trib1M							
16	BB-Trib1N							
17	BB-Trib2	10 to 15	5	Silt and some exposed bedrock	Ephemeral	Good	Unlikely	At the top of the slope it flows for about 30 m before gong subterranean and the channel is lost
18	BB-Trib3	20 to 30	10	Silt and some exposed bedrock	Ephemeral	Fair	Unlikely	Flows through an open forest area that has a large deer / moose hunting blind adjacent to it
19	BB-Trib4	10 to 20	5 to 10	Silt and exposed bedrock	Ephemeral	Good	Unlikely	Deeply incised channels and flows down a steep bank to Burchill's Brook
20	BB-Trib4A							
21	BB-Trib4B							
22	BB-Trib5	30 to 120	10 to 25	Silt with some exposed angular cobble and boulders	Perennial	Good	Unlikely	Wetlands and groundwater are the source of this watercourse
23	BB-Trib5A-1	30	5 to 10	Silt	Ephemeral	Good	Unlikely	
24	BB-Trib5A-2	60 to 150	10 to 40	Silt and angular cobble and boulders	Perennial	Good	Unlikely	Ditch along the eastern side of Burchill Road that collects water from several watercourses and wetlands
25	BB-Trib5B	30	5 to 10	Silt	Perennial	Good	Unlikely	Drains water from eastern side of Burchill Road to the western side
26	BB-Trib5C							
27	BB-Trib5D							
28	BB-Trib5E	30	5 to 10	Silt	Ephemeral	Good	Unlikely	
29	BB-Trib5F	45	5	Silt	Ephemeral	Good	Unlikely	Flows along an old wood's road (*i.e.,* within former wheel ruts)
30	BB-Trib5F1	30	5 to 10	Silt	Ephemeral	Good	Unlikely	
31	BB-Trib6	30 to 50	10	Silt	Ephemeral	Good	Unlikely	
32	BB-Trib6A							
33	BB-Trib6B							
34	BB-Trib6C							

Map ID	Unique ID	Width (cm)	Depth (cm)	Substrate	Flow	Streamside Vegetation	Fish Presence (Observed / Possible / Unlikely)	Comments
35	BB-Trib7	30 to 250	5 to 30	Mostly silt with pebbles to boulders intermixed	Perennial	Excellent	Possible	Considerable woody debris; picks up groundwater along its highly sinuous flowpath
36	BB-Trib7A	10 to 60	5 to 15	Silt with some exposed angular cobble to boulders	Ephemeral	Excellent	Unlikely	A small forested wetland is the source, but collects groundwater as it flows and is subterranean in some locations
37	BB-Trib7B	10 to 50	5 to 15	Silt	Ephemeral	Excellent	Unlikely	Collects water from old-growth cedar stand; considerable woody debris
38	FC-Trib1	30 to 200	10 to 50	Silt with some cobble to boulders in steeper gradients	Perennial	Fair	Likely	Drains pond with former beaver activity
39	FC-Trib1A	10 to 50	5 to 10	Silt	Ephemeral	Fair	Unlikely	
40	FC-Trib1C	10 to 80	5 to 10	Silt	Ephemeral	Excellent	Unlikely	Drains surfacewater runoff and groundwater from upgradient quarry / gravel pit; excellent streamshade and considerable woody debris
41	FC-Trib1D							
42	FC-Trib1E							
43	FC-Trib1F							
44	FC-Trib1G							
45	FC-Trib1H							
46	FC-Trib2	To be confirmed in Spring 2020			Ephemeral		Unlikely	
47	FC-Trib2A	To be confirmed in Spring 2020			Ephemeral		Unlikely	
48	MC-Trib1A-1	100	5 to 10	Cobble and gravel	Ephemeral	Good	Unlikely	
49	MC-Trib1A-2							
50	MC-Trib1A-3							
51	MC-Trib1A-4							
52	MC-Trib1B	75 to 100	10 to 20	Sand and silt	Perennial	Good	Possible	
53	MC-Trib1C	30 to 250	5 to 40	Silt and angular cobbles and boulders	Perennial	Excellent	Possible	Considerable woody debris; wetlands are its source
54	MC-Trib1C-1	30 to 45	5 to 25	Silt and angular gravel to boulders	Ephemeral	Good	Unlikely	
55	MC-Trib1C-2	30 to 45	5 to 25	Silt and angular gravel to boulders	Ephemeral	Good	Unlikely	Drains a large wetland to Mill Creek; flows across the Pipeline ROW road
56	MC-Trib1E	30 to 45	5 to 25	Silt and angular gravel to boulders	Ephemeral	Good	Unlikely	
57	MC-Trib1F	30 to 45	5 to 25	Silt and angular gravel to boulders	Ephemeral	Good	Unlikely	
58	MCB	120 to 300	10 to 45	Fines with angular gravel to boulders	Perennial	Excellent	Observed	Considerable woody debris; brook trout were observed
59	MCBW-Trib1	50 to 150	5 to 20	Silt with angular gravel to boulders	Ephemeral	Good	Unlikely	Considerable number of downed trees and woody debris; flows through a mature cedar forest
60	MCBW-Trib1A	50 to 150	5	Silt with angular gravel to boulders	Ephemeral	Good	Unlikely	Sourced from an upslope forested wetland
61	MCBW-Trib1B	50 to 150	5	Silt with angular gravel to boulders	Ephemeral	Good	Unlikely	Considerable woody debris; flows down steep bank
62	MCBW-Trib2	50 to 200	5	Silt with angular gravel to boulders	Ephemeral	Good	Unlikely	Dry at time of delineation
63	MCBW-Trib3	50 to 300	5 to 15	Silt with angular gravel to boulders	Ephemeral	Good	Unlikely	In some locations the watercourse appears to flow adjacent to an old roadbed
64	OD-Ditch	60 to 100	5	Silt and garbage	Ephemeral	Fair	Unlikely	Drainage ditch adjacent to roadway into former dumping area; drains to ditch along Burchill Road
65	WC-01-A	30 to 45	5 to 10	Silt with some angular cobble and boulders	Ephemeral	Fair	Unlikely	Flows along the surface in some areas and subterranean in others; some water flow comes from drainage ditch along Burchill Road
66	WC-01-B							
67	WC-02-A	40 to 250	10 to 20	Silt and angular cobbles and boulders	Ephemeral	Good	Unlikely	Follows a portion of an old wood's road; sourced by a forested wetland; some portions of channel are subterranean
68	WC-02-B							
69	WC-03	60 to 100	5 to 10	Silt and angular cobbles and boulders	Ephemeral	Excellent	Unlikely	
70	WC-04	20 to 60	5 to 15	Silt and angular cobbles and boulders	Ephemeral	Good	Unlikely	

Map ID	Unique ID	Width (cm)	Depth (cm)	Substrate	Flow	Streamside Vegetation	Fish Presence (Observed / Possible / Unlikely)	Comments
71	WC-05	30 to 70	5 to 15	Silt	Ephemeral	Good	Unlikely	Appears to be sourced by the drainage ditch along the western side of Burchill Road; flows into the woods, flows through the woods, then back alongside the road
72	WC-06	20 to 40	5 to 15	Silt	Ephemeral	Good	Unlikely	Sourced from ditch along Burchill Road and drains to wetland
73	WC-07	20 to 40	5 to 10	Silt	Ephemeral	Good	Unlikely	A tributary to Maguires Cove Brook
74	WC-08	20 to 50	10 to 15	Silt	Ephemeral	Excellent	Unlikely	

4.2.3.2.1 *Watershed Protected Areas*

Thirty-six percent (36%) of New Brunswick's population is reliant on surface water sources for supplying domestic freshwater. Some municipalities that supply potable water to residents obtain that water from surface water sources. The Watershed Protected Area Designation Order of the New Brunswick Clean Water Act protects many of those surface water sources. Watersheds designated under the Order are afforded three protection zones (Table 4-6).

There are three protected watersheds within the City of Saint John: the East and West Musquash Watershed, the Loch Lomond Watershed, and the Spruce Lake Watershed. There are no setbacks from watershed protected areas for wind turbines. Instead, the wind turbines should be sited outside of watershed protected areas. Although the Spruce Lake Watershed forms part of the northern boundary of PID 00412189 (Figure 4-21), there is no overlap between the Project infrastructure and the three protection zones of that watershed.

Table 4-6: Summary of the designated setback zones and activities restricted in those setback zones as per the Watershed Protected Designation Order of the New Brunswick Clean Water Act.

Zone	Details	Restricted Activities*
A	The watercourse	• Recreational water use activities for waterfront owners/occupants only • Swimming at public beaches only • Motorized boating prohibited
B	A 75 m setback (at perimeter of the watercourse)	• No new residential development • Size restrictions on renovations/additions to existing dwellings • No new agriculture operations • Existing agriculture operations permitted with restrictions • Mineral exploration only • No clear-cutting • Selection harvest silviculture and pesticide application permitted with restrictions • Shoreline protection permitted with appropriate permits
C	Balance of watershed	• Residential development is permitted • No effluent discharge from mining or aquaculture is permitted • Maximum clearcut size of 25 ha and further buffer and adjacency delay requirements • No new agriculture operations • Restrictions on land clearing, manure storage and spreading, and there are soil conservation practices • No new landfills, asphalt plants, bulk storage of fuels/PCBs, septic treatment plants and/or lagoons, commercial, industrial, and/or institutional development

*For a complete list, the Guide to New Brunswick's Watershed Protected Area Designation Order (DELG, Undated) should be consulted.

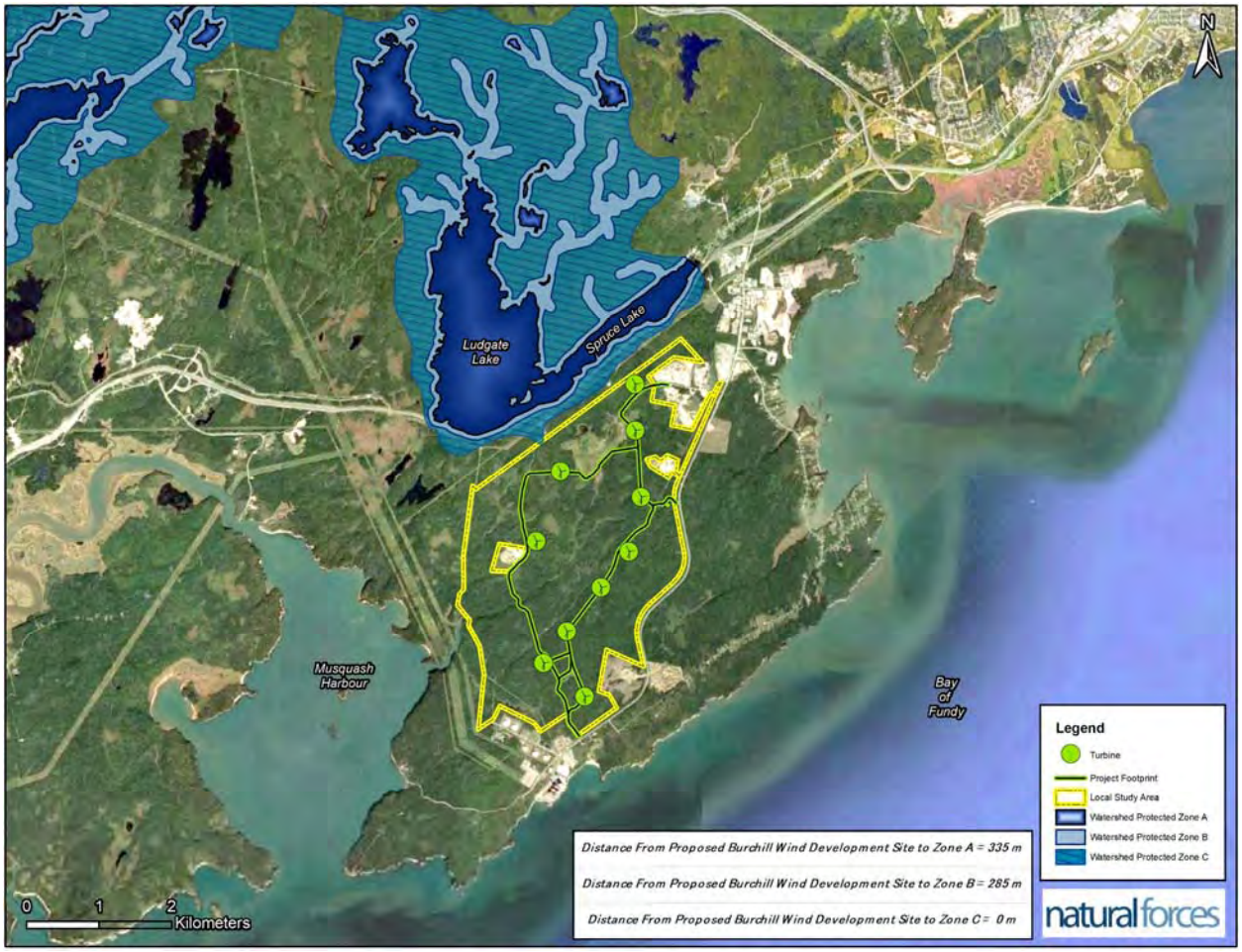

Figure 4-21: Proximity of the Spruce Lake Protected Watershed to the Burchill Wind Project site.

4.2.3.3 Wetland Assessment Results

GeoNB mapping shows several large wetlands within the boundaries of the property (Figure 4-22). Several of the wetlands are contiguous with on-site watercourses, such as Burchill's Brook, Frenchman's Creek, Mill Creek, and Marsh Brook. The wetlands at the mouth of each of those aforementioned watercourses are considered provincially significant because they are tidal wetlands. These provincially significant wetlands are located outside of the Project lands. Wetlands were delineated in the field between August 19 and October 15, 2019. Those wetlands are shown in Figure 4-23: and summarized in the sections below.

Soils within the local study area are extremely shallow and sit atop bedrock. Wicklund and Langmaid (1953) described the soils in the area as Lorneville silty clay loam derived from marine deposits. The Lorneville series comprises red coloured fine-textured soils occurring along the coast. The soils are described as being poorly drained. Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. These conditions are consistent across the site. Because of this, digging test pits and assessing the soils was considered above and beyond

considering the landscape. Representatives with the DELG and DNRED were consulted in a meeting with Natural Forces on 9 October 2019, and agreed that test pitting was not required for soils assessments.

The majority of the wetland boundaries were delineated in the field. However, given the size of the survey area, some of the wetland boundaries were interpreted using aerial photography and LIDAR data with spot ground-truthing. Those aerial interpreted boundaries are represented as dashed lines on the mapping of the survey area. As mentioned previously, following field studies and the discovery of unmapped wetlands, the proposed turbine locations were optimized to avoid or minimize impacts to those wetlands. This resulted in some locations not having been ground-truthed. It is expected that the Project Footprint boundary will be confirmed in the field during the 2020 field season.

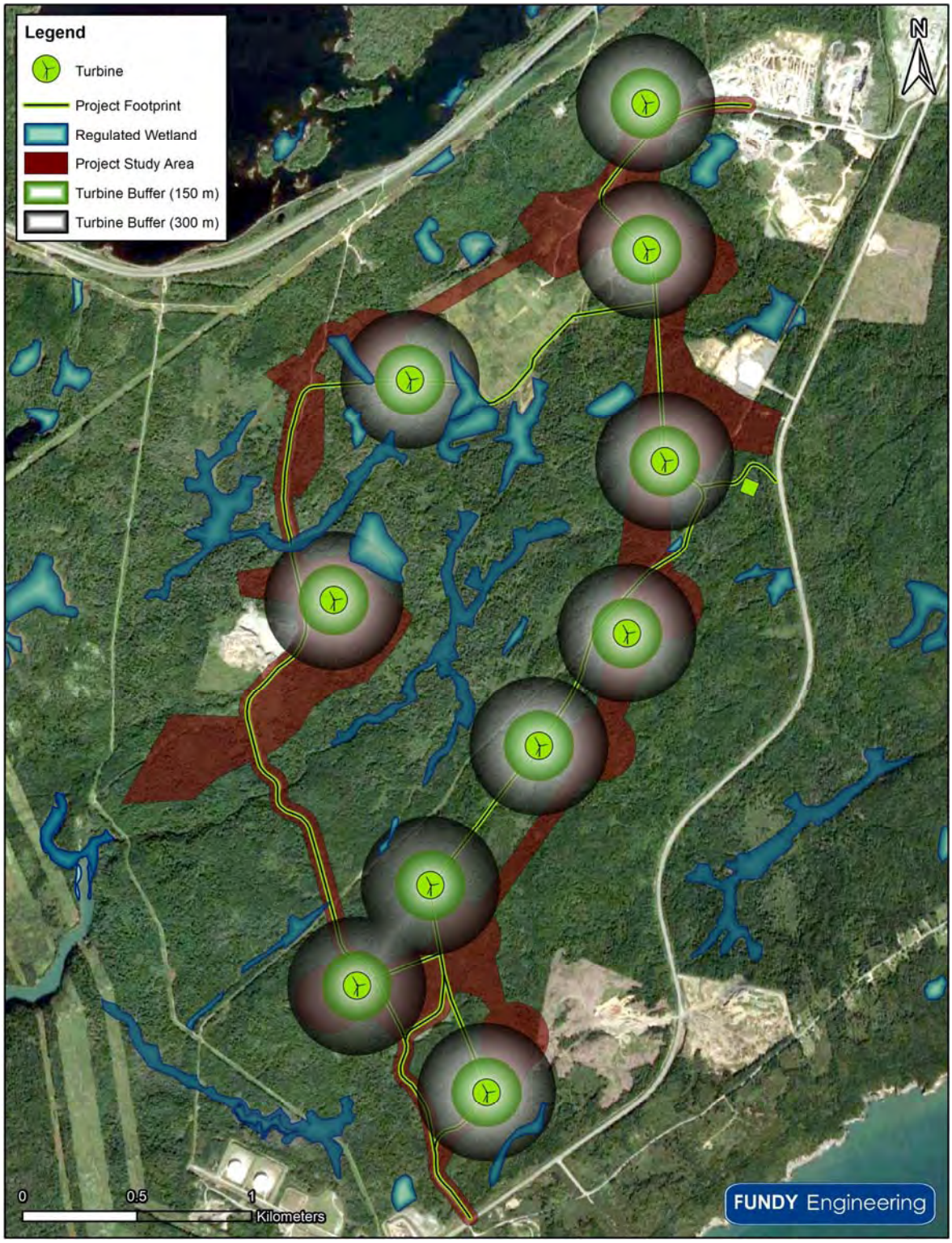

Figure 4-22: Mapped wetlands present on the Burchill Wind Project site (n.b., turbines depicted on the map is not representative of the size of the turbine on the ground).

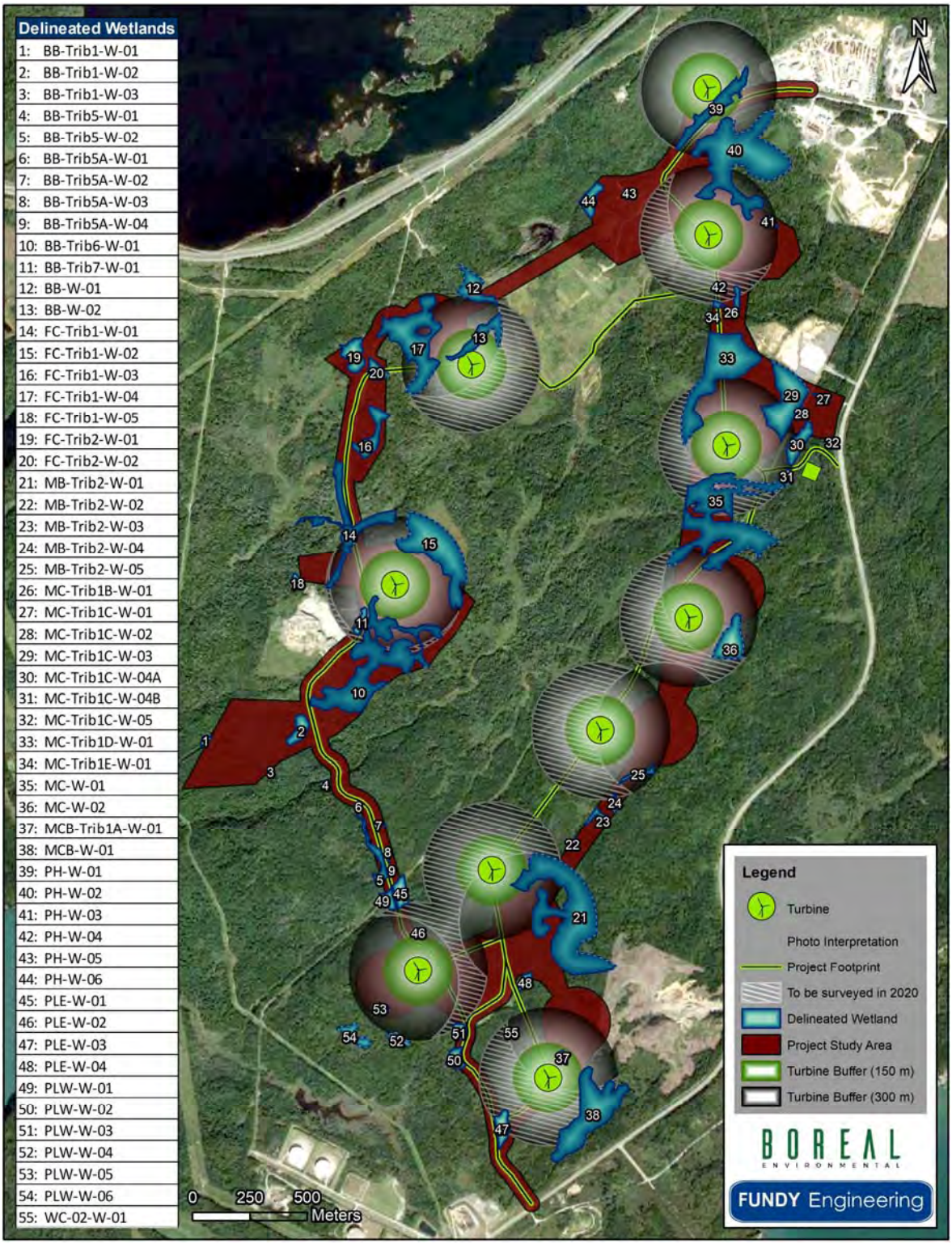

Figure 4-23: Wetlands delineated in the field within the survey area of the Burchill Wind Project site (n.b., dashed lines represent survey limits and not necessarily the edge of the mapped wetland. Turbines depicted on the map is not representative of the size of the turbine on the ground).

4.2.3.3.1 *Smaller Wetlands*

For this Project, wetlands <0.5 ha in size are considered small wetlands. Upland versus wetland detailed paired point analyses and Wetland Functional Assessment (WFA) were not completed for small wetlands. Instead, information gathered from the large nearby wetlands (≥0.5 ha) were used for delineating the wetland boundaries.

A total of 27 small wetlands with a total area of 3.45 ha were delineated within the Project study area (Table 4-7). Overall, there is a fairly even mix of small tall shrub swamps and coniferous swamps located within the Project study area.

Table 4-7: Summary of small wetlands (<0.5 ha) delineated on the Burchill Wind Project site.

Map ID	Unique ID*	Classification	Size (ha)
1	BB-Trib1-W-01	Black spruce tall shrub swamp	0.118
3	BB-Trib1-W-03	Coniferous riparian linked swamp	0.034
4	BB-Trib5-W-01	Coniferous riparian linked swamp	0.041
6	BB-Trib5A-W-01	Coniferous riparian linked swamp	0.038
7	BB-Trib5A-W-02	Coniferous riparian linked swamp	0.036
8	BB-Trib5A-W-03	Coniferous basin swamp	0.026
9	BB-Trib5A-W-04	Coniferous basin swamp	0.030
18	FC-Trib1-W-05	Tall shrub swamp	0.207
22	MB-Trib2-W-02	Coniferous basin swamp	0.055
23	MB-Trib2-W-03	Coniferous basin swamp	0.377
24	MB-Trib2-W-04	Coniferous basin swamp	0.123
25	MB-Trib2-W-05	Coniferous basin swamp	0.222
27	MC-Trib1C-W-01	Tall shrub swamp	0.194
28	MC-Trib1C-W-02	Coniferous swamp	0.025
31	MC-Trib1C-W-04B	Tall shrub swamp	0.096
32	MC-Trib1C-W-05	Tall shrub swamp	0.039

Map ID	Unique ID*	Classification	Size (ha)
34	MC-Trib1E-W-01	Riverine tall shrub swamp	0.018
37	MCB-Trib1A-W-01	Balsam fir riparian linked slope swamp	0.203
41	PH-W-03	Coniferous basin swamp	0.207
42	PH-W-04	Tall shrub swamp	0.069
43	PH-W-05	Tall shrub basin swamp	0.029
46	PLE-W-02	Tall shrub riparian linked swamp	0.045
48	PLE-W-04	Coniferous basin swamp	0.304
51	PLW-W-03	Coniferous basin swamp	0.356
52	PLW-W-04	Tall shrub swamp	0.307
53	PLW-W-05	Tall shrub swamp	0.211
55	WC-02-W-01	Mixed forest riparian linked slope swamp	0.040

*BB = Burchill's Brook; Trib = Tributary; W = Wetland; FC = Frenchman's Creek; MB = Marsh Brook; MC = Mill Creek; MCB = Maguires Cove Brook; PH = Paddy's Hill; PLE = PipeLine East; PLW = PipeLine West; WC = Watercourse

4.2.3.3.2 *Large and / or Distinctive Wetlands*

For this Project, wetlands ≥0.5 ha in size are considered large wetlands. Distinctive wetlands are those small wetlands that displayed some noteworthy feature in the field such as being the source of a perennial tributary, being located in a highly disturbed area, etc. Upland versus wetland detailed paired point analyses and functional assessments were completed for all large and/or distinctive wetlands. A summary of the results is provided below (Table 4-8) and comprehensive information can be found in Appendix G.

Overall, 28 large and/or distinctive wetlands with a combined area of 76.5 ha were delineated within the survey area. Five wetlands still require detailed ground-truthing to be completed in spring 2020 and include:

- BB-W-01 (Map ID 12);
- FC-Trib1-W-03 (Map ID 16);
- MC-W-02 (Map ID 36);
- PH-W-06 (Map ID 44); and
- PLW-W-06 (Map ID 54).

Table 4-8: Summary of large wetlands (>0.5 ha) and/or distinctive wetlands delineated on the Burchill Wind Project site.

Map ID	Unique ID*	Classification	Size (ha)
2	BB-Trib1-W-02	Eastern white cedar tall shrub swamp	0.681
5	BB-Trib5-W-02	Coniferous riparian linked swamp	0.708
10	BB-Trib6-W-01	Mature eastern white cedar (150 years old) swamp	7.538
11	BB-Trib7-W-01	Coniferous basin swamp	0.289[†]
12	BB-W-01	Tall shrub wetland	1.242
13	BB-W-02	Mixed forested swamp basin	1.211
14	FC-Trib1-W-01	Coniferous swamp	2.759
15	FC-Trib1-W-02	Bog	5.097
16	FC-Trib1-W-03	Coniferous basin swamp	1.160
17	FC-Trib1-W-04	Eastern white cedar swamp	4.763
19	FC-Trib2-W-01	Tall shrub swamp	1.014
20	FC-Trib2-W-02	Tall shrub swamp	0.503
21	MB-Trib2-W-01	Coniferous slope swamp	9.760
26	MC-Trib1B-W-01	Riverine tall shrub swamp	0.479[‡]
29	MC-Trib1C-W-03	Mature eastern white cedar (100 years+ old) riparian linked swamp	3.337
30	MC-Trib1C-W-04A	Mature eastern white cedar (40 years+ old) riparian linked swamp	0.936
33	MC-Trib1D-W-01	Mature eastern white cedar (100 years+ old) swamp	5.530
35	MC-W-01	Mature eastern white cedar swamp	8.868
36	MC-W-02	Coniferous basin swamp	1.600

Map ID	Unique ID*	Classification	Size (ha)
38	MCB-W-01	Tall shrub riparian linked basin swamp	4.975
39	PH-W-01	Tall shrub basin swamp	1.815
40	PH-W-02	Eastern white cedar swamp	8.727
44	PH-W-06	Coniferous basin swamp	0.724
45	PLE-W-01	Coniferous tall shrub riparian linked swamp	0.610
47	PLE-W-03	Coniferous basin swamp	0.705
49	PLW-W-01	Spruce tall shrub riparian linked swamp	0.368¶
50	PLW-W-02	Eastern white cedar basin swamp	0.516
54	PLW-W-06	Tall shrub swamp	0.606

*BB = Burchill's Brook; Trib = Tributary; W = Wetland; FC = Frenchman's Creek; MB = Marsh Brook; MC = Mill Creek; MCB = Maguires Cove Brook; PH = Paddy's Hill; PLE = PipeLine East; PLW = PipeLine West; WC = Watercourse

†Considered distinctive because it is the source of BB-Trib7 and is impacted by activities within the adjacent rock quarry

‡Considered distinctive because it is the source of MC-Trib1B

¶Considered distinctive because it is located along the pipeline right-of-way and is impacted regularly by all-terrain vehicles

There are no mapped wetlands on the GeoNB mapping layer within 150 m buffer from the turbines. Four turbine sites, from 150m to 300m, intersect mapped wetlands. Some mapped wetlands do occur within the road ROW and the collector line ROW.

4.2.3.3.3 *Wetland Functional Assessments – WESP-AC Model Results*

WFAs were completed for 23 wetlands. The following five wetlands still require WFAs to be completed in spring 2020:

- BB-W-01 (Map ID 12);
- FC-Trib1-W-03 (Map ID 16);
- MC-W-02 (Map ID 36);
- PH-W-06 (Map ID 44); and
- PLW-W-06 (Map ID 54).

The full WESP-AC Model results for the wetlands assessed are included in Appendix G. A summary of the WFA scoring, which includes wetland condition and wetland risk results, is provided in Table 4-9.

The WFA results were plotted on a condition risk matrix, which is included within Appendix G. A summary of the benefits ratings is included in Table 4-9. All of the wetlands assessed, save for one, scored a moderate to higher condition rating. All of the wetlands assessed, except for one, had a lower and higher risk rating. Six of the assessed wetlands have a higher risk rating and include:

- BB-Trib5-W-02 (Map ID 5);
- BB-Trib7-W-01 (Map ID 11);
- PH-W-01 (Map ID 39);
- PLE-W-01 (Map ID 45);
- PLW-W-01 (Map ID 49); and
- PLW-W-02 (Map ID 50).

Table 4-9: Summary of WFAs (benefits rating) completed for large wetlands (>0.5 ha) and/or distinctive wetlands delineated on the Burchill Wind Project site.

Map ID	Unique ID*	Wetland Condition	Wetland Risk
2	BB-Trib1-W-02	HIGHER	LOWER
5	BB-Trib5-W-02	MODERATE	HIGHER
10	BB-Trib6-W-01	HIGHER	LOWER
11	BB-Trib7-W-01	MODERATE	HIGHER
13	BB-W-02	HIGHER	LOWER
14	FC-Trib1-W-01	MODERATE	HIGHER
15	FC-Trib1-W-02	HIGHER	LOWER
17	FC-Trib1-W-04	HIGHER	LOWER
19	FC-Trib2-W-01	HIGHER	LOWER
20	FC-Trib2-W-02	MODERATE	LOWER
21	MB-Trib2-W-01	HIGHER	LOWER
26	MC-Trib1B-W-01	HIGHER	LOWER
29	MC-Trib1C-W-03	MODERATE	MODERATE
30	MC-Trib1C-W-04A	MODERATE	LOWER
33	MC-Trib1D-W-01	MODERATE	LOWER
35	MC-W-01	MODERATE	LOWER
38	MCB-W-01	MODERATE	LOWER
39	PH-W-01	MODERATE	HIGHER
40	PH-W-02	MODERATE	LOWER
45	PLE-W-01	MODERATE	HIGHER
47	PLE-W-03	MODERATE	LOWER
49	PLW-W-01	LOWER	HIGHER
50	PLW-W-02	MODERATE	HIGHER

*BB = Burchill's Brook; Trib = Tributary; W = Wetland; FC = Frenchman's Creek; MB = Marsh Brook; MC = Mill Creek; MCB = Maguires Cove Brook; PH = Paddy's Hill; PLE = PipeLine East; PLW = PipeLine West; WC = Watercourse

4.2.4 *Fish and Fish Habitat*

Overall, 74 watercourses were identified and delineated within the survey area. Most of the watercourses are ephemeral and likely do not support fish and/or fish habitat. However, the four mapped and named watercourses (i.e., Burchill's Brook, Frenchman's Creek, Mill Creek, and Marsh Brook) are likely salmonid bearing and support fish habitat.

4.2.4.1 Previously Recorded Fish Species According to ACCDC Database

The ACCDC databases were queried for known observation data of fish species within close proximity of the Project site. There are observations for several designated species on or within close proximity to the Project site as shown in Figure 4-24.

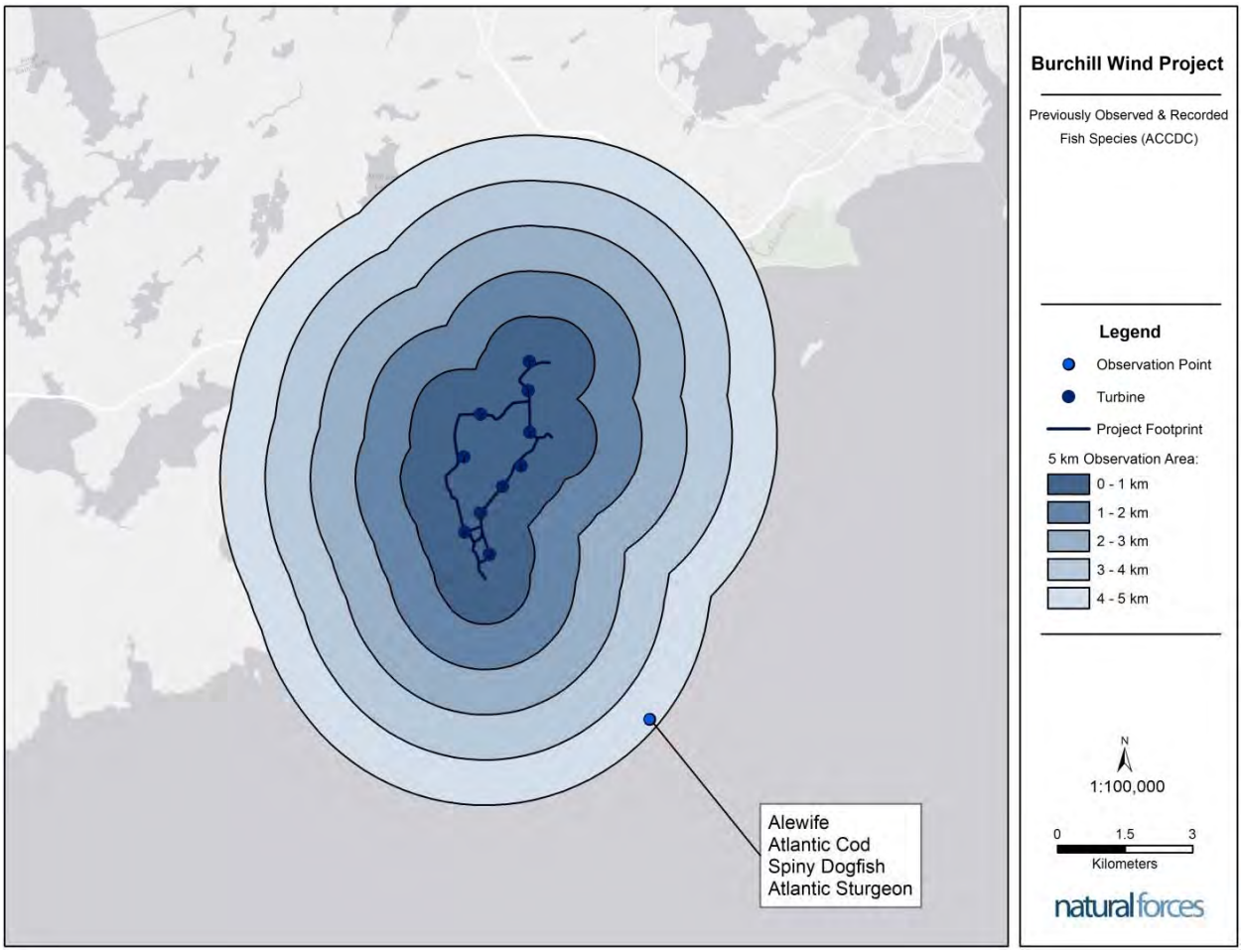

Figure 4-24: Map showing the recorded observations of fish species listed by the COSEWIC within a 5 km radius of The Burchill Wind Project site.

4.2.4.2 Observed Fish Species

The only watercourse delineated in the field where fish were observed was Maguires Cove Brook (MCB). Several brook trout (*Salvelinus fontinalis*) were observed in pools below the outlet from the wetland

connected to MCB. Although none were observed in other watercourses, it is suspected the four mapped and named watercourses (i.e., Burchill's Brook, Frenchman's Creek, Mill Creek, and Marsh Brook), are likely salmonid bearing and support fish habitat. However, this was not confirmed through field assessments.

Further assessments will be conducted as deemed necessary in the spring of 2020 in watercourses that may be impacted by the proposed infrastructure.

4.2.4.3 Fish Species at Risk or Special Conservation Concern

According to the ACCDC records review, there are no records of SAR or SOCC that have been historically observed within 5 km of the proposed project area. In addition, no aquatic SOCC were observed during the field studies.

4.2.5 *Wildlife and Wildlife Habitat*

The areas surveyed indicated five main habitat types, including shrub land, mixed softwood aged 50-100yrs+, dry with rocky outcrops, dry with mixed softwood and rocky outcrops, and mixed softwoods, as well as wetlands and watercourses. The habitat types are further described in Section 4.2.6.1.

4.2.5.1 Previously Recorded Terrestrial Wildlife Species According to ACCDC Database

The ACCDC databases were queried for known observation data of terrestrial wildlife species within close proximity of the Project site. There are observations for several designated species on or within close proximity to the Project site as shown in Figure 4-25.

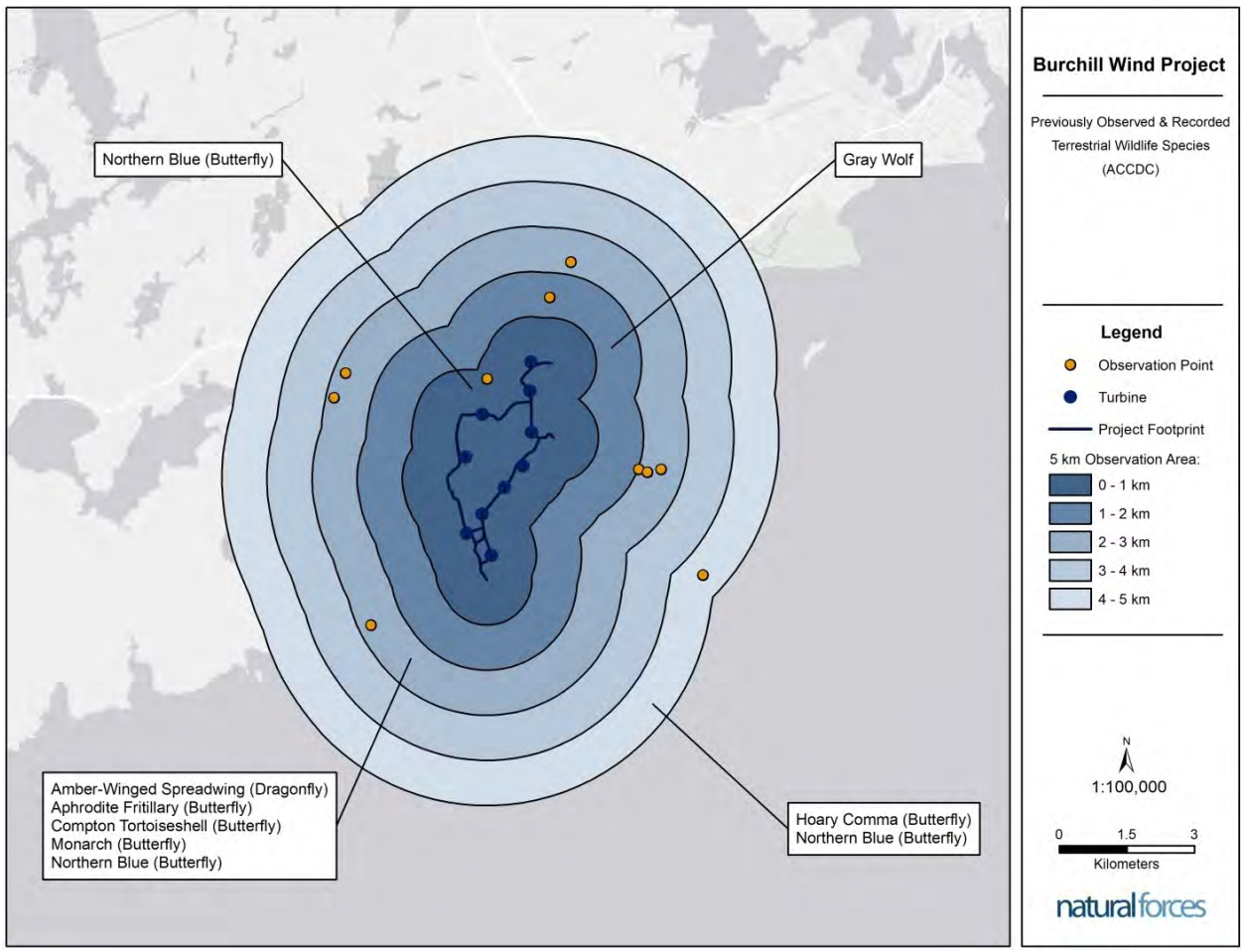

Figure 4-25: Map showing the recorded observations of wildlife species (not including birds and bats) listed by the COSEWIC within a 5 km radius of The Burchill Wind Project site.

4.2.5.2 Previously Recorded Aquatic Wildlife Species According to ACCDC Database

The ACCDC databases were queried for known observation data of aquatic wildlife species within close proximity of the Project site. There are observations for several designated species on or within close proximity to the Project site as shown in Figure 4-26. The observations recorded by the ACCDC are not exact (i.e., the observation of fin whale onshore), but they do provide an initial understanding regarding the presence of species at risk near the Project location.

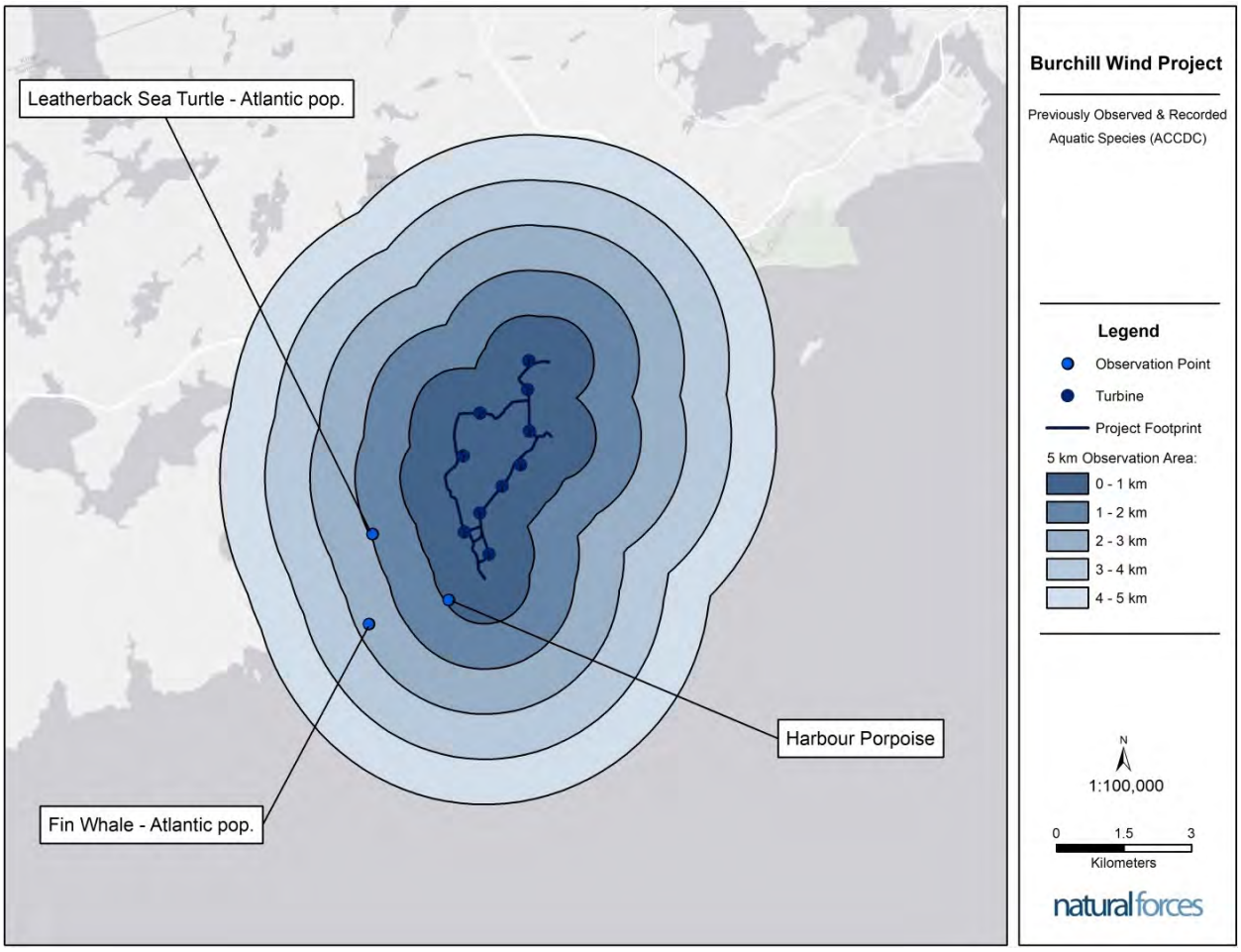

Figure 4-26: Map showing the recorded observations of aquatic wildlife species listed by the COSEWIC within a 5 km radius of The Burchill Wind Project site.

4.2.5.3 Observed Wildlife Species

A total of 14 observations of mammals were made within the assessment area during the terrestrial field studies. Direct sightings and/or indirect evidence (i.e., scat, tracks, bones, and browse) of these species were recorded during the field surveys. The mammal species observed included:

- Eastern coyote (*Canis latrans*);
- Snowshoe hare (*Lepus americanus*);
- Eastern chipmunk (*Tamias striatus*);
- White-tailed deer (*Odocoileus virginianus*);
- American moose (*Alces alces*);
- American black bear (*Ursus americanus*);
- North American porcupine (*Erethizon dorsatum*);
- Raccoon (*Procyon lotor*);
- American red squirrel (*Tamiasciurus hudsonicus*);

- Red fox (*Vulpes vulpes*);
- Meadow vole (*Microtus pennsylvanicus*);
- River otter (*Lontra canadensis*);
- Mink (*Neovision vision*); and
- Striped skunk (*Mephitis mephitis*).

All the above species have populations in New Brunswick that are considered secure (ACCDC, 2017).

Although only the wildlife species above were observed, the proposed project area provides habitat that would be suitable for most wildlife species common to New Brunswick.

4.2.5.4 Wildlife and Wildlife Habitat Species at Risk or Special Conservation Concern

The ACCDC databases were queried for known observation data of provincial and federal wildlife species at risk within close proximity of the Project site. A copy of the ACCDC report is included in Appendix F. There are observations for several designated species on or within close proximity to the Project site as shown in Table 4-10 and Figure 4-27. The observations recorded by the ACCDC are not exact (i.e., the observation of fin whale onshore), but they do provide an initial understanding regarding the presence of species at risk. It would be important to note that of the four species observed, two are ocean based species that would not be found on land.

Table 4-10: Provincial and Federal SAR located on and in close proximity to the Burchill Wind Project site.

Common name	Scientific name	NB SARA Status	Federal SARA Status	COSEWIC
Fin whale (Atlantic population)	*Balaenoptera physalus*	Special Concern	Special Concern	Special Concern
Gray wolf	*Canis lupus*	Extirpated	No Status	No Status
Leatherback sea turtle (Atlantic population)	*Dermochelys coriacea*	Endangered	Endangered	Endangered
Monarch butterfly	*Danaus plexippus*	Special Concern	Special Concern	Endangered

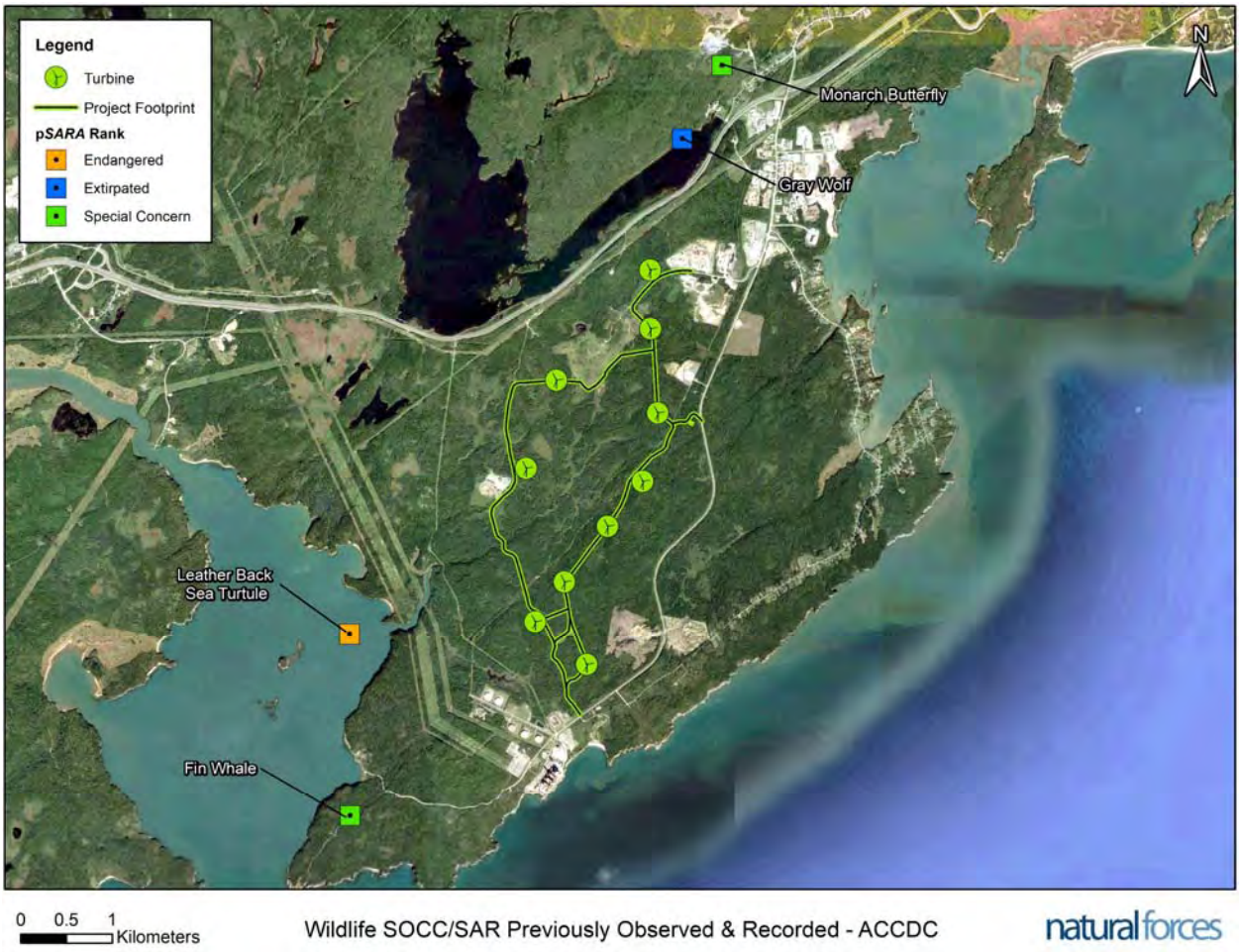

Figure 4-27: Observations of provincial and federal SAR on or in the vicinity of the Burchill Wind Project site.

4.2.5.4.1.1 Fin Whale

Second to the blue whale, the fin whale/finback whale is the largest mammal on Earth. It reaches maturity at 25 years of age and can live up to 100 years. Females reproduce at 2 - 3 year intervals. They have a distinct ridge along their back behind the dorsal fin. One unusual feature is their lower right jaw is bright white and their lower left jaw is black. They travel alone or in small groups and feed on krill and small fish, such as herring and capelin. Commercial whaling considerably reduced the fin whale population and they are threatened by noise pollution caused by shipping, seismic activity, military sonar, and industrial development. For these reasons, the fin whale has been listed provincially and federally as being of special concern.

4.2.5.4.1.2 Gray Wolf

The gray wolf is native to the wilderness and remote areas of North America. Mortality caused by human activity, such as hunting and trapping, road-kills, industrial, agricultural, and residential developments, and the abundance of prey have all affected the gray wolf's numbers and geographic range. In New

Brunswick, the gray wolf is listed as being extirpated. Gray wolves are territorial and wolf packs fiercely defend their turf. They feed on a wide-variety of animals and birds. Because they have been eliminated in many areas of their original geographic range, many of those populations that remain are heavily protected. They are an often feared and maligned species that has a characteristic howl.

4.2.5.4.1.3 Leatherback Turtle

The leatherback is a migratory sea turtle that breeds in tropical and subtropical waters and migrates to temperate water during other times of the year in search of food. Their nesting habitat is constantly being reduced and they are susceptible to getting entangled in fishing gear and waste floating in the ocean. In Atlantic Canadian waters, leatherbacks are sometimes seen between June and October. Because of their limited sightings, they are listed as being endangered both provincially and federally. It is estimated that fewer than 30,000 nesting females remain of this, the world's largest, living turtle. Their bluish-black shell is composed of skin with small bones imbedded it. The leatherback's shell has seven prominent ridges that run from the head towards the tail and its front limbs are flippers that are used to propel the turtle through the water.

4.2.5.4.1.4 Monarch Butterfly

The monarch butterfly is considered a species of special concern provincially and federally. The caterpillars are striped yellow, black, and white, the chrysalis is gold-green, and the butterfly is bright orange with heavy black veins. The eastern population, found throughout Atlantic Canada, is the largest of the populations. The population is estimated in the tens of millions; however, the population can have drastic ups and downs each year depending on the climate. This species tends to be present wherever milkweed (*Asclepius sp.*) and wildflowers, such as goldenrod (*Solidago sp.*), asters (*Aster sp.*), and purple loosestrife (*Lythrum salicaria*), exist.

4.2.6 *Vegetation and Habitat*

Vegetation and habitat surveys have been completed within the Project study area as defined in Figure 4-37 and summarized below.

4.2.6.1 Habitat

In addition to wetlands described in Section 4.2.3, five general types of habitat were observed across the Project site. The dominant species observed within each habitat are summarized in Table 4-11. Photographs are provided in Figure 4-28 through Figure 4-36.

Table 4-11: Habitat types observed, including dominant species, at the Burchill Wind Project site.

Habitat Type	Stratum	Dominant Species
Type 1 – Shrub land	Trees	• No trees
	Shrubs	• Green alder, 30% • White meadowsweet, 30% • Bebb's willow, 25% • Shrubby cinquefoil, 5%
	Herbs	• Meadow hawkweed, 10% • Canada goldenrod, 5%
	Moss	• No moss
Type 2 – Mixed softwood aged 50 to 100yrs+	Trees	• Balsam fir, 40% • Heart-leaved birch, 15% • Red spruce, 25%
	Shrubs	• Balsam fir, 5%
	Herbs	• Common wood fern, 5% • Mountain wood fern, 5% • Wild-Lily-of-the-valley, 5% • Wild sarsaparilla, 2%
	Moss	• Red-stemmed feather moss, 25% • Three-toothed whipwort, 25%
Type 3 - Dry with rocky outcrops	Trees	• Red spruce, 40% • Balsam fir, 25% • Eastern white cedar, 5% • Heart-leaved birch, 5%
	Shrubs	• Heart-leaved birch, 10% • Balsam fir, 5% • Eastern white cedar, 5% • Red spruce, 5%
	Herbs	• Bunchberry, 5% • Wild sarsaparilla, 2%
	Moss	• Reindeer lichen, 20% • Red-stemmed feather moss, 60%
Type 4 – Dry with mixed softwood and rocky outcrops	Trees	• Red spruce, 75% • Balsam fir, 10%
	Shrubs	• Sheep laurel, 5% • Red spruce, 2%
	Herbs	• Bunchberry, 5%
	Moss	• Red-stemmed feather moss, 50%

		• Dicranum sp., 5% • Three-toothed whipwort, 10%
Type 5 – Mixed softwood	Trees	• Red spruce, 60% • Balsam fir, 15% • Heart-leaved birch, 5% • Tamarack, 5%
	Shrubs	• Red spruce, 20% • Mountain holly, 10% • Balsam fir, 5% • Sheep laurel, 2% • Late lowbush blueberry, 1%
	Herbs	• No herbs
	Moss	• Red-stemmed feather moss, 90% • Reindeer lichen, 5%

Figure 4-28: Shrub land habitat (Type 1) observed at the Burchill Wind Project site.

Figure 4-29: Another example of shrub land habitat (Type 1) observed at the Burchill Wind Project site.

Figure 4-30: Mixed softwood aged 50 to 100+ years habitat (Type 2) observed the Burchill Wind Project site.

Figure 4-31: Another example of mixed softwood aged 50 to 100+ years habitat (Type 2) observed at the Burchill Wind Project site.

Figure 4-32: Dry with rocky outcrops habitat (Type 3) observed at the Burchill Wind Project site.

Figure 4-33: Another example of dry with rocky outcrops habitat (Type 3) observed at the Burchill Wind Project site.

Figure 4-34: Dry with mixed softwood and rocky outcrops habitat (Type 4) observed at the Burchill Wind Project site.

Figure 4-35: Another example of dry with mixed softwood and rocky outcrops habitat (Type 4) observed at the Burchill Wind Project site.

Figure 4-36: Mixed softwood habitat (Type 5) observed at the Burchill Wind Project site.

4.2.6.2 Proposed Turbine Locations Specific Habitat & Vegetation

Specific habitat and vegetation analysis was completed in the vicinity of the turbines, and is summarized in Table 4-12 below. Field studies to date have confirmed the nearest plant considered a SOCC is 140 m from the closest turbine, which is discussed in further detail in Section 4.2.6.6.

Table 4-12: Terrestrial habitat types observed at the proposed Turbine locations at the Burchill Wind Project site.

Turbine	Representative Photo within General Vicinity of the Turbine	Dominant Habitat Type
1		Second-growth coniferous forest (< 30 years) dominated by red spruce and balsam fir.
2		Second-growth mixed forest (<50 years) dominated by white birch, balsam fir, and red spruce.
3		Second-growth coniferous forest (<30 years) dominated by red spruce and balsam fir. Former dump site located nearby.
4		Immature mixed forest dominated by white birch, balsam fir, and red spruce.

Turbine	Representative Photo within General Vicinity of the Turbine	Dominant Habitat Type
5		Immature mixed forest dominated by white birch, balsam fir, and red spruce.
6		Second-growth mixed forest (<50 years) dominated by white birch and balsam fir.
7		Second-growth mixed forest (<50 years) dominated by white birch and balsam fir.
8		Immature mixed coniferous forest dominated by balsam fir and black spruce.

Turbine	Representative Photo within General Vicinity of the Turbine	Dominant Habitat Type
9		Second-growth coniferous forest (<40 years) dominated by black spruce, balsam fir, and eastern white cedar.
10		Stand of mature eastern white cedar.

4.2.6.3 Proposed Collector Specific Habitat & Vegetation

Specific habitat and vegetation along the proposed collector line will be addressed in an addendum to this submission following further field studies in 2020.

4.2.6.4 Previously Recorded Vegetation Species According to ACCDC Database

The ACCDC databases were queried for known observation data of vegetation species within close proximity of the Project site. There are observations for several designated species on or within close proximity to the Project site as shown in Figure 4-37.

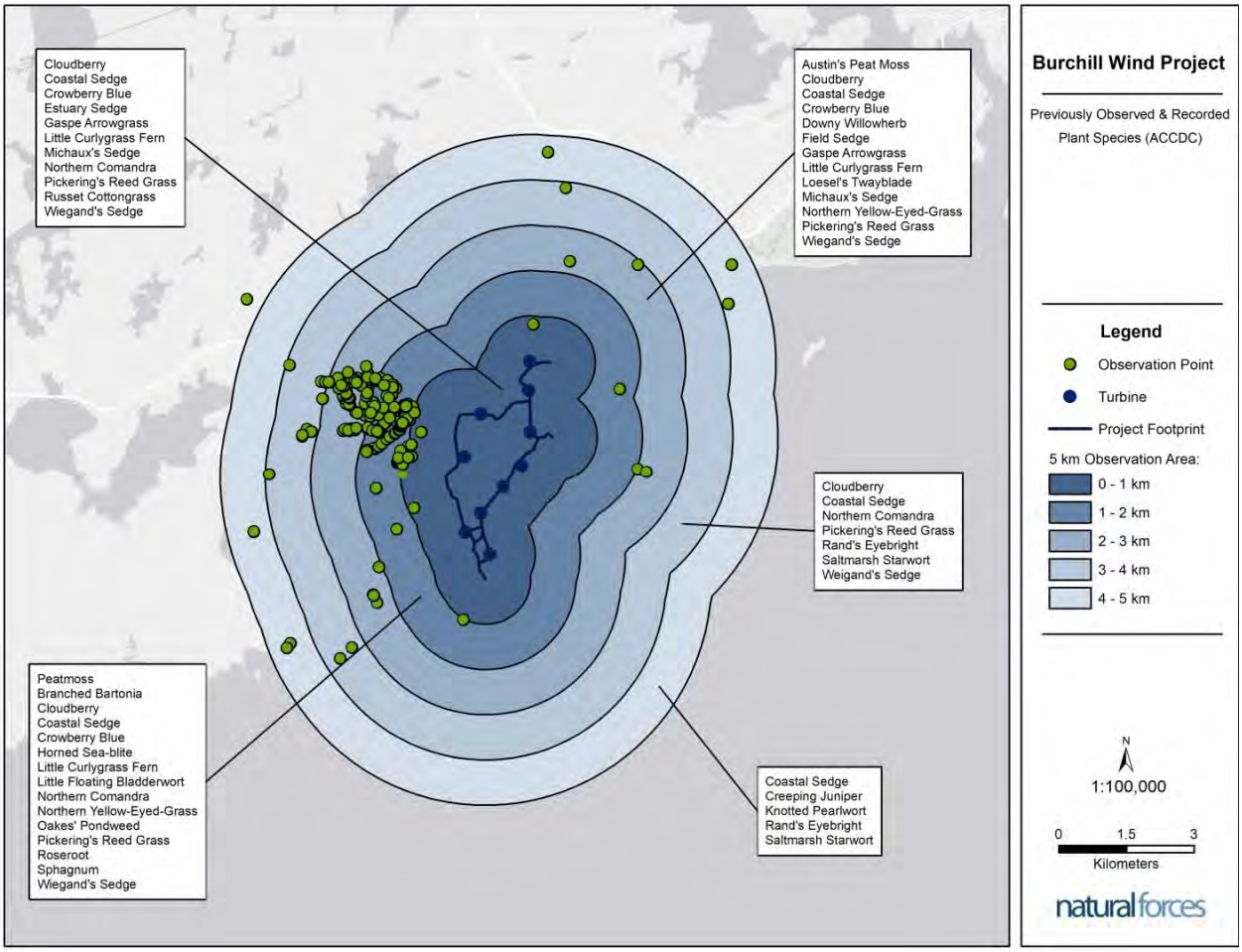

Figure 4-37: Observations of vegetation species listed by the COSEWIC within a 5 km radius of the Burchill Wind Project site.

4.2.6.5 Observed Vegetation Species – Site Specific

A vegetation survey was conducted across the Project site between June 10 and October 15, 2019 to determine the presence and locations of any rare plant species and rare vegetation communities. In total, 294 plant species were identified on the property. Refer to Appendix G for a list of all flora species observed, as well as their ACCDC ranking. Species of special concern are described in further detail in Section 4.2.6.6. Additional field studies will be completed in spring of 2020 to confirm those locations not previously ground-truthed within the Project Footprint. As noted earlier, due to micro-siting of the turbines to minimize impact to wetlands, the Project Footprint was slightly revised, resulting in small areas of the Project footprint that were not ground-truthed in 2019.

4.2.6.6 Vegetation – Species at Risk or of Special Concern

The ACCDC databases were queried for known observation data of provincial and federal species at risk or of special concern within close proximity of the Project site. A copy of the ACCDC report is included in Appendix F. There are observations recorded for only one designated species (i.e., Branched bartonia) on or within close proximity to the Project site. The current provincial and federal status of the species at risk as well as the COSEWIC is provided in Table 4-13.

A vegetation survey was conducted across the Project site between June 10 and October 15, 2019 to determine the presence and locations of any additional rare plant species and rare vegetation communities. In total, 294 plant species were identified on the property (Appendix G). According to ACCDC databases, five of those species are considered rare, and are discussed in further detail in the sections below. No observation of Branched bartonia occurred during the field studies.

Table 4-13: Flora SOCC/SAR species observed at the Burchill Wind Project site.

Common Name	Scientific Name	SRank	SRankDate	Sgsrank	Observed
Purple false foxglove	*Agalinis purpurea*	S1 – Extremely Rare*	2015 07 15	May Be At Risk	In Field
Coastal sedge	*Carex exilis*	S3 – Uncommon*	2015 07 15	Secure	In Field
Wiegand's sedge	*Carex wiegandii*	S3 – Uncommon*	2015 07 15	Secure	In Field
Loesel's twayblade	*Liparis loeselii*	S3 – Uncommon*	2015 07 15	Secure	In Field
Cloudberry	*Rubus chamaemorus*	S3S4 – Numeric Range Rank*	2015 07 15	Secure	In Field
Branched bartonia	*Bartonia paniculata*	S2S3 – Numeric Range Rank-	2015 07 15	Sensitive	Listed on ACCDC

*a range between two consecutive ranks for a species/community; denotes uncertainty about the exact rarity (e.g., S3S4).

Figure 4-38 shows the general location of the rare plants observed at the Project site.

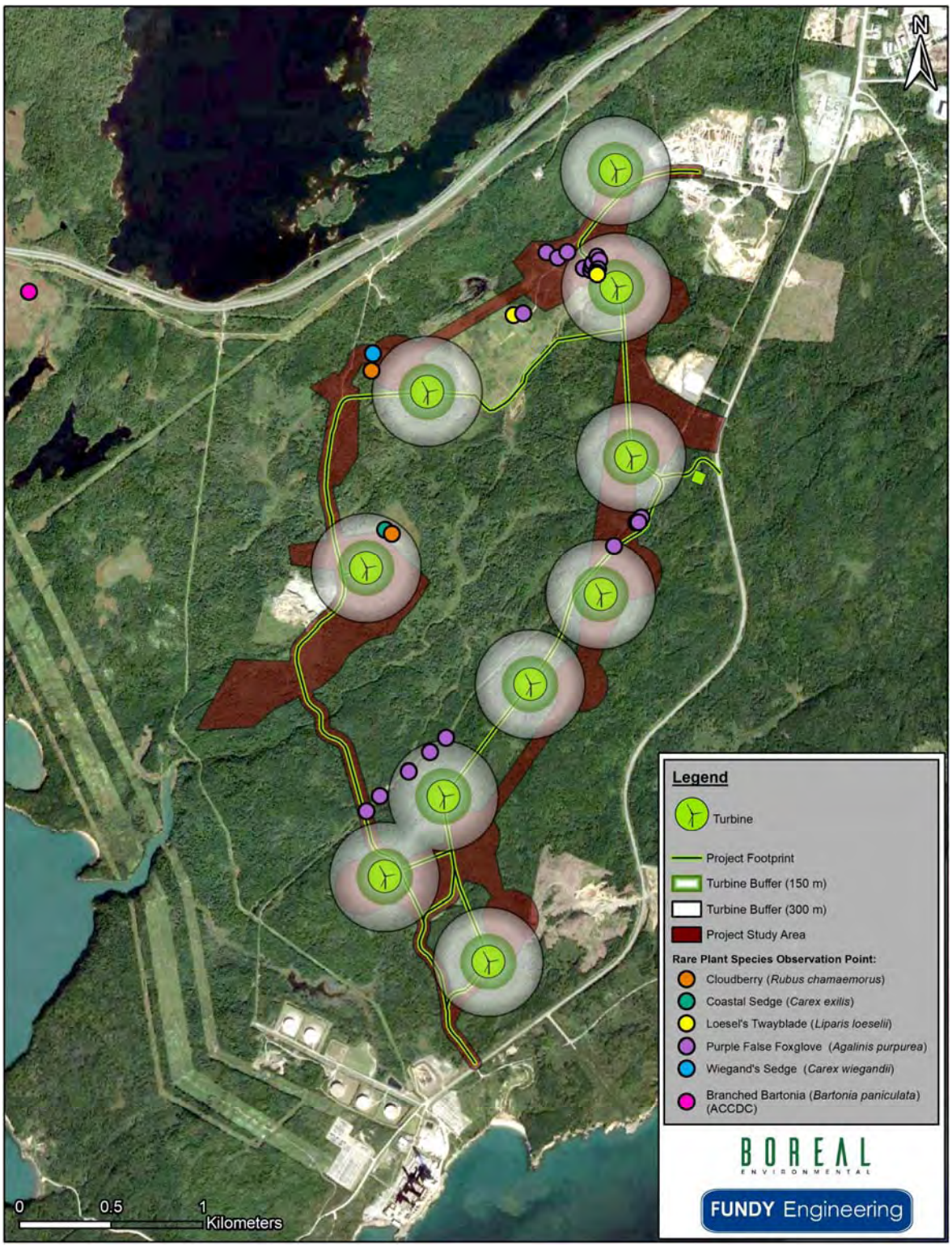

Figure 4-38: Location of rare plants observed or recorded on the ACCDC database for the Burchill Wind Project site.

4.2.6.6.1.1 Purple False Foxglove

Agalinis purpurea (Figure 4-39) is an annual forb native to eastern Canada. In late summer or early fall, the plant, which stands 10 - 120 cm tall, produces purple flowers that last about a month. It is hemiparasitic on a variety of hosts, particularly graminoids and appears to thrive in areas with occasional disturbance. According to the ACCDC databases, it is listed as S1 and May Be At Risk in New Brunswick (Table 4-13 and Table 4-14).

Purpurea was found at several locations on the property, but mainly in disturbed areas, such as along all-terrain vehicle trails, the pipeline right-of-way, and along the edges of roadways growing up through cracks in the asphalt (Figure 4-38). The closest location of *Purpurea* observed from a turbine was 160 m.

Figure 4-39: Purple false foxglove (*Agalinis purpurea*) specimens identified at the Burchill Wind Project site.

Table 4-14: Locations of purple false foxglove (*Agalinis purpurea*) observed at the Burchill Wind Project site.

Latitude	Longitude	Approximate Density
45°11'11.99"N	66°11'10.34"W	Several hundred
45°10'20.31"N	66°12'19.19"W	Several hundred
45°10'22.96"N	66°12'15.84"W	Several hundred
45°10'27.24"N	66°12'8.64"W	Several hundred
45°10'30.56"N	66°12'3.35"W	Several hundred
45°10'33.09"N	66°11'59.28"W	Several hundred
45°11'6.99"N	66°11'17.20"W	Several hundred
45°11'11.10"N	66°11'11.64"W	Several hundred
45°11'58.88"N	66°11'33.76"W	Several hundred
45°11'57.93"N	66°11'30.91"W	Several hundred
45°11'11.17"N	66°11'11.02"W	A few hundred
45°11'48.04"N	66°11'39.65"W	A few hundred
45°11'58.94"N	66°11'28.48"W	5
45°11'56.05"N	66°11'24.49"W	50+
45°11'55.70"N	66°11'22.68"W	50+
45°11'56.38"N	66°11'22.42"W	50+
45°11'57.01"N	66°11'22.13"W	50+
45°11'58.11"N	66°11'21.09"W	50+
45°11'57.40"N	66°11'20.60"W	50+
45°11'55.90"N	66°11'20.90"W	50+

4.2.6.6.1.2 Coastal Sedge

Several hundred specimens of *Carex exilis* were observed (Figure 4-40) throughout the bog with central coordinates 45°11'10.01"N and 66°12'10.22"W (Figure 4-38). This species of sedge is found in open peatlands and patterned fens, which distinguishes it from all other *Carex* species. It blooms in late May through early June and fruiting occurs in early June through late July. The ACCDC lists the coastal sedge as being uncommon but secure in New Brunswick (Table 4-13). The closest location of *Carex exilis* observed from a turbine was 226 m.

Figure 4-40: Coastal sedge (*Carex exilis*) specimens identified at the Burchill Wind Project site.

4.2.6.6.1.3 Wiegand's Sedge

Wiegand's sedge (*Carex wiegandii*) is a grass-like densely clumped sedge found in thin peatlands and bogs and acidic swamps in the shade of conifers or alder thickets. It generally has numerous flowering/fruiting stems 10 - 100 cm long with four to six flower/fruit clusters (Figure 4-41). The ACCDC lists Wiegand's sedge as being uncommon but secure in New Brunswick (Table 4-13). Three clumps of *wiegandii* were observed at 45°11'41.11"N and 66°12'17.20"W (Figure 4-38, Table 4-15) within a swamp. The closest location of *Carex wiegandii* observed from a turbine was 364 m.

Figure 4-41: Wiegand's sedge (*Carex wiegandii*) specimens identified at the Burchill Wind Project site.

4.2.6.6.1.4 Loesel's Twayblade

Loesel's twayblade (*Liparis loeselii*) was found in three locations on the property (Table 4-15 and Figure 4-38). *Loeselii* (Figure 4-42) is a small (i.e., 15 - 20 cm tall) bright yellowish green orchid often overlooked in fens, bogs, and disturbed habitats because of its size. It has two dark green, often glossy, basal leaves that appear in the spring and produces up to 18 small flowers in June and July. The ACCDC lists Loesel's twayblade as being uncommon but secure in New Brunswick (Table 4-13 and Table 4-14). The closest location of *Loesel's Twayblade* observed from a turbine was 140 m.

Table 4-15: Locations of Loesel's twayblade (*Liparis loeselii*) observed at the Burchill Wind Project site.

Latitude	Longitude	Approximate Density
45°11'47.77"N	66°11'42.01"W	Nine plants over 1 m^2
45°11'55.27"N	66°11'21.28"W	Seven plants over 10 m^2
45°11'54.90"N	66°11'21.09"W	Three plants over 1 m^2

Figure 4-42: Loesel's twayblade (*Liparis loeselii*) specimens identified at the Burchill Wind Project site.

4.2.6.6.1.5 Cloudberry

Cloudberry (*Rubus chamaemorus*) was found throughout the two bogs at the Project site (Figure 4-38). *Chamaemorus* (Figure 4-43) is a 10 - 25 cm tall rhizomatous herb that produces an amber-coloured edible fruit in the fall similar to raspberries or blackberries. It is typically found in cool boggy places and calcareous soils. The ACCDC lists the cloudberry as being uncommon but secure in New Brunswick (Table 4-13). The closest location of *Rubus chamaermorus* observed from a turbine was 226 m.

Figure 4-43: Cloudberry (*Rubus chamaemorus*) specimens identified at the Burchill Wind Project site.

4.2.6.6.1.6 Branched bartonia

Branched bartonia (*Bartonia paniculata*) is a spindly flowering plant that grows between 10 - 40 cm in height, with a green or purple stem, alternate leaves that are tiny and scale like (Figure 4-44). Branched bartonia produces small white flowers that form a branched cluster. This species is commonly found in bogs or wetlands dominated by sedges of low shrubs, in areas with Tamarack and Black Spruce trees. Figure 4-38 denotes the locations where Branched bartonia was observed in field. The closest location of *Bartonia paniculata* observed from a turbine was 2,245 m, as was listed on the ACCDC database.

Figure 4-44: Branched bartonia (Bartonia paniculate) identified by ACCDC on / near the Burchill Wind Project site.

4.2.7 *Significant and Sensitive Habitat*

4.2.7.1 Coastal Features

Databases were reviewed for coastal features present on or in the vicinity of the licensed land for the Project. As previously mentioned, there are two Provincially Significant Wetlands (PSWs) along the outside eastern edge of the parcel (Figure 4-45). The PSWs at the mouth of Lorneville Creek and Mill Creek are saltwater wetlands. Because of this, they are also considered coastal features.

Located to the west of the Project site is the Musquash Estuary, which is New Brunswick's only Marine Protected Area (Figure 4-45). On December 14, 2006, the Musquash Estuary Marine Protected Area Regulations came into force under Section 35 of the Oceans Act. The area, which comprises three protection zones, is protected because of its high biodiversity and biological productivity; it is one of the last fully functioning estuaries in the Bay of Fundy. Since 2001, the Nature Conservancy of Canada has secured about 1700 ha of land in the area, through purchases and donations, for protection. There are several saltwater wetlands, which are PSWs, within the estuary, including ones at: Black Beach, Burchills Brook and Frenchmans Creek, Ferguson Creek, and Hepburn Basin. There are also several beaches in the area.

Setbacks of 500 m were applied to all coastal features shown in Figure 4-45, which overlaps with a small portion of the Licensed Lands; however, all infrastructure is located outside of the established setback.

Figure 4-45: Coastal features on or in the vicinity of the Burchill Wind Project site.

4.2.7.2 Managed Areas (MAs) and Environmentally Significant Areas (ESAs)

New Brunswick's MAs and ESAs are sites with a rich diversity of species and/or special features (e.g., rare plants, rare animals, etc.). Although they are not protected by any specific legislation in New Brunswick,

the species found within them potentially are; any projects that potentially impact any unique, rare, or endangered feature of the environment requires EIA approval. Buffers for both environmentally important area categories were applied setback buffers of 300 m (i.e., 1.5 × height of the turbine).

4.2.7.2.1 *Managed Areas (MAs)*

There are environmentally important areas near the Project site (Figure 4-46:), which include five MAs:

- the Musquash Estuary MA;
- the South Musquash Ducks Unlimited MA;
- the Irving Nature Park MA;
- the Taylors Island MA; and
- the Manawagonish Nature Preserve MA.

The Musquash Estuary MA is described in Section 4.2.7.1 because it comprises the Musquash Estuary Marine Protected Area.

The 18.8 ha South Musquash Ducks Unlimited MA is a saltwater marsh located at the headwaters of the Musquash River. In 2005, tidal flow was restored to the marsh by Ducks Unlimited. This involved removal of agricultural dykes that had been in place for more than 50 years.

The 243 ha Irving Nature Park MA and ESA was created by JDI in 1992 to help protect an environmentally important area of southern New Brunswick. It is a peninsula of volcanic rock that has a long sandy beach along the Bay of Fundy side and a salt-marsh on the inland side. The area is a traditional staging area for birds migrating between the Arctic and South America. More than 250 species of birds have been observed during a single migration season. Eight walking trails on the Taylor's Island MA allow visitors to experience the area's fragile ecosystems. Upkeep, educational programs, and beautification of the Park are fully funded by JDI.

The Manawagonish Nature Preserve (*i.e.*, the Manawagonish Island MA and ESA), which comprises a 40 ha island about 1 km long x 500 m wide, is continentally significant for congregatory species. The partially wooded island has rocky shores, coastal cliffs, and many small inlets. About 2% to 3% of the Atlantic Coast population of double-crested cormorants (*Phalacrocorax auritus*) inhabits the Island. This colony of *auritus* is among the three largest in the Maritimes. Herring gulls (*Larus sp.*), great black-backed gulls (*L. marinus*), and glossy ibis (also nest on the Island. This is the only known Canadian breeding spot for *falcinellus*.

4.2.7.2.2 *Environmental Significant Areas (ESAs)*

There are environmentally important areas near the Project site (Figure 4-46), which include five ESAs:

- the Musquash Harbour and Island ESA;
- the Black Beach Headlands Park ESA;
- Saints Rest Marsh and Beach ESA;
- the Irving Nature Park ESA; and

- the Manawagonish Island ESA.

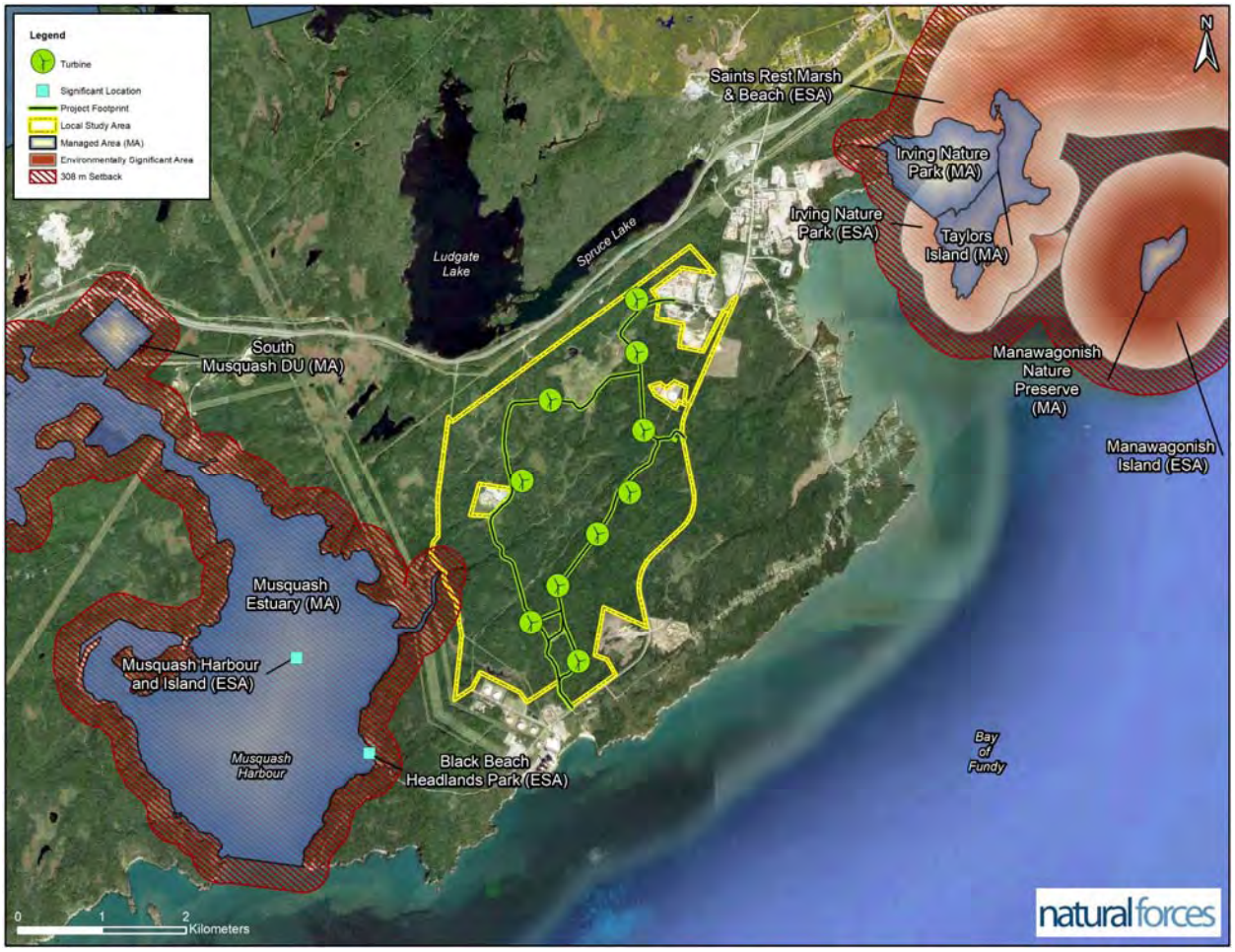

Figure 4-46: Environmentally important areas in the vicinity of the Burchill Wind Project site.

Important bird habitat is found within the Musquash Harbour and Island ESA (Figure 4-47). The area is a relatively large estuarine embayment with a relatively narrow entrance between rocky headlands. The area also includes pocket beaches and intertidal flats of sand and muddy sand. Mud dominates the substrate in more protected embayments.

The Black Beach Headlands Park ESA is significant for geology. The ESA encompasses the rare charcoal coloured Black Beach and the steep cliffs of Musquash Head. Black Beach is the only black beach along the Bay of Fundy's coastline.

The Saint's Rest Marsh and Beach is an IBA (also known as the F. Gordon Carvell Nature Preserve) is an internationally renowned bird-staging area as it is one of the largest salt marshes on the Bay of Fundy's north shore (Figure 4-47). Glossy ibis (*Plegadis falcinellus*) from Manawagonish Island are sometimes sighted there. Due to efforts of the Nature Trust of NB who erected several nesting platforms within the IBA, the great blue heron (*Ardea herodias*) population has been on the rise within the Marsh. A small peat bog is also found within this 49 ha IBA. Globally significant numbers (i.e., >1% and >3%, respectively) of

semipalmated sandpipers (*Calidris pusilla*) and semipalmated plovers (*Charadrius semipalmatus*) visit this IBA during the fall migration.

Figure 4-47: Important bird areas in the vicinity of the Burchill Wind Project site.

The Irving Nature Park and Manawagonish Island (i.e., Manawagonish Nature Preserve) are described above in Section 4.2.7.2.1.

4.2.7.2.3 *Observed Vegetation Species at Risk/Special Concern During Field Studies*

4.3 Existing Socio-economic VECs

4.3.1 *Archaeological Resources*

The field work was completed on November 5, 2019 with the site traversed on foot along existing roads and trails (Figure 4-48), near the Project Footprint. It should be noted that archaeological walkover primarily followed the anticipated Project layout at that time.

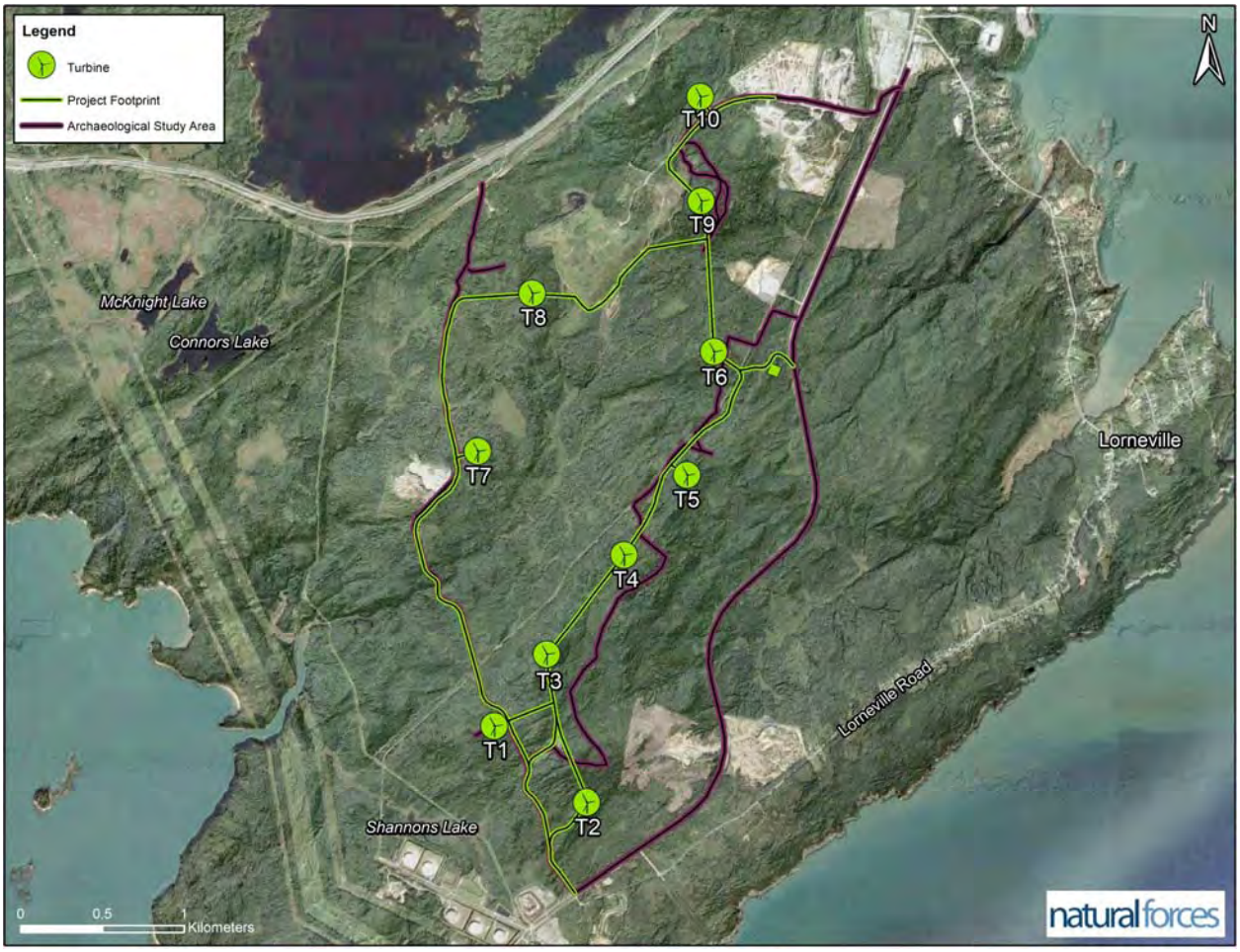

Figure 4-48: Archaeological Resources survey area at the Burchill Wind Project site.

There are not any previously recorded archaeological sites registered at Archaeological Services New Brunswick within the vicinity of the proposed construction activities in the area surveyed.

The Borden system is a nation-wide, geographically based method for recording sites of archaeological value. In New Brunswick, each Borden block is 10 minutes of latitude by 10 minutes of longitude. Each of these blocks is referred to by a four-letter code, which describes the location of that particular block.

Consequently, sites within each Borden block are numbered sequentially in the order in which they are reported. The Borden block that is of concern to this report is BhDm.

No evidence of significant extant structures was visible during the desktop survey or in the field. However, several turbine locations, new roads and additional work space associated with this project meet the criteria for holding high potential for the presence of significant archaeological resources.

A review of early and modern aerial photographs (1935 5093/048 and 059) failed to indicate any extant cultural features of interest. The aerial photographs and topographical mapping indicate that the assessed area of the proposed wind farm is sited across an area that has previously been forested with occasional wood lots and rests at an elevation of ~57 - 73 m asl. As can also be seen from the LiDAR data (see Figure 4-49), the project area is comprised of flat areas with several increases in elevation, which are usually bedrock outcrops. The flat areas are often at the lower local elevations and were sometimes wet and classified as a wetland. While bedrock can clearly be seen at the surface in places, there is also a good chance that much of the wet surface can be attributed to the near-surface presence of marine clay. The maximum elevation of the marine transgression is reported to be ~61 m asl (Lohse, 1977), which places much of the project area below or near this level.

The bedrock geology of the area, the outcrops on which some of the turbines are proposed, is comprised of four different formations – Taylor Island, Saint John Group, Ashburn and the Spruce Lake Tonalite (Barr and White, 2005). Of potential interest is the middle to late Neoproterzoic Ashburn Formation which is reported to contain white to grey fine-grained quartzite. This quartzite may have been used in the production of stone tools. Turbines 6 & 7 are sited in the area resting on the Ashburn Formation deposits.

The notable surficial geology of the project area consists of ice contact and marine shallow water deposits (refer to Section 3.2.2 for more detailed description of surficial geology). In the north of the project area, an elongated ice contact deposit was mapped with at least three recorded gravel pits. Below the topsoil, this deposit is described as fine to coarse-grained sand with fine to coarse gravel to several metres in depth. Turbine 10 is sited on the northern edge of this deposit. In the south of the map area, a couple of marine shallow water deposits were mapped, just south of Turbine 2. These deposits are also described as fine to coarse-grained sand with fine to coarse gravel to several metres in depth.

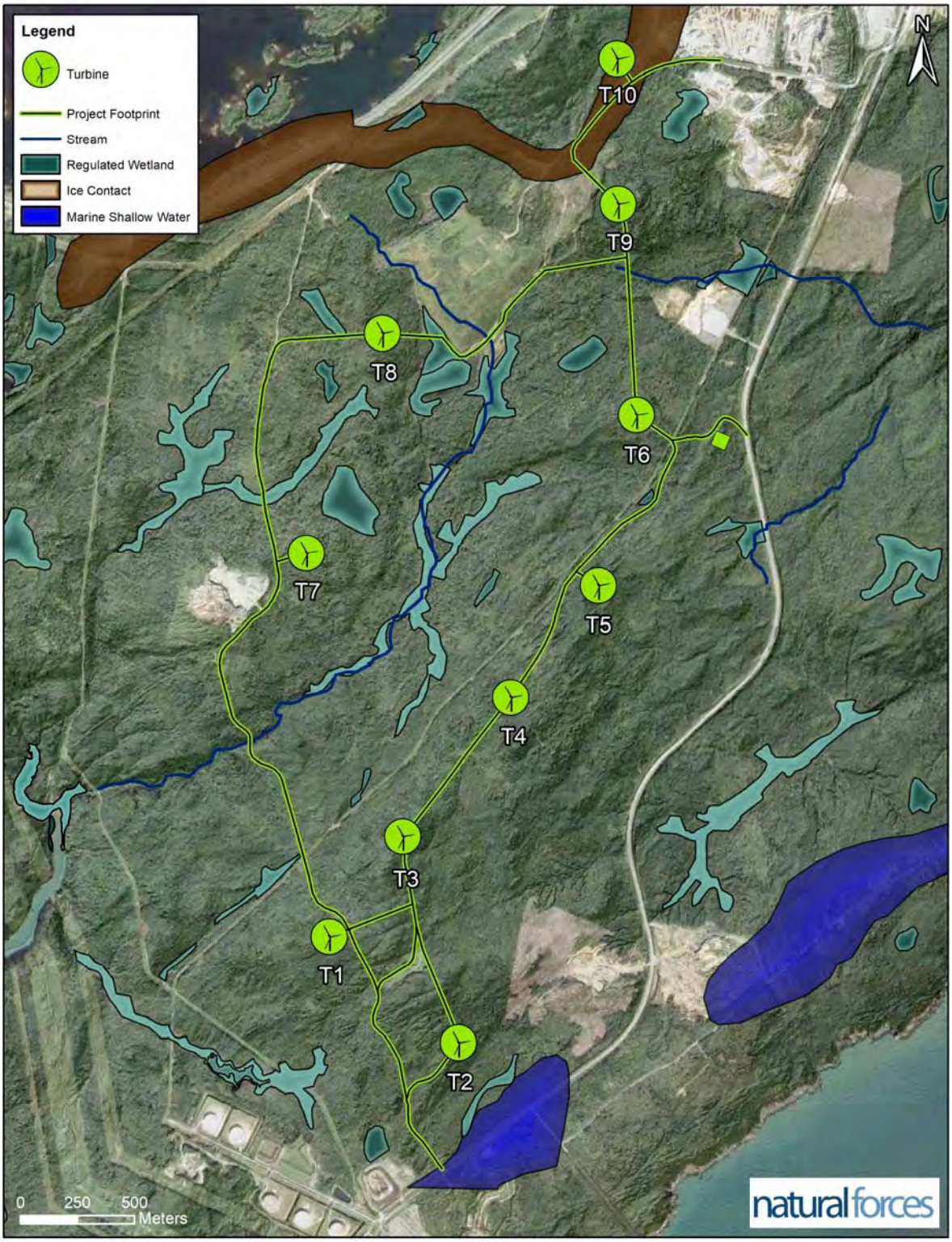

Figure 4-49: LiDAR data with turbine locations, wetlands, streams & geology at the Burchill Wind Project site.

With the maximum marine limit at ~61 m asl, it is assumed that early habitation sites may be found in close proximity to this migrating shoreline. Turbines 5-9 are at elevations at or below the 61 m asl level and consequently are considered as holding high potential for the presence of Indigenous archaeological remains. A few streams were noted within the project area. A tributary to Mill Creek crosses the line between Turbines 6 & 9 (i.e, MC-Trib1E and MC-Trib1B). Burchill Brook (BB) can be found between Turbines 8 & 9 and again south of Turbine 7, as is Frenchman's Creek (FC). It should also be noted that many mapped wetlands occupy the project area, which are known to be great sources of food and resources as well as being ideal locations for human habitation for thousands of years after the last glaciation. Each of these modern and ancient geographical features should be considered as holding high potential for the presence of Indigenous archaeological remains. Due to their proximity to the former marine shoreline, Turbines 5-9 should be considered as holding high potential for the presence of early postglacial archaeology (Figure 4-50). New/upgraded roads or collector lines are planned that cross mapped streams/wetlands. These areas may have been used for navigation or provided resources to people in the past and should therefore be considered as holding high potential for the presence of significant archaeological resources.

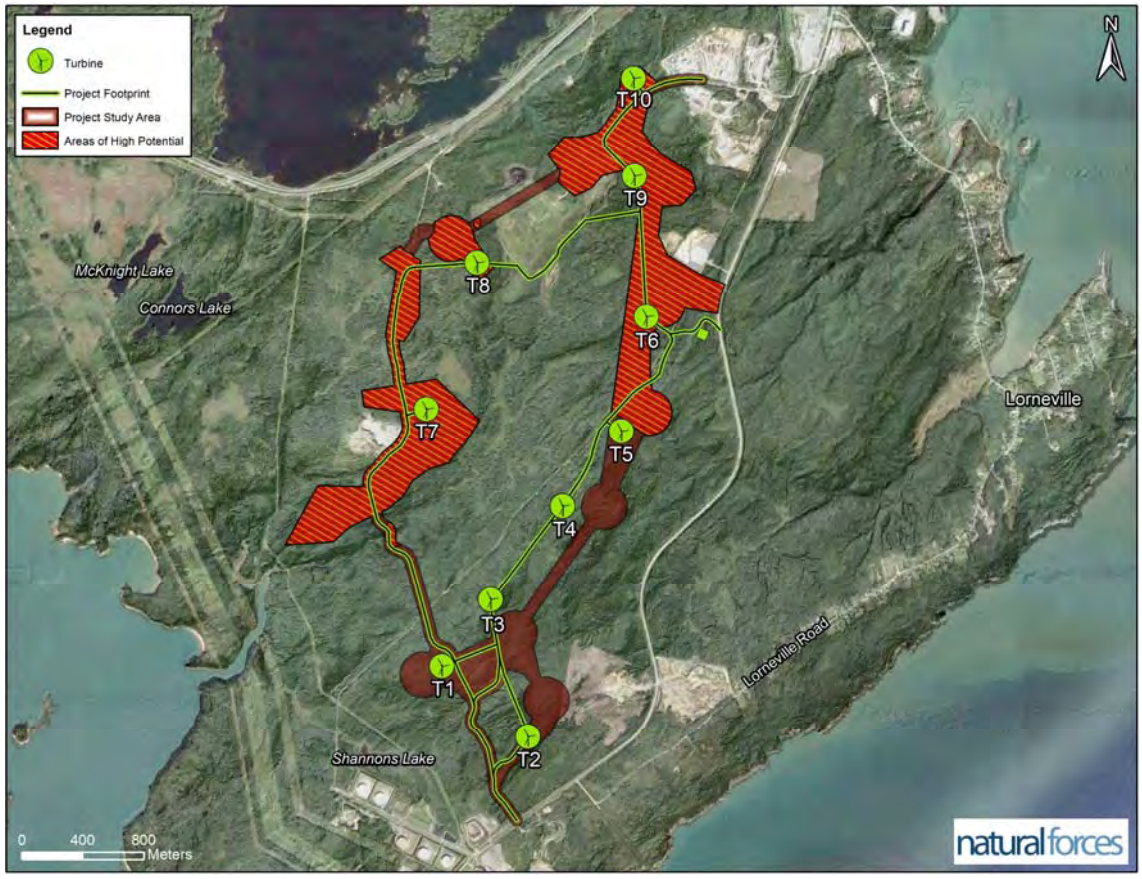

Figure 4-50: Areas assessed as holding a high potential for archaeological resources (red shaded areas) at the Burchill Wind Project site.

Following the *Guidelines* (2012*),* further studies will be conducted such as archaeological test pits prior to ground-disturbing activities (removing tree stumps, use of heavy equipment, etc.). Initially, it might be suitable to excavate test pits along a transect (in a N/S direction) at each of these locations, to better understand the surficial geology and the potential for early human habitation and to narrow focus. With Turbine 10 sited on a well-drained ice contact deposit in proximity to the ancient marine shoreline, it should also be considered as high potential and receive the same archaeological testing procedure mentioned above (see Figure 4-49).

The results of the archaeological pedestrian surveys along the access roads and the excavation test pits along the collector line will be submitted as an addendum to this EIA report.

4.3.2 *Electromagnetic Interference*

There are three telecommunication towers along the southern edge of NB Route 1/Saint John Throughway. Bell Canada owns lands identified as PID 00144359 and operates a communications booster station tower on the 0.41 ha property. Rogers Wireless Inc. leases the 3.34 ha parcel of land identified as PID 55183180 from the City of Saint John and operates a communications tower there. The telecommunication tower at the Coleson Cove Generation Station is owned by NB Power on lands identified as PID 00434522, and operates a land mobile radio tower on the 330.73 ha property.

Locations of those two towers are shown in Figure 4-51. As indicated in Figure 4-51, both Bell and Rogers telecommunication towers are within 1000 m from the closest proposed wind turbine.

There are several radar towers in the region. For example, the Canadian Coast Guard (CCG) operates a marine communications and traffic services radio tower site (Fundy Traffic) atop Red Head Mountain near Mispec Point. Any wind turbines placed within 60 km of a vessel traffic radio tower could affect vessel radars. Representatives with the CCG were consulted regarding the Project, and indicated there were no interference issues anticipated with this site.

The nearest weather radar is believed to be the one located in Chipman, New Brunswick, which is >100 km distant. Consultations with ECCC are only required when wind turbines are being proposed within 80 km of a weather radar.

The closest air defence radar is believed to be the one located in Barrington, Nova Scotia, which is >200 km from the Project site. The Department of National Defence only requires consultation when a wind turbine is erected within 100 km of a radar site.

The nearest seismograph is located in St. George, which is approximately 49 km away from the closest proposed turbine.

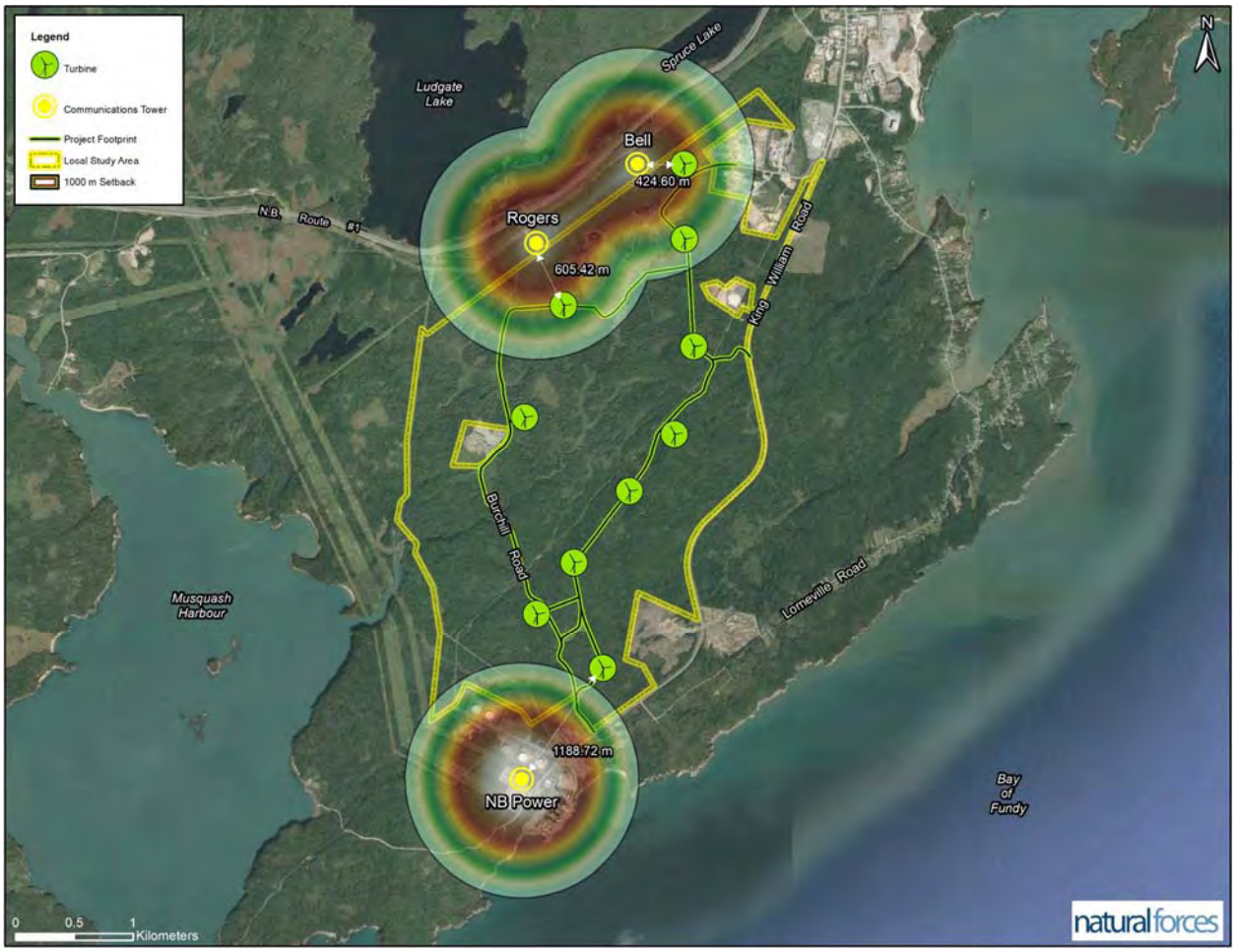

Figure 4-51: Telecommunication towers in the vicinity of the Burchill Wind Project site.

4.3.3 *Land Uses and Property Value*

4.3.3.1 Traditional Land Use

The Project site is located within the traditional Maliseet territory of Wolastoqiyik (Hinds, 2000). A Land and Resource Use Study is being conducted by the WNNB. As part of this study, a site visit was conducted with Elders and Land Users from several Wolastoqey Nations. The study is not yet complete, however should WNNB agree, the study will be included as part of the Indigenous Consultation Report.

4.3.3.2 Historical Land Use

Aerial photographs from 1962, 1976, 1984, and 1996 are shown in Figure 4-52: to Figure 4-55, respectively. The Spruce Lake Sanitary Landfill was operated on a 30 ha portion of the property between 1978 and 1997. The unlined landfill accepted all forms of waste atop unprepared soils. A clay cover, strong drainage control measures, a perimeter leachate collection system, and an engineered wetland for

effluent treatment were installed when the landfill was decommissioned. Long-term environmental monitoring, such as groundwater quality sampling, is ongoing at the site.

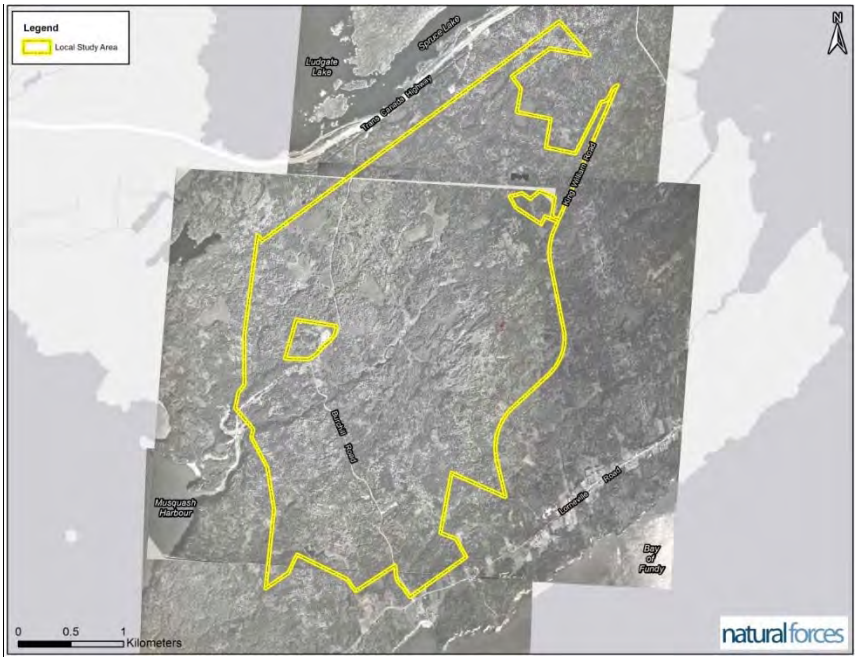

Figure 4-52: Burchill Wind Project site in 1962.

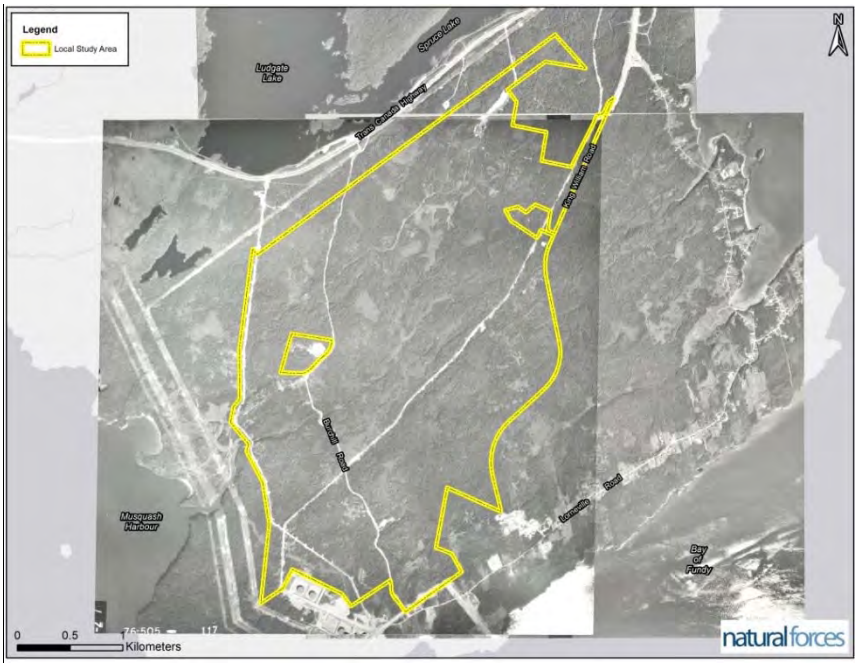

Figure 4-53: Burchill Wind Project site in 1976.

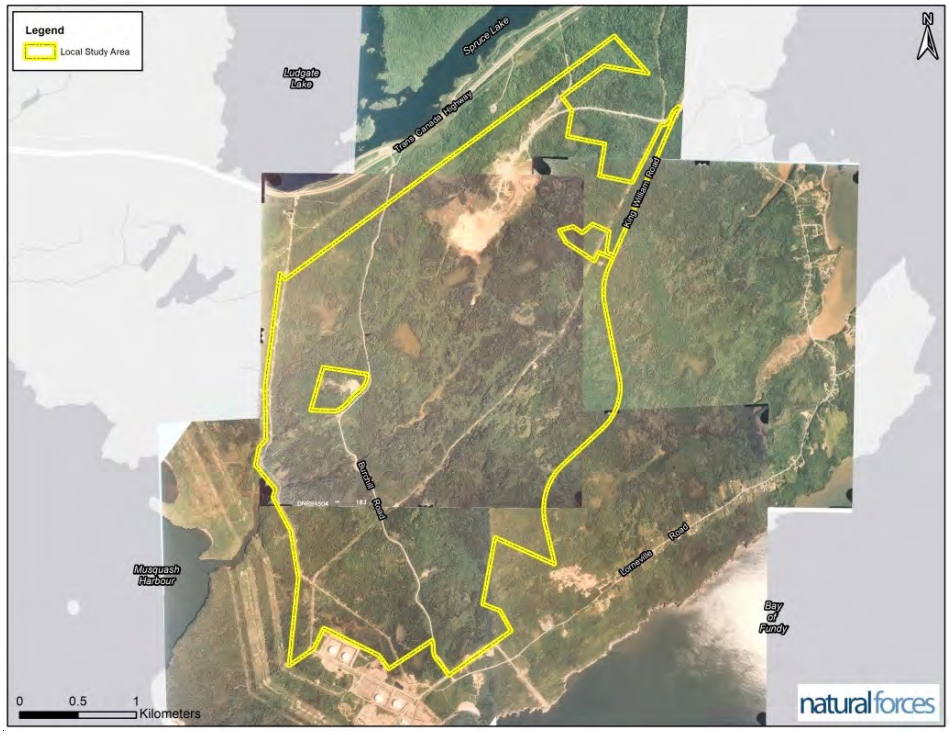

Figure 4-54: Burchill Wind Project site in 1984.

Figure 4-55: Burchill Wind Project in 1996.

4.3.3.3 Existing Land Use

The lands on which the project will reside are Crown Lands owned by the Province of New Brunswick. An Option agreement and Investigative License of Occupation were obtained by SJE from the province to study the wind resource in this area in May, 2019. This License will be transferred to Natural Forces in the coming months.

There are multiple industrial land uses on and nearby this site. On May 27, 2010, a Right-Of-Way (ROW) was granted to Saint John Industrial Parks Ltd. in order to access the 12.14 ha landlocked PID 55193908 (Figure 4-56) owned by Debly Resources Inc. and operated as a quarry. The 8.0 m wide ROW, also known as Burchill Road, extends from the northerly limits of King William Road across PID 00412189 to PID 55193908, which is identified as being at 1035 Burchill Road. Because the ROW only provides access to PID 55193908, is gravel, and is gated, it is assumed that Burchill Road is private.

Figure 4-56: Ownership of the Burchill Wind Project site.

On May 22, 1975, Irving Oil Limited Pipeline obtained an easement across PID 00412189 for the placement of a Bunker C pipeline between the Canaport Crude Receiving Terminal at Mispec Point and the Coleson Cove Generating Station. The easement for the Lorneville Pipeline is not registered.

Saint John Water also owns a pipeline that extends along the inner western boundary of the Project lands. Perpendicular to the northwest boundary of the site, the Lorneville Liquified Natural Gas (LNG) pipeline runs along NB Route 1. NB Power Transmission lines run along this same trajectory, and extend further outside the south east boundary of the Project Lands connecting to the NB Power Coleson Cove Generating Station.

4.3.3.3.1 *Zoning*

The Licensed area is primarily zoned Rural except for the land along King William Road, which is zoned Medium Industrial (Figure 4-57), a small section zoned Heavy Industry alongside Paddy's Hill Road, and a small portion zoned Pit/Quarry along Burchill Road. None of those zones permit the construction and operation of a wind farm therefore Natural Forces has submitted a rezoning application with the City of Saint John to rezone the area under the Green Energy Zone.

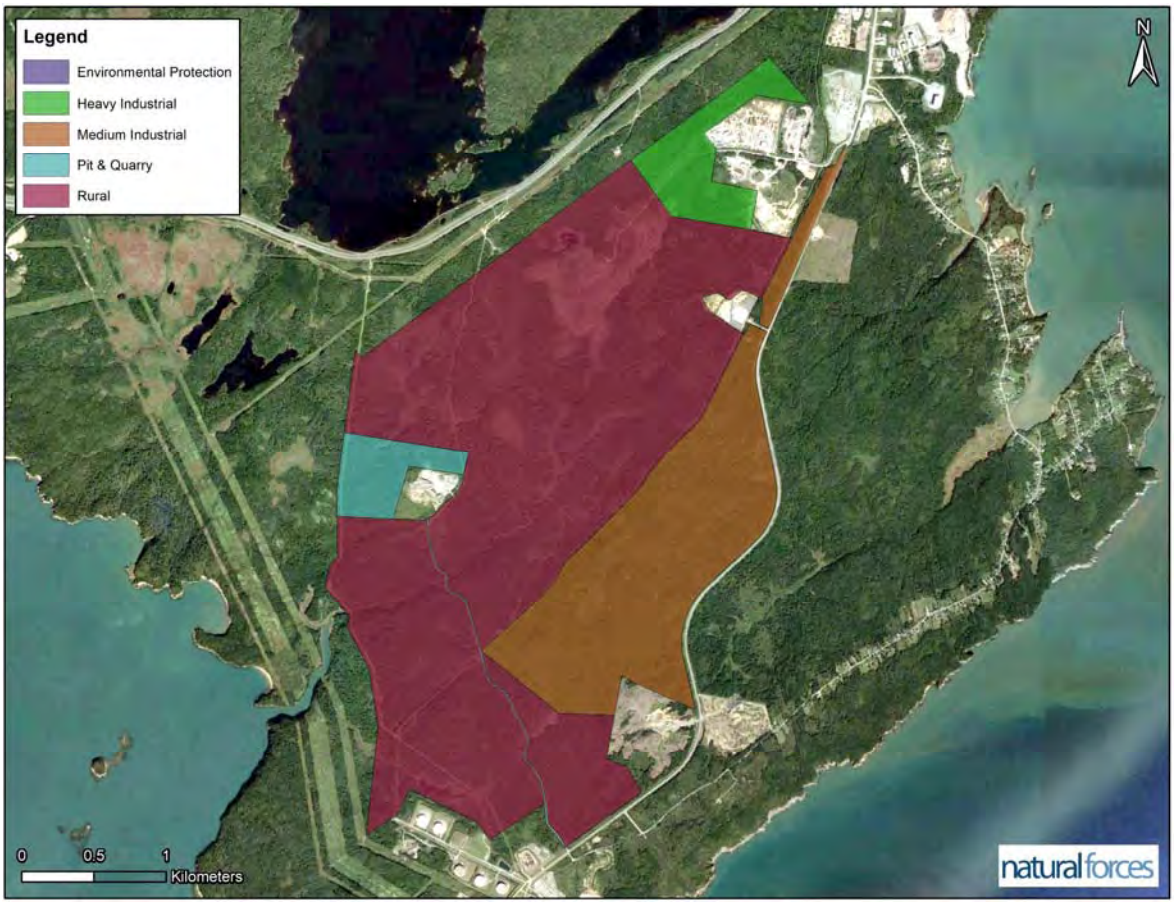

Figure 4-57: Zoning of the Burchill Wind Project site.

Upon a positive outcome of the EIA process, a Wind Farm Lease and a License of Occupation will be sought allowing construction and operation of the Burchill Wind Project on these lands.

4.3.3.3.2 *Adjacent Properties*

The BWP requires consideration of current land uses adjacent to the proposed Project site. The City of Saint John's Spruce Lake Industrial Park is located at the northeastern end of King William Road and NB Power's Coleson Cove Generating Station is located at the southwestern end. There are more than 100 residences along Lorneville Road (Figure 4-58). There are various land uses to consider on and within close proximity to the Project lands. Consultation with these land users will be ongoing to ensure safe use of these lands.

Figure 4-58: Residences in the vicinity of the Burchill Wind Project site.

4.3.3.4 Property Values

According to Service New Brunswick's Real Property Information Registry (2019), the average value of a property with a dwelling within the Project area was assessed at $138,948.

4.3.3.5 Recreation

It is good practice to consult with ATV and snowmobile trails to discuss potential impacts and mitigation measures that would be beneficial and practical for all parties. Discussions have been held with the Lorneville ATV Club.

Interactive mapping from Hiking NB was reviewed for trails that may be locally present. The mapping does not show any trails on the licensed area, but it does show three hiking trails in the vicinity of Black Beach: the short Split Rock Trail, the 4.2 km roundtrip Black Beach Trail, and the 11.4 km roundtrip Five Fathom Hole Trail (Figure 4-59).

There is a small landing strip used by the Saint John Model Flying Club (SJMFC) to fly their remote control planes at the end of Paddy's Hill Road atop the former Spruce Lake Landfill as shown in Figure 4-59. Several meetings have been held with the SJMFC and ongoing consultation will continue throughout the development, operations and decommissioning of the Project.

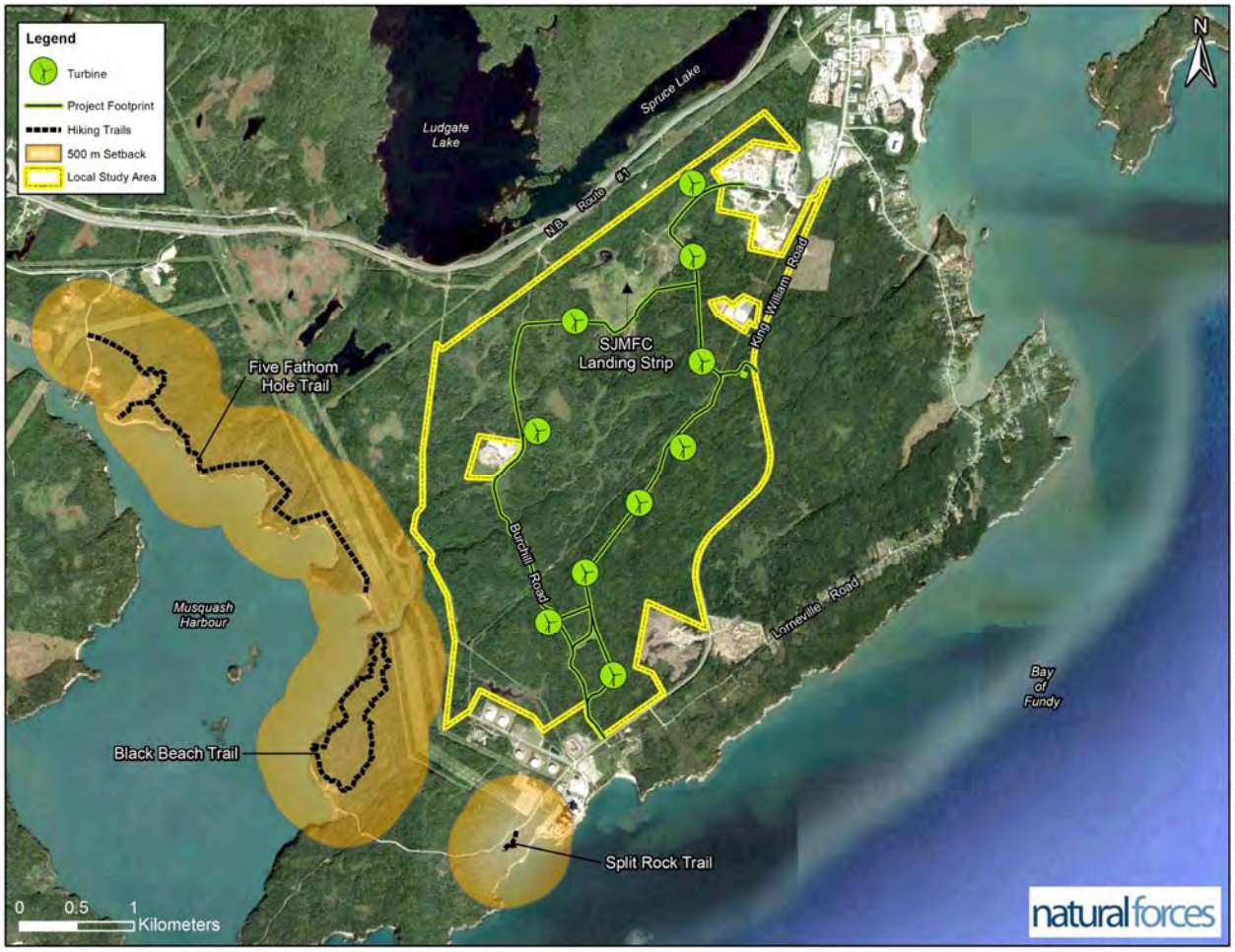

Figure 4-59: Recreational trails in the vicinity the Burchill Wind Project site.

4.3.4 *Transportation, Vehicle Traffic and Pollution*

Delivery of materials and equipment will be phased throughout the construction period depending upon the specific construction activity. The vehicles likely to be involved include:

- Large trucks with trailers for delivery of materials, earth-moving equipment and cargo containers for storage of tools and parts;
- Dump trucks to deliver and/or move stone for constructing the internal site road;
- Concrete trucks for constructing WTG foundation;
- One 800 - 1000 tonne main lift crane;
- One 150 tonne tailing crane;
- One 135 tonne rough-terrain crane for assembling WTGs;
- WTG component delivery vehicles; and
- Miscellaneous light vehicles including cars and pickup trucks.

Of these predicted vehicle movements, many will be oversized loads associated with the delivery of WTG component parts (towers, blades, and nacelles) and the cranes required for erection. These deliveries will be subject to movement orders as agreed upon with governing authorities.

The turbine manufacturer and supplier will be responsible for determining delivery routes to ensure the routes meet specific requirements for the turbine parts. The delivery route will be decided after a thorough review or the local road network and through consultation with local authorities in each jurisdiction. A description of existing transportation routes in the vicinity of the Project are discussed in the following sections.

4.3.4.1 Roadways

Wind turbines are required to be setback from public highways, roads, and streets, which includes roads and streets within boundaries of a city, designated highways, and areas designated for those purposes in a community plan. Figure 4-60 demonstrates the roadways in the area surrounding the Project area.

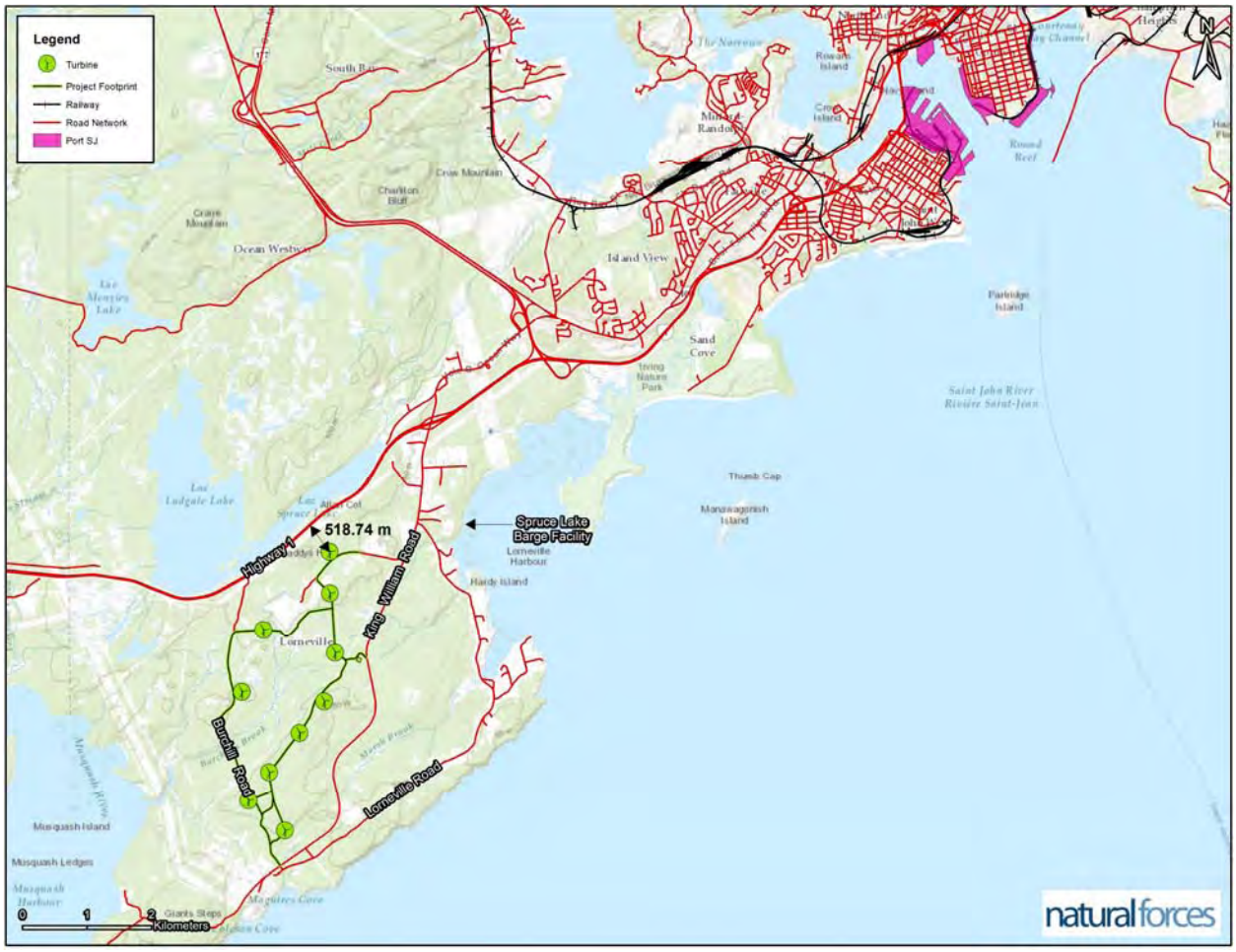

Figure 4-60: Public roadways in the vicinity of the Burchill Wind Project site.

4.3.4.2 Port Saint John & Spruce Lake Barge Facility

The WTG component parts (towers, blades, and nacelles) are likely to be brought to Saint John by water. Once delivered to Saint John, there are two viable ice-free options to land the materials; either the Port of Saint John or the Spruce Lake Barge Facility (Figure 4-60). This decision will ultimately be made by the WTG manufacturer.

Eastern Canada's largest port, PortSJ, is located at the head of Saint John Harbour near the mouth of the Saint John River. The Port has several berths capable of supporting a large variety of ships. There is also a wide range of facilities to handle all types of cargo and there are several large laydown areas within the Port's land holdings. PortSJ is a recognized port of national significance and one Canada's marine gateways for domestic and international trade and tourism. Port Saint John's facilities are linked to major railroads and highways.

The Port of Saint John boast tidal water depths between 10 m and 18 m over 300 m long with a capacity of over 48 kPa. Long Wharf within the Port has been used often in 2019 to land WTG components. From

the Port, the Project site is 13 km west and accessed from Route 1 for 11 km and then by taking exit 112 and heading south 2 km along Highway 100 (King William Road).

The Spruce Lake Barge Facility is located less than 1 km from the Burchill site. It was purpose built for the advanced manufacturing industry in mind. The facility can service barges up to 125 m in length, 30 m in width, with a depth of 6.4 m and can handle loads of up to 500 tonnes. The facility has extensive outdoor space available for laydown, marshalling, storage or project assembly, and a minimum of 30 m road width to access the wharf. From the Spruce Lake Barge Facility, the WTG components could move up the access road which connects to Highway 100 (King William Road).

4.3.4.3 Saint John Airport

The Saint John Airport, YSJ, is located in the Loch Lomond area of east Saint John, approximately 45 km away from the Project site. Although not a major cargo handling facility, Air Canada Cargo does process, store, and ship cargo at YSJ.

4.3.5 *Public Health and Safety*

Many of the assessments that have been completed or will be completed are to mitigate any potential impact to public health and safety. The perceived health and safety issues with wind turbines include noise and shadow flicker impacts, rare turbine malfunctions, ice throw, electrical fires through lightning strikes, traffic accidents, and aviation hazards. The public health and safety risks are further discussed in Section 5.3.5. Below is a listing of existing public health and safety Departments within the Project vicinity.

4.3.5.1 Police

Saint John is served by the Saint John Police Force (SJPF), one of the oldest police departments in the country, and the largest municipal force in New Brunswick with more than 160 sworn officers. The Force operates using intelligence-led policing and has units involved with community policing, traffic, criminal investigations, and tactical response. The Force operates from their headquarters at One Peel Plaza.

4.3.5.2 Fire

In Saint John, fire-fighting and protection services are provided by the Saint John Fire Department whose services include: fire rescue and suppression, technical rescue, hazardous materials emergency response, fire prevention, fire investigation, and medical first response. The full-time permanent force operates from seven fire stations strategically located throughout the City. The closest Saint John Fire Station is located on Manchester Avenue, approximately 17 km from the Project site.

4.3.5.3 Medical

Ambulance New Brunswick (ANB) provides paramedic and critical care flight nurse ambulance services to New Brunswick, which includes Saint John. ANB operates a fleet of 136 ambulances from 67 stations, 12 posts, and two fleet centres.

Saint John has two hospitals that are part of the Horizon Health Network, the Saint John Regional Hospital and St. Joseph's Hospital. The closest emergency department would be located at St. Joseph's Hospital, which is approximately 23 km from the Project site.

4.3.6 *Community and Local Economy*

In 2016, the population of the Saint John Census Metropolitan Area (CMA) was 126,202 (Statistics Canada, 2019a). Between 2011 and 2016, the population within the CMA decreased by 2.2% from 129,057, a result of outmigration that was commonly felt throughout the Province in response to an economic downturn. As is common in most Canadian jurisdictions, the baby boomer generation (45 - 65 years old) is the dominant demographic (n = 38,155; Figure 4-61). Women represent a greater proportion of the population 25 years+ while men are the dominant group for those <25 years old. More than 95% of the population identifies English as their mother tongue.

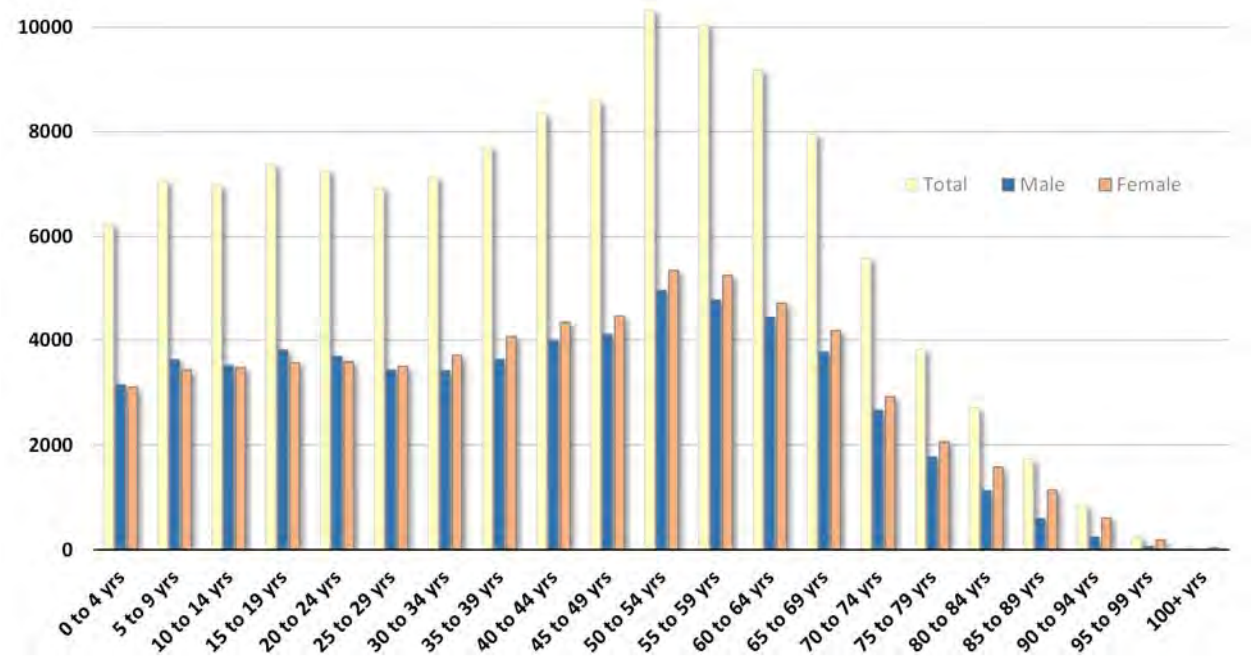

Figure 4-61: 2016 Statistics Canada demographics of the Saint John census metropolitan area.

At 3,510 square kilometers, the Saint John CMA represents about 4.9% of New Brunswick's landmass. In 2016, the total number of private dwellings within the CMA was 58,398 and the average number of persons occupying each household was 2.3. Although there are urban, suburban, and rural areas of the CMA, residential development is considered scatterized (Urban Strategies, 2011). The population density was 36 persons/km2 in 2016.

New Brunswick's monthly unemployment rate is shown in Figure 4-62 for January 2015 through to July 2019. Unemployment was its greatest during July 2015 when it hit 11%. At that time, approximately 38,269 people were unemployed. During the 4.5 year period shown, unemployment was at its lowest in July 2017 when it was 6.5%. At that time, 352,400 people were employed throughout the Province. The

largest economic region for employment in New Brunswick is typically the southeast (Albert, Westmorland, and Kent Counties).

The most recent labour force survey data available for Saint John are from 2016 (Statistics Canada, 2017). In 2016, the top five industries that employed people were: health care and social assistance; retail trade; construction; accommodation and food services; and administrative support, waste management, and remediation services.

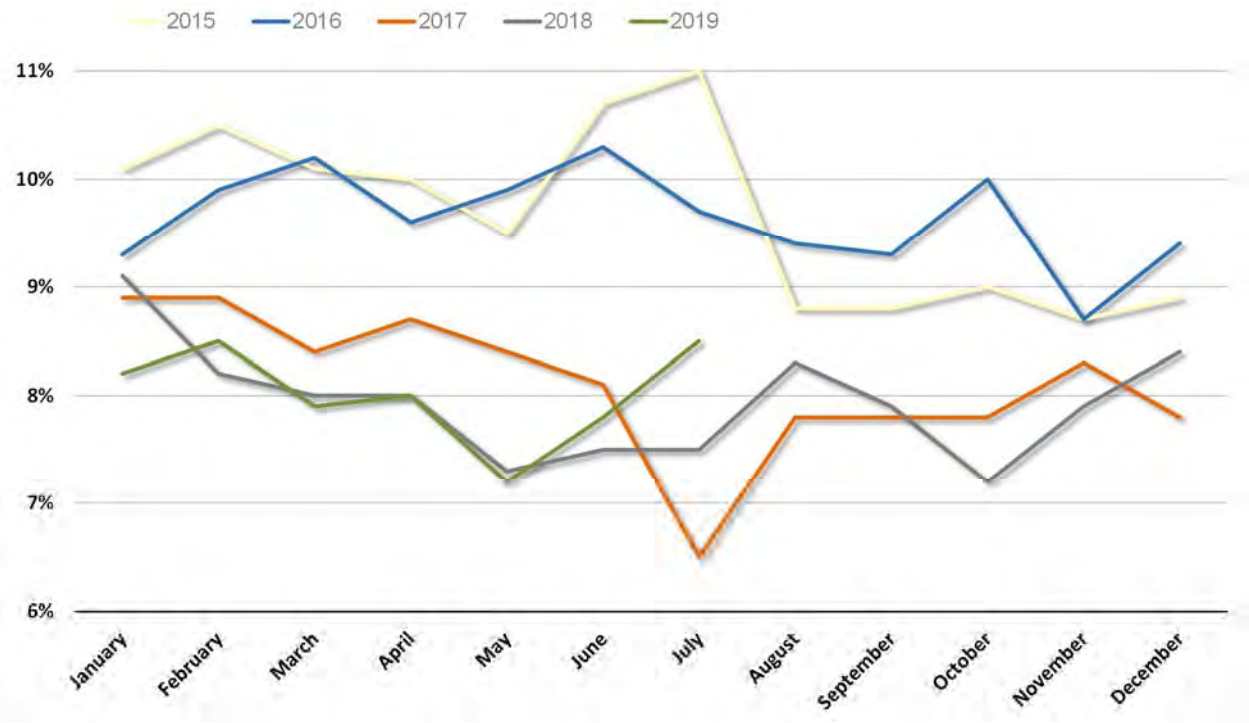

Figure 4-62: New Brunswick monthly unemployment rate between January 2015 and July 2019 based on data from New Brunswick Department of Labour and Statistics Canada.

The median total income for Saint John families (two or more person households) in 2015 was $81243, which jumped 13% from the $70,610 median total income in 2011. However, >17% of the population are still considered low-income earners.

Saint John is located within the southwest economic region of New Brunswick, which encompasses Charlotte, Kings, and St. John Counties (12% of New Brunswick's land area). According to census data, the region was home to about 168,389 people (2016 Census). Saint John County where the Project is located comprises Saint John, Simonds, Musquash, and Saint Martins, which represents about 44% of the region's population.

The southwest economic region has a relatively balanced economy (NBDPSETL, 2018). Over one quarter of employment in the region is within the sales and service occupations. After the public sector, the majority of individuals are employed in the sales and services sector. Some of the most significant private sector industries in the southwest economic region are trade, manufacturing, and construction.

5 Predicted Environmental Impacts and Mitigation

The construction, operation, and decommissioning phases of the BWP have the potential to affect the physical, biophysical, and socio-economic environment. Identifying the VECs is an important part of the EIA process. Following the presentation of the Project's activities in Section 2 and the Existing Environmental Setting in Section 4, the interaction of the Project activities with the VECs can be completed.

Table 5-1 presents the potential interactions between Project activities and each identified VEC. These VECs are presented in the following sub-sections in terms of potential environmental effects of Project activities, as well as proposed mitigation strategy, cumulative effects and finally, the level of significance of the residual effects. This VEC assessment will be completed as outlined in the methodology as presented in Section 3.5.

Table 5-1: Potential Linkages of Project and the Environment.

	Site Preparation and Construction								Operation and Maintenance				Decommissioning		
	Clearing and Grubbing	Access Road and Laydown Area	Turbine Foundation	Electrical and Transmission	Crane Pad Construction	Turbine Installation	Commissioning	Accidents and Malfunctions	Turbine Operation	Transmission Line	Inspection and Maintenance	Accidents and Malfunctions	Infrastructure Demolition	Site Reclamation	Accidents and Malfunctions
Physical VECs															
Ground Water		•	•	•	•			•					•	•	•
Geophysical		•	•	•	•			•					•	•	•
Atmospheric	•	•	•		•			•	•				•		•
Wind Resource															
Noise	•	•	•	•	•	•		•	•				•	•	
Shadow Flicker & Visual						•			•				•		
Biophysical VECs															
Avian	•	•		•	•	•			•	•		•		•	
Bats									•						
Wetlands & Watercourses	•	•			•			•				•	•	•	•
Fish and Fish Habitat	•	•			•			•				•	•	•	•
Wildlife and Wildlife Habitat	•				•									•	
Vegetation	•	•												•	
Significant & Sensitive Habitat	•				•			•				•			•
Socio-economic VECs															
Archaeological Resources	•	•	•	•				•						•	•
Electromagnetic Interference									•						
Land use & Property Value	•	•			•	•			•	•		•			•

	Site Preparation and Construction								Operation and Maintenance				Decommissioning		
	Clearing and Grubbing	Access Road and Laydown Area	Turbine Foundation	Electrical and Transmission	Crane Pad Construction	Turbine Installation	Commissioning	Accidents and Malfunctions	Turbine Operation	Transmission Line	Inspection and Maintenance	Accidents and Malfunctions	Infrastructure Demolition	Site Reclamation	Accidents and Malfunctions
Vehicle Traffic & Pollution			•	•	•	•		•				•	•		•
Public Health & safety								•	•			•			•
Local economy	•	•	•	•	•	•	•		•		•		•	•	

5.1 Assessment of Physical VEC Impacts

5.1.1 *Ground Water*

Management of ground water quality is important as it is an integral aspect of a diverse ecosystem and functional ecology. As a result, ground water quality and quantity have been identified as a VEC.

A significant environmental effect would result if a considerable change to ground water quantity or quality is identified as a result of project activities.

Boundaries – Spatial boundaries include the ground water at the Project site as well as any water bodies and watercourses that are supplied by the ground water. Temporal boundaries are focused on the construction and decommissioning phases but include all phases of the Project in the unlikely event of an unplanned release of contaminants.

Discussion – A geotechnical investigation will be conducted in the Spring of 2020. If ground water is encountered during these surveys, depth to groundwater will be recorded. Residential well logs within the area identified groundwater ranging from 1.52-259.08 m below surface. There are no residential areas/wells within the 500 m setback (NBDOE 2009, NBDNR 2012) of any proposed turbine. There are two Wellfield Protection Areas in the City of Saint John (i.e., the Harbourview and South Bay Wellfield). However, the turbines are sited well outside the three wellhead protection areas (Figure 4-1). In light of the considerable distance between the Project site and the Wellfields, there are expected to be no impacts of the Project on the Wellfield.

Table 5-2: Potential impacts and proposed mitigative measures for ground water.

Potential Impacts on Ground Water	Proposed Mitigative Measures
Vegetation clearing, grubbing, ground stripping, excavation and machinery traffic during the construction of the WTG pads and access roads might induce a change in hydrology or sediment input into ground water.	• A setback distance of 30 m between the site works and wetlands will be implemented where feasible; if not feasible, a Wetland and Watercourse Alteration (WAWA) permit will be obtained; • Efforts will be made to design access roads such that they do not interfere with a watercourse, water body or drainage channel; • Erosion control strategies (i.e., Straw bales and geo-textiles) will be outlined in the Erosion and Sedimentation Control Plan in the Environmental Management Plan (EMP); and • Where water must be pumped out of excavation pits, it will not be discharged into a wetland, watercourse or defined channel. If pumped water contains total suspended solids the water will be pumped to vegetated land with gentle slope to allow sediment to filter, or the water will be filtered before release with a filter bag.
Exposure or accidental spillage of hazardous materials such as fuel, oils and hydraulic fluids has potential to contaminate ground water supplies during construction, operation and decommissioning phases.	• Equipment shall be in good working order and maintained so as to reduce risk of spill/leaks and avoid water contamination; • Spill response kits will be provided on site for each piece of equipment to ensure immediate response to a potential waste release and will be stocked with supplies to handle a worst-case scenario on ground or in surface or groundwater; • Routine maintenance, refueling and inspection of machinery will be performed off-site or on level ground onsite; and

Potential Impacts on Ground Water	Proposed Mitigative Measures
	• If a spill occurs, corrective measures will be implemented immediately and reported to the DELG's Saint John Regional Office at (506) 658-2558 or outside of business hours to the Canadian Coast Guard's environmental emergencies reporting system at 1-800-565-1633.
Vehicular traffic during decommissioning might induce a change in hydrology or sediment input into ground water.	• Efforts will be made such that the access roads and other supporting infrastructure do not interfere with a watercourse, water body or drainage channel; • Erosion control strategies (i.e., Straw bales and geo-textiles) will be outlined in an EMP in order to maintain baseline water quality conditions in the watercourses and wetlands onsite; and • Used oil filters, grease cartridge containers and other products associated with equipment maintenance shall be collected and disposed of in accordance with regulatory guidelines.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to ground water.

Significance of Residual Effects – After employing the proposed mitigative strategy, should any sedimentation and/or erosion occur, it will be temporary, of small magnitude and contained. While any direct release into groundwater would be a negative effect, it would be of small magnitude, of short duration and local. The significance of residual effects on ground water is to be considered minor.

5.1.2 *Geophysical*

The surrounding geophysical environment needs to be considered in order to ensure a strong stable structure exists for the lifespan of the project. As a result, geophysical conditions have been identified as a VEC.

A significant environmental effect would result if a considerable change to geophysical conditions or quality is identified as a result of project activities.

Boundaries – Spatial boundaries include the construction site while the temporal boundary focuses on the construction and decommissioning phases.

Discussion – The construction of the BWP will require the excavation of materials in order to support the WTG foundations, and grading and filling for the crane pads and access roads. The geophysical conditions will be disturbed for the construction and installation of the BWP. Mitigation measures will be applied to minimize the impact.

Table 5-3: Potential impacts and proposed mitigative measures for geophysical conditions.

Potential Impacts on Geophysical Conditions	Proposed Mitigative Measures
Soil and ground conditions may need to be altered for construction.	• A geotechnical survey will determine the ground conditions and any potential limitations to construction; and • A designated professional will provide recommendations for design and construction of the BWP based on the geotechnical survey results.
Excavation and transportation of material will be required for the turbine foundations, crane pads and access roads.	• Topsoil will be stored separately from excavated material; • Topsoil and excavation material will be backfilled in a manner that does not result in soil inversion; • Areas susceptible to erosion will be stabilized and erosion will be minimized through the use of control measures (i.e., haybales, coco mats etc.); • Soil compaction will be limited to the Project Footprint; and • Soil and aggregate mixing will be minimized.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to geophysical conditions.

Significance of Residual Effects - It is expected that there will be a disturbance to the immediate geophysical conditions. The impact is predicted to be of small magnitude, and local. The significance of residual effects on geophysical conditions after applied mitigation measures is considered to be negligible.

5.1.3 *Atmospheric Conditions*

Atmospheric conditions are an important topic facing all new developments due to the uncertainty climate change will bring in the future. It is important to understand how the climactic conditions of the proposed project will change over the Project's lifetime. Based on the 25 year lifespan of the proposed project, atmospheric conditions have been identified as a VEC.

A significant environmental effect would result if a significant change in atmospheric conditions was determined as a result of Project activities.

Boundaries – Spatial boundaries include the Province of New Brunswick while the temporal boundary focuses on the duration of the project lifespan.

Discussion - The purpose of the Project is to provide renewable energy to the Province of New Brunswick to help reach and potentially exceed goals of producing 40% of electricity from renewables by the year 2020. By reaching/exceeding these targets there will be a significant reduction in CO_2 emissions through the reduction of fossil fuel generation in the energy sector. This reduction in CO_2 emissions will help global efforts of slowing climate change and will help mitigate the predicted changes and risks associated.

Table 5-4: Potential impacts and proposed mitigative measures for atmospheric conditions.

Potential Impacts on Atmospheric Conditions	Proposed Mitigative Measures
Climate change is predicted to bring increasing precipitation amounts to the project location.	• This impact is addressed in Section 5.4: Effect of the Environment on the Project.
The electricity produced from this project will supply approximately 10 000 homes with clean renewable energy, reducing fossil fuel requirements.	• Reducing reliance on fossil fuels is a positive impact; no mitigation is proposed.
The BWP is one step towards achieving/exceeding the provinces renewable energy goals in an attempt to reduce emissions and slow climate change and associated risks.	• Reducing emissions to slow climate change is a positive impact; no mitigation is proposed.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to atmospheric conditions.

Significance of Residual Effects – The BWP will help global long-term efforts to slow climate change as such, the significance of residual effects on atmospheric conditions is to be considered beneficial.

5.1.4 *Wind Resource*

In order for the operation of the BWP to be successful, the project site must be located in an area with sufficient wind resource. As a result, the wind resource has been identified as a VEC.

A significant environmental effect would result if a considerable change to the wind resource was a result of project activities.

Boundaries – Spatial boundaries include local wind regimes while the temporal boundary focuses on the duration of the project lifespan.

Discussion - The BWP has over 5 years of wind resource monitoring data in close proximity to the Project site, and will have additional onsite wind resource monitoring data with the installation of wind monitoring sensors onsite in the summer and fall of 2019. This will confirm the wind resource onsite prior to erection of the turbines. The data collected to date has provided information to determine the best possible technology to use to effectively and efficiently capture the wind resource.

Table 5-5: Potential impacts and proposed mitigative measures for the wind resource.

Potential Impacts on Wind Resource	Proposed Mitigative Measures
Sufficient wind is required to make the project financially successful.	• Data is being collected from the installed wind monitoring sensors to ensure sufficient wind resource is available on site.
The Project will harness the wind resource to produce electricity.	• Producing electricity from the wind is a positive impact; no mitigation is proposed.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to the wind resource.

Significance of Residual Effects – The BWP will use the wind resource in the local area over the lifetime of the project. As the BWP will use a renewable resource such as the wind regime in order to produce electricity, the significance of residual effects on the wind resource is considered beneficial.

5.1.5 *Noise*

Noise is defined as a sound, especially one that is loud, unpleasant or that causes disturbance. There are two different types of the noise that are expected to be produced by the BWP: noise from the construction and decommissioning phase, and noise from the WTG operation. As a result, noise has been identified as a VEC.

A significant environmental effect would result if a considerable change in the ambient noise was found to be the result of project activities.

Boundaries – The spatial boundary is the area in which the noise impact study was conducted; this being a 4,000 m radius from the BWP location. The temporal boundary includes all Project activities from site preparation, construction, and operation to decommissioning.

Discussion

Noise Assessment

Natural Forces has conducted a noise impact assessment of a 4.0 km area surrounding the proposed BWP location. A copy of this assessment is included in Appendix A. This assessment includes a total of 510 receptors. Prior to this assessment careful siting of the turbines has reduced the majority of sound impacts to neighbouring residents by applying sufficient setbacks. The New Brunswick maximum allowable noise impact starts a 40 dB(A) for wind speeds at 4.0 m/s and increases to 53 dB(A) for wind speeds at 11.0 m/s. The SPL is defined as the force of sound on a surface area which is measured in dB(A); dB or decibels is a logarithmic unit that is used to measure SPL and (A) is the weighting applied to denote 'as perceived by humans'.

The results of both the worst case and realistic noise prediction models at the top 22 receptors are summarized in Table 5-6, while all receptor noise levels are provided in Appendix A. All but two receptors prove compliance with the *Additional Information Requirements for Wind Turbines* document created to outline additional requirements to the *Environmental Impact Assessment Regulation* specifically for wind turbines under worst case conditions. All residential homes are in compliance with the provincial requirements. The two receptors that do not meet the requirements are industrial buildings within the Spruce Lake Industrial Park. Under the more realistic conditions model, only one industrial building is non-compliant. The table below demonstrates the loudest noise levels for any wind speed modelled between and including 4.0 to 12.0 m/s.

As mentioned, the receptors exceeding the requirements under worst case conditions are two buildings in the Spruce Lake Industrial Park. These buildings are owned by Simpson Truck & Tractor Parts (receptor E), a heavy equipment parts supplier and steel distributor, and GFL Environmental (receptor F), a waste management company. The GFL Environmental building is a warehouse-style building. The Simpson Truck & Tractor Parts building is an office/warehouse style building. Both of these businesses will be engaged to assess how these buildings are used, any sound level concerns, and mitigation strategies, if necessary.

Because of the industrial nature of the area and of these two businesses, the sound levels are naturally quite high, which is predicted to result in the noise levels from the WTGs to be negligible.

Table 5-6: Wind Turbine Noise Impact Assessment Summary of the Most Impacted Receptors

Receptor ID	Worst Case Max Sound Level from WTG [dB(A)]	Realistic Case Max Sound Level from WTG [dB(A)]	Compliance with New Brunswick's Requirements (under worst case assessment)	Compliance with New Brunswick's Requirements (under realistic case assessment)
F	44.6	42.7	No	No
E	42.2	39.7	No	Yes
D	38.1	36.8	Yes	Yes
NL	37.3	33.4	Yes	Yes
NK	37.2	33.2	Yes	Yes
IE	37.0	33.1	Yes	Yes
IF	37.0	33.1	Yes	Yes
NV	36.5	32.5	Yes	Yes
IG	36.4	32.4	Yes	Yes
NT	36.2	32.2	Yes	Yes
C	36.1	34.1	Yes	Yes
B	36.0	34.0	Yes	Yes
GH	35.9	31.9	Yes	Yes
BY	35.8	31.8	Yes	Yes
BZ	35.6	31.6	Yes	Yes
CA	35.6	31.6	Yes	Yes
CZ	35.5	31.5	Yes	Yes
DR	35.5	31.4	Yes	Yes
IJ	35.2	31.2	Yes	Yes
IH	35.1	31.1	Yes	Yes
IK	35.1	31.0	Yes	Yes
II	35.0	30.9	Yes	Yes

Based on the parameters used to run the windPRO noise prediction model, it has been shown that the predicted SPLs expected to be experienced by the vast majority of receptors from proposed WTG model in the 10-turbine layout are less than 40 dB(A). All of the residential dwellings are shown to experience less than 40 dB(A).

Construction Noise

Construction noise is not always constant and can produce impulsive and variable sounds at different noise levels, which could create heightened annoyance levels in the surrounding community. The construction noise assessment has considered the maximum noise levels produced by various construction equipment to determine maximum sustained noise levels when all equipment is running.

General construction activities include those associated with vegetation clearing, road building, foundations, and turbine erection. These activities will likely involve the use of backhoes, concrete mixers and pumps, cranes, dump trucks, excavators and light-duty pick-up trucks with the associated sound levels predicted in Table 5-7.

Table 5-7: Noise Levels Associated with Construction Equipment (WSDoT, 2017).

Equipment	Max dB[A]
Backhoe	78
Concrete Mixer	79
Concrete Pump	81
Crane	81
Dump Truck	76
Excavator	81
Pick-up Truck	75

It is not expected that all equipment would be running at the same time, but to determine maximum expected noise levels, the WSDoT (2017) guidelines for decibel addition were used to determine that 86 dB[A] is the highest expected noise during combined construction activities.

The environment in which the project construction will occur is considered a soft environment with normal unpacked earth. The normal unpacked earth and topography will facilitate attenuation of noise emissions at shorter distances. Table 5-8 identifies the noise levels predicted to be observed at distances from the construction site determined using WSDoT (2017) guidelines.

Table 5-8: Worst-case noise impact to the surrounding environment calculated using WSDoT (2017) guidelines assuming sound levels in a soft environment attenuate at -7.5 dB[A] per doubling of distance.

Distance	Construction Noise dB[A]
50 ft (15.2 m)	86
100 ft (30.5 m)	78.5
200 ft (61 m)	71
400 ft (122 m)	63.5
800 ft (244 m)	56
1600 ft (488 m)	48.5
3200 ft (975 m)	41

Many noise scales refer to 70 dB(A) as an arbitrary base of comparison where levels above 70dB[A] can be considered annoying to some people (Purdue University, 2017). As indicated in Table 5-8, at 61 m from the construction site, noise levels are approximately 70 dB[A], similar to that of a car travelling at 100 km/h and just at the threshold of possible annoyance (Purdue University, 2000). Also indicated in Table 5-8, noise levels from the construction site reach ~40 dB(A) at 1 km from the site. With the nearest residential dwelling located ~1.2 km from a proposed turbine, construction noise is not expected to impact residences in the area. The nearest industrial building is ~500 m from a proposed turbine, meaning that construction noise will remain limited to ~50 dB(A). Further, the construction noise is not expected to be annoyingly high beyond 61 m from the construction site as noise levels at this distance have already attenuated to approximately 70 dB(A).

Additionally, this site has been chosen due to its wind resource. Wind generally increases ambient sound levels in an area and in combination with the vegetative cover will aid in making construction noise less noticeable at even shorter distances (WSDoT, 2017). Dense vegetation is estimated to reduce noise levels by as much as 5 dB for every 100 ft (30.5 m) and wind is estimated to reduce noise levels by as much as 20-30 dB at long distances (USDOT, 1995).

Table 5-9: Potential impacts and proposed mitigative measures for noise.

Potential Impacts on Noise	Proposed Mitigative Measures
During construction and decommissioning phases, the ambient noise SPLs will be elevated as a result of the use of equipment and machinery such as excavators, dump trucks and bulldozers. Elevated noise levels can disturb fauna and local residents.	• Noise impact will be limited by restricting construction and decommissioning activities to daytime hours when feasible; • Health Canada recommends the long-term average day-night sound level (Ldn) be below 57 dB(A) at the closest residence. An Ldn of 57 dB(A) is expected to be within the threshold for widespread complaints for construction noise (USEPA, 1974); and • At 250 m from the construction site, construction noise levels are estimated at 56 dB(A).
Elevated SPLs will be observed during operation from the nacelles, which will be a maximum of 135 m above ground level.	• A noise impact assessment has been conducted to predict a 'worst case scenario' and 'realistic scenario' SPL that can be expected at the surrounding dwellings. These values have been determined to be below 40 dB[A] at all residential buildings in both cases; • The noise impact assessment shows that two buildings in the adjacent industrial park could experience SPLs slightly above the guidelines at certain wind speeds, but this is not expected to be an issue given the existing noise associated with the industrial nature of the buildings; • A Compliant Resolution Plan has been provided in Appendix I for residents to refer to if they have concerns about any noise observed during operation; • The turbine locations have been sited in order to largely comply with Provincial wind turbine noise guidelines, aside from the potential impacts on the two industrial buildings, the owners of which will be engaged to identify any necessary mitigation measures;

Potential Impacts on Noise	Proposed Mitigative Measures
	• The wind turbines chosen for the project incorporate advanced noise reduction technologies in order to mitigate noise generated by the moving blades; and • By minimizing grubbing and clearing, flora on the Project site will aid in attenuation of noise produced from the WTG as perceived by local receptors, factors that were not considered in the worst-case noise impact assessment.
Infrasound from wind turbines.	• Infrasound from wind turbines is not a concern given the distance the wind turbine is in relation to homes and dwellings.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to ambient noise.

Significance of Residual Effects – Elevated SPLs caused by construction and decommissioning phases will be temporary, during the day and short term. Noise production from the WTG during operation has been mitigated by setback distances and confirmed by a noise impact assessment. The Project is not anticipated to have any significant residual environmental effect on noise levels. While any effect on ambient noise will be negative, the significance of residual effects on ambient noise is to be considered negligible.

5.1.6 *Shadow Flicker and Visual Aesthetics*

There are three attributes associated with the Project that have potential to cause an impact on the visual aesthetics of the site: lighting during nighttime construction activities, WTG lighting, and shadow flicker during WTG operation. A visual impact assessment was completed by collecting photographs from high-traffic areas around the Project site. Photomontages were created at two high traffic areas using WindFarm software. As a result, shadow flicker and visual aesthetics have been identified as a VEC.

A significant environmental effect would result if a considerable change in the ambient light and visual aesthetics was found to be the result of project activities.

Boundaries – The spatial boundary is the area in which the visual impact study was conducted; this being a 4,000 m radius from the BWP location. The temporal boundary is focused on the operation phase of the WTGs, but also includes the turbine installation phase of construction.

Discussion

Shadow Flicker

A shadow flicker impact assessment for the proposed BWP has been conducted to assess the potential impact of shadow flicker on the surrounding receptors. Details outlining the shadow receptors, prediction methodology, and assumptions made for the assessment are included in Appendix B.

Under the *Additional Information Requirements for Wind Turbines* document published by New Brunswick Ministry of Environment and Local Government pursuant to Section 5(2) of the *Environmental Impact Assessment Regulation* of the *Clean Environment Act*, requirements regarding visual impacts due to shadow flicker must be limited to 30 hours per year and 30 minutes per day based on a worst case scenario if feasible mitigation is not effective. Prior to conducting an assessment, careful site design through the application of sufficient setbacks can reduce the majority of predicted shadow flicker. In addition to the shadow flicker impact assessment, mitigation measures will be proposed to mitigate predicted shadow flicker impact.

The shadow receptors included in this shadow flicker assessment include a 4.0 km area surrounding the proposed BWP location. A total of 510 receptors have been included in this assessment.

The results of the shadow flicker prediction model at each receptor are used to prove compliance with the New Brunswick requirements of no more than 30 hours per year of shadow, and no more than 30 minutes on the worst day of shadow under a “worst case” scenario where mitigation is not feasible.

This study uses the E-141 EP4 WTG model and assumes a maximum hub height of 135 m and a blade length of 70 m. The results of this worst-case scenario study demonstrate that all but two of the receptors located within 4.0 km of the 10 WTG project layout are subject to less than 30 hr/year or 30 min/day. The two buildings shown to exceed these requirements under a worst case scenario are in the industrial park adjacent to the site.

A worst case scenario is achieved by assuming that for every day of the year:

1. The sky is cloudless between sunrise and sunset;
2. The turbines are always in operation; and,
3. The wind direction changes throughout the day such that the blades are perpendicular to the sun rays at all times causing the maximum amount of shadow.

Table 5-10 shows the results for the receptors that are predicted to experience 21+ hr/year of shadow flicker.

Table 5-10: Predicted worst case shadow flicker for E-141 at 135 m hub height for receptors predicted to experience 21+ hr/year of shadow flicker.

Receptor	Worst Case Shadow Hours per Year (hr/year)	Worst Case Max Shadow Hours per Day (hr/day)	Compliance with New Brunswick's Requirements
F	223:17	1:07	No
E	107:52	0:51	No
DV	26:29	0:22	Yes
EN	24:59	0:21	Yes
DW	23:39	0:20	Yes
CZ	22:18	0:25	Yes
NL	21:42	0:27	Yes
EB	21:05	0:23	Yes
IF	20:45	0:26	Yes
BR	20:32	0:23	Yes
BK	19:58	0:22	Yes
NK	19:52	0:26	Yes
IL	19:51	0:21	Yes
IE	19:45	0:26	Yes
BV	18:51	0:23	Yes
BN	18:30	0:21	Yes
IK	18:03	0:22	Yes
IH	17:41	0:22	Yes
CA	17:16	0:23	Yes
BC	16:43	0:20	Yes
II	16:07	0:21	Yes
BJ	15:25	0:21	Yes
DU	15:29	0:21	Yes
FB	15:10	0:22	Yes
DP	15:04	0:21	Yes

As previously mentioned, the receptors exceeding the requirements are two buildings in the Spruce Lake Industrial Park. These buildings are owned by Simpson Truck & Tractor Parts (receptor E) and GFL

Environmental (receptor F). The GFL Environment building is a warehouse-style building with very few, small windows. The Simpson Truck & Tractor Parts building is an office/warehouse style building with narrow horizontal windows. Photos of these buildings are included in Appendix B.

A realistic shadow flicker assessment was carried out for these two buildings. This study, which considers the size and orientation of the windows for these two buildings, as well as realistic atmospheric conditions, demonstrates that neither building is expected to experience shadow flicker exceeding 30 hr/year, which is summarized in Table 5-11. The detailed results of this realistic case shadow flicker assessment for these two buildings are included in Appendix B. These results demonstrate that under realistic atmospheric and realistic site conditions, neither of these two industrial buildings are predicted to experience shadow flicker that exceeds the requirements.

Table 5-11: Predicted realistic case shadow flicker for E-141 WTGs with 135 m hub height for receptors predicted to have the most impact based on a worst case scenario.

Receptor	Window Description	Realistic Case Shadow Hours per Year (hr/year)
A: Simpson Truck and Tractor Parts	Long side of building, lower windows	12:15
B: GFL Environmental	Long side of building, upper warehouse windows	27:29
C: Simpson Truck and Tractor Parts	Long side of building, upper windows	9:37
D: Simpson Truck and Tractor Parts	Short side of building, lower window	7:07
E: Simpson Truck and Tractor Parts	Short side of building, upper window	6:15
F: GFL Environmental	Long side of building, lower windows	19:52
G: GFL Environmental	Short side of building, lower windows	12:42
H: GFL Environmental	Short side of building, upper warehouse windows	6:37

Though all receptors are expected to receive less than the regulatory threshold of shadow flicker, mitigation can be implemented should different results be experienced by the local community.. Coniferous trees are considered a mitigation measure to shadow flicker as they block or screen the

shadow of the turbine from reaching the receptor. Additional screening mechanisms and altering turbine operation have also been determined as effective mitigation measures for reducing shadow flicker impact, as described in Section 7.2.3

Table 5-12: Potential impacts and proposed mitigative measures for shadow flicker and visual aesthetics.

Potential Impacts on Shadow Flicker and Aesthetics	Proposed Mitigative Measures
Shadow flicker may occur during certain weather conditions and times of the year.	• The potential negative effect of shadow flicker has been largely mitigated at the design stage through responsible turbine siting; • A shadow flicker assessment has been completed for residences and businesses within 4.0 km of the proposed BWP; • Compliance with industry standard guidelines on shadow flicker in a worst case scenario have been adhered to for all residences. All residential dwellings will experience less than 30 hours of shadow flicker per year and 30 minutes of shadow flicker on the worst day. Compliance is shown for all buildings under more realistic conditions; • If shadow flicker occurrences during operation are found to be exceeding guidelines and annoying to surrounding houses and buildings, screening receptors may be considered as detailed in Appendix B; and • A Compliant Resolution Plan has been provided in Appendix I for residents to refer to if they have concerns about any shadow flicker observed during operation.
Lighting during nighttime construction activities such as turbine installation.	• Construction activities will be limited to the day time when possible. The turbine may be erected during the evening as the activity must be completed when the wind

Potential Impacts on Shadow Flicker and Aesthetics	Proposed Mitigative Measures
	is less than 4 m/s. These conditions are commonly seen in the early evening.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius of the project site. No cumulative effects are expected to occur with respect to shadow flicker and visual aesthetics.

Significance of Residual Effects – Annoyance during project construction from work lighting, if necessary, will be temporary and of short duration. Lighting concerns from residents during operations such as shadow flicker and WTG lighting is expected to be limited, as mitigation measures will be employed during site design and further mitigation can be implemented during operation, if necessary. The perception of landscape aesthetics is a subjective matter. The Proponent recognizes the development of the proposed WTGs may have a negative effect in the perception of the community. It is possible that the negative reaction may be a result of a change in the landscape and may diminish over time. Therefore, while any effect from shadow flicker and on the visual aesthetics of the land will be negative, the significance of residual effects is predicted to be minor.

5.1.6.1 Photomontage

ReSoft Ltd WindFarm software was used to create two photomontages of the BWP from Lorneville Church and from the Lorneville Community Center (Figure 4-14). Determining suitable locations for photomontages required an open area for some distance to ensure the turbine would be visible over the treeline. Areas in close proximity to the turbine were not suitable as the trees were an obstacle. Figure 5-1 through Figure 5-2 demonstrate how the WTGs are predicted to look on the landscape.

Figure 5-1: Predicted Visibility from of the turbines from Lorneville Church (Figure 4-14).

Figure 5-2: Predicted Visibility from the Lorneville Community Centre (Figure 4-14).

5.1.6.2 Zone of Visual Influence (ZVI)

A ZVI model was conducted to determine the visual impact the turbines may have on the surrounding landscape. A hub height of 135 m and blade length of 70 m was used to calculate the worst-case visual impact. Given the size of the turbines and the proposed hilltop location, it is expected the turbines will be visible at several locations throughout the Saint John area.

The basic ZVI model only uses digital elevation to determine if any part of the turbine is visible demonstrating a worst case scenario as vegetation and other obstacles between the viewpoint and the turbines are not considered.

Figure 5-3 shows the windPRO ZVI model output showing the 48 km visual radius recommended for visual analyses by Sullivan et al. (2012) in *Wind Turbine Visibility and Visual Impact Threshold Distances in Western Landscapes*. Though the proposed turbine model is larger than those included in the western study, it is noted that blade movements become less noticeable to the naked eye. Further, Figure 5-4 demonstrates the ZVI model including the subtended vertical angle (SVA) analysis. The SVA analysis was conducted to incorporate distance in the visual assessment for the BWP. The SVA analysis will help determine how dominant the turbine appears on the landscape.

The SVA demonstrates that at ~9 km from the BWP location the angle of view becomes consistently less than one degree, meaning the turbines appears very small on the landscape and will no longer have a dominant impact on visual aesthetics. The photos for the photomontages were taken at locations predicted to be in the 3 - 10 degree angle of view range in the Lorneville area.

Figure 5-3: Results of the basic Zone of Visual Influence analysis using a 48 km visual analysis radius. Orange colour demonstrates some portions of the turbine may be visible.

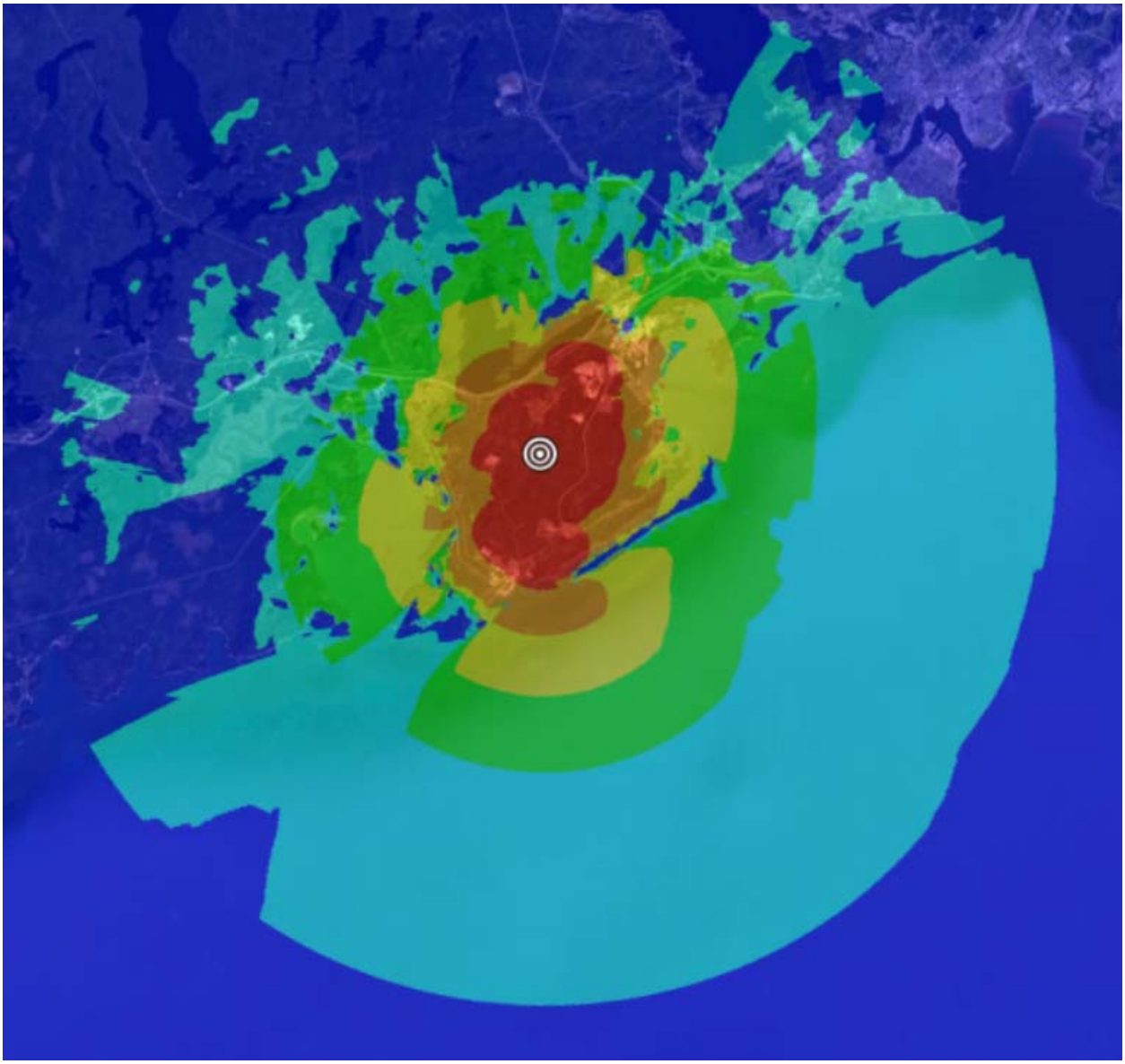

Figure 5-4: Results of the Subtended Vertical Angle analysis within the Zone of Visual Influence model using a 48 km visual analysis radius, which shows the value of the largest vertical angle of the visible turbines for values from 0-1° (dark blue), 1-2° (light blue), 2-3° (green), 3-5° (5-10), and 10-180° (red).

Table 5-13 outlines potential impacts of shadow flicker and visual impacts that have been known to occur at wind energy facilities. Additionally, standard mitigation measures have been proposed for these impacts.

Table 5-13: Potential impacts and proposed mitigative measures for visual aesthetics.

Potential Impacts on Shadow Flicker and Aesthetics	Proposed Mitigative Measures
During the night time, lighting will be seen on top and mid-way up the turbine tower.	• LED lighting will be used to minimize light throw; • Only the minimum amount of pilot warning and obstruction avoidance lighting will be used; • Only lights with short flash durations and the ability to emit no light during the 'off phase' of the flash (*i.e.,* as allowed by strobes and modern LED lights) will be installed on WTG structures; • Lights will operate at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada; • Exterior turbine maintenance lights will be turned off prior to maintenance staff leaving the site.
Community members may have a negative reaction towards the aesthetics of the WTGs.	• The Proponent considered landscape aesthetics when deciding on specific siting of the WTGs; • The paint on the WTGs has been selected so that it does not contrast sharply with the environment; • Policies regarding responsible siting of WTGs were followed to minimize the potential impact on the landscape aesthetics during WTG siting; and • Visual impact assessment and photomontage studies will be conducted to proactively demonstrate what the Project may look like.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to shadow flicker and visual aesthetics.

Significance of Residual Effects –The perception of landscape aesthetics is a subjective matter. The Proponent recognizes the development of the proposed WTGs may have a negative effect in the perception of the community. It is possible that the negative reaction may be a result of a change in the landscape and may diminish over time. Therefore, while any effect from shadow flicker and on the visual aesthetics of the land will be negative, the significance of residual effects is predicted to be minor.

5.2 Assessment of Biophysical VEC Impacts

5.2.1 *Avian*

Throughout the construction, operation, and decommissioning of a wind farm the potential negative impacts can be classified into four categories: collision, displacement due to disturbance, barrier effects, and habitat loss. As a result, migratory and breeding birds have been identified as a VEC. The Proponent will comply with the Migratory Bird Convention Act at all times and for all Project related activities.

A significant environmental effect would result if a considerable change to migratory and breeding birds was the result of project activities.

*Boundarie*s – The spatial boundaries include the area where the WTGs will be located, and also includes pathways and locations that are frequented by birds. The temporal boundary is all phases of the Project.

Discussion - At the time of this submission, only high-level desktop studies were conducted to determine any previously recorded avian SOCC or SAR had been observed in or near the Local Study Area according to the ACCDC database. In total, there were five SOCC or SAR located on or in close proximity (i.e., 5 km) to the Project site. These include the Barn swallow, Canada warbler, Eastern wood-peewee, Horned grebe, Olive-sided flycatcher, and the Red knot rufa subspecies.

In addition to the desktop survey for avian SOCC or SAR, avian surveys were completed in the spring, summer and fall of 2019. The avian survey results will be submitted in an addendum following the completion of the field report. Below are the proposed mitigative measures to reduce impact to migratory and breeding birds. Depending on the results of the field surveys, additional mitigation measures may be required.

Table 5-14: Potential impacts and proposed mitigative measures for migratory and breeding birds.

Potential Impacts on Migratory and Breeding Birds	Proposed Mitigative Measures
During construction (clearing/grubbing) some vegetation might be cleared that may be habitat to some migratory and breeding birds.	• The Proponent will endeavor to conduct construction activities such as clearing and grubbing during a time period that does not coincide with the time period in which

Potential Impacts on Migratory and Breeding Birds	Proposed Mitigative Measures
	migratory and breeding birds would be in the area.
During operation there is a possibility that migrating birds could collide with the WTGs and Project infrastructure.	• A follow up avian mortality survey will be conducted after the BWP commissioning and appropriate actions will be taken in consultation with DERD and CWS should there be a significant negative impact to migration flyways; • A comprehensive Adaptive Management Plan will be developed and implemented in consultation with DELG and CWS; and • The Proponent is participating in a regional radar and acoustic study to determine movement patterns and abundance across New Brunswick.
Birds may alter their migration flyways and/or local flight paths to avoid WTGs.	• A follow up avian mortality survey will be conducted after the WTG commissioning and appropriate actions will be taken in consultation with DERD and CWS should there be a significant negative impact to migration flyways.
Lighting on turbines can result in adverse impacts on birds. The Proponent recognizes that nocturnal migrant and night-flying seabirds are the birds most at risk of attraction to lights.	• Only the minimum amount of pilot warning and obstruction avoidance lighting will be used; • Only lights with short flash durations and the ability to emit no light during the 'off phase' of the flash (i.e., as allowed by strobes and modern LED lights) will be installed on tall structures; • Lights will operate at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada; • Instruction will be given to wind farm maintenance staff to ensure all work lights are turned off upon leaving the site

Potential Impacts on Migratory and Breeding Birds	Proposed Mitigative Measures
	particularly during foul weather events; and • A follow up avian mortality survey will be conducted after the wind farm commissioning, and appropriate actions will be taken in consultation with DELG, DNRED and CWS should there be a significant negative impact to night migrants.
Fog events can impair avian visibility, increasing the likelihood of mortality from collision with WTGs.	• ECCC climate database has been consulted to predict the rate of fog occurrence; • An annual average of 6.34% fog is predicted for the Project site; and • Instructions will be given to wind farm maintenance staff to ensure all work lights are turned off upon leaving the site particularly during foul weather events.
The Project Footprint will cause a loss of habitat for breeding and migratory birds.	• Desktop and field studies conducted suggest a minimal loss of habitat due from clearing. The clearing footprint is minimized by using existing access roads and areas previously cleared from forestry activities.
There will be an increase in habitat when the Project site is reclaimed at the end of the 25 year project lifetime.	• N/A – no mitigation measures necessary for a positive potential impact.
When the WTG is removed there will no longer be the potential barrier effect impeding flyways or local flight paths.	• N/A – no mitigation measures necessary for a positive potential impact.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to migratory and breeding birds.

Significance of Residual Effects – Disturbance of bird habitat will be minimal by employing the proposed mitigation measures. It is expected that the mortality rate of birds from collision or habitat loss during

Project operation, if at all, will be low. This assessment will be further reviewed and discussed with the full results of the avian studies conducted by Boreal Environmental.

The Proponent does not anticipate increased mortality rates for the proposed turbines at a maximum height of 205 m. Post-construction monitoring for bird mortality during operation will verify the impact the Project has on migratory and breeding birds.

5.2.2 *Bats*

Throughout the construction, operation, and decommissioning of a wind farm the potential negative impacts to bats can be classified into two categories: collision and habitat disturbance. As a result, bats have been identified as a VEC.

A significant environmental effect would result if a considerable change to bat habitat, relative abundance/population decline was caused by the project activities.

Boundaries – The spatial boundaries include the area where the WTGs will be located. The temporal boundary is all phases of the Project.

Discussion - There are seven species of bats that occur in New Brunswick, three of which are listed as endangered by COSEWIC, the Canadian SARA and the NB SARA (i.e., Little brown myotis, Northern long eared myotis and the Tri-coloured bat). These species are also defined as S1 species by ACCDC. The remaining four species found throughout New Brunswick are defined by ACCDC as follows:

- Big brown bat (EPFU) – S3
- Eastern red bat (LABO) – S2
- Hoary bat (LACI) – S2
- Silver Haired bat (LANO) – S1

These four species are considered migratory, whereas the three endangered species mentioned previously are resident bats. Studies have shown that on average, greater than 80% of bat fatalities currently recorded at wind energy developments in North America, involve migratory species (Arnett et al. 2008). Bat fatalities, primarily migratory species, occur through direct collision with blades or indirectly from rapid decompression (barotrauma) near turbines (Baerwald et al., 2008).

The pre-construction acoustic bat surveys were being analyzed at the time of EIA registration. Acoustic bat detectors have been collecting data throughout the spring and fall migration periods to capture peak periods of bat activity. A full acoustic analysis will be conducted by Boreal Environmental and results will demonstrate bat passes per night and per detector. This data will be submitted to the TRC as an addendum to the EIA registration document. Though the data has yet to be analyzed, there are no known bat hibernacula within the 5 km required setback (NBDOE 2009, NBDNR 2012) of the Project Footprint. Table 5-15 outlines potential impacts to bats that have been known to occur at wind energy facilities. Additionally, standard mitigation measures have been proposed for these impacts. Upon completion of data analysis, impacts and proposed mitigation will be adjusted for site specific occurrences.

Table 5-15: Potential impacts and proposed mitigative measures for bats.

Potential Impacts on Bats	Proposed Mitigative Measures
Clearing and construction activities have the potential to cause disturbance to bat habitat.	• The project site has been designed to minimize the amount of land cleared. This reduces the ecological impact of the Project Footprint and minimizes the potential impact to bat habitat.
During operation there is a possibility that bats could collide with the WTG or succumb to barrotrauma.	• A follow up bat mortality survey will be conducted after the BWP commissioning and appropriate actions will be taken in consultation with DELG and DNRED should there be a significant negative impact to bats; and • Should it be deemed necessary, mitigation scenario for this site may involve increasing the rotor cut-in speed to 5 m/s from half hour before sunset to half hour after sunrise.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to bats.

Significance of Residual Effects – Disturbance of bat habitat during construction will be unlikely to occur by employing the proposed mitigation measures. The predicted mortality rate of bats due to collision and/or habitat loss cannot be accurately predicted at the time of EIA registration. However, due to lack of critical habitat, known caves and open mines in close proximity to the project site, preliminary estimates would suggest the BWP is well sited to avoid impacts to bats and bat habitat. Monitoring for bat mortality during operation will also verify the effect the Project has on bats. When considering projects of similar nature to the BWP in Atlantic Canada, and that no bat hibernacula are located near the Project Footprint the preliminary prediction of impact is to be considered negligible. However, field surveys will confirm populations at the proposed BWP site.

5.2.3 *Wetlands and Watercourses*

Management of wetlands and watercourses is an important and integral aspect of maintaining a diverse ecosystem. The Project's impact on ground water quality and quantity as assessed in Section 5.1.1 was predicted to be minor in terms of significance of environmental effect. While the quality and quantity of ground water is important in terms of ecological functionality of wetlands and watercourses, the Project may also interact with surface wetlands and watercourses in terms of direct alteration.

A significant environmental effect would result if a considerable change to wetlands and watercourses was the result of project activities.

Boundaries – Spatial boundaries are limited to works associated with the Project focusing on the access roads, the WTG locations and the collector line. The temporal boundary focuses on Project construction but also includes operation and decommissioning for the unlikely event of an accident or malfunction.

Discussion – The proposed project is situated primarily within the Musquash River Watershed (specifically near the mouth of the watershed), but a portion does fall within a composite of watersheds (specifically East of Musquash River composite). The Musquash River Watershed encompasses a drainage area of 481 square kilometers while the East of Musquash River composite encompasses a drainage area of 76 square kilometers. The Musquash River has two main branches, the East Branch and the West Branch. A series of dams were previously erected within the Musquash Watershed to create large reservoirs, which were used in the generation of hydro power by NB Power up until 2009. The Loch Alva Protected Natural Area, the Musquash Estuary Marine Protected Area, the Ducks Unlimited South Musquash Marsh, and the Nature Conservancy's Musquash Nature Reserve are all located within the Musquash Watershed. The Irving Nature Park, Taylor's Island Managed Area, the Saint's Rest Marsh and Beach Environmentally Significant Area/Important Bird Area, the Manawagonish Island Important Bird Area, and the F. Gordon Carvell Nature Preserve all fall within the East of Musquash River composite watershed.

The proposed turbine locations have been optimized to limit interaction with mapped watercourses and wetlands, as well as unmapped watercourses and wetlands within the Project Study Footprint. Wind turbines have been set back at least 150 m from any mapped watercourse or wetland. Further field delineation is required in the spring of 2020 to confirm the presence of unmapped watercourses and wetlands outside of the 2019 Project Study Area. If additional watercourses and wetlands are discovered outside of the 2019 Project Study Area, and within the Project Footprint, it is likely that the wetlands and watercourses will be of similar in nature to the ones delineated on site in 2019 (i.e., ephemeral watercourses).

Table 5-16: Potential impacts and proposed mitigative measures for wetlands and watercourses.

Potential Impacts on Wetlands and Watercourses	Proposed Mitigative Measures
During the construction phase, possible impacts to wetlands may arise from clearing, grubbing, infilling and excavation activities. Such activities might induce silt run-off, alter flow into the wetlands or see them become repositories of significantly increased water flow, nutrients or sediments.	• Additional field studies will be conducted in 2020 to delineate any unmapped watercourse or wetland within the Project Footprint, and surrounding the turbine locations; • Wind turbines have been set back at least 150 m from any mapped aquatic features; • Collector line poles will span wetlands, where possible, to reduce direct

Potential Impacts on Wetlands and Watercourses	Proposed Mitigative Measures
	disturbance but a WAWA permit will be obtained for any poles that cannot be setback 30 m; • Field surveys in the summer and fall of 2019 were completed to ensure unmapped wetlands were delineated; • Appropriate sediment erosion and run-off control measures (e.g. silt fencing, haybales) will be implemented when needed; • Natural regeneration of the site will be promoted to aid in storm water retention and reduce run-off; • An application to conduct work will be made for any work within the 30 m of a watercourse and/or wetland • No refuelling of equipment will occur within 30 m of a watercourse or wetland; and • No stockpiling of materials will occur within 30 m of a watercourse or wetland.
Exposure or accidental spillage of hazardous materials such as fuel, oils and hydraulic fluids has potential to contaminate surface water supplies during construction, operation and decommissioning phases.	• Equipment shall be in good working order and maintained so as to reduce risk of spill/leaks and avoid water contamination; • Spill response kits will be provided on site for each piece of equipment to ensure immediate response to a potential waste release and will be stocked with supplies to handle a worst-case scenario on ground or in surface and ground water; • Corrective measures will be implemented immediately and reported to the DELG's Saint John Regional Office at (506) 658-2558 or outside of business hours to the Canadian Coast Guard's environment emergencies reporting system at 1-800-565-1633;

Potential Impacts on Wetlands and Watercourses	Proposed Mitigative Measures
	• Routine maintenance, refueling and inspection of machinery will be performed off-site whenever possible; and • A spill contingency and emergency response plan will be included within the EMP to be submitted as an addendum.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to wetlands and watercourses.

Significance of Residual Effects –The WTGs have been located such that a 150 m buffer exists between the WTGs and any mapped wetland or watercourse. All but four WTGs have a 300 m buffer between them and any mapped wetland. This is similar for mapped watercourses. In all instances, no direct impact to the mapped watercourses or wetlands is expected and collector line poles will span the sensitive area. A WAWA permit will be obtained, where required, for any work within a 30 m wetland or watercourse buffer. With the proposed setbacks and mitigation to reduce direct impacts, the significance of residual effects on mapped wetlands and watercourses is predicted to be minor. Direct impact to unmapped watercourses and wetlands due to the WTGs is expected to allow for roads and collector lines. In most instances, collector line poles will span sensitive areas. Due to the small project footprint proposed within the unmapped watercourses or wetlands and the mitigation proposed to reduce the direct impacts, the significance of residual effects on unmapped wetlands and watercourses is predicted to be minor.

5.2.4 *Fish and Fish Habitat*

Most of the watercourses identified and delineated in-field are ephemeral and likely do not support fish and/or fish habitat. However, the four mapped and named watercourses (i.e., Burchill's Brook, Frenchman's Creek, Mill Creek, and Marsh Brook), are likely salmonid bearing and support fish habitat. In addition to the above mentioned watercourses, several brook trout (*Salvelinus fontinalis*) were observed in pools below the outlet from the wetland connected to Maguires Cove Brook (MCB).

A significant environmental effect would result if a considerable change in fish and fish habitat was the result of project activities. As a result of the potential watercourse interaction along the collector line fish and fish habitat has been identified as a VEC.

Boundaries – Spatial boundaries are limited to the watercourses that may require disturbance form the collector line installation. The temporal boundary focuses on Project construction.

Discussion - There is existing access and culverts along Burchill Road; however, it is likely the road may need some upgrades to support construction, which may include culvert replacements along Burchill Brook and Frenchman's Creek. Although not confirmed in field, both are anticipated to have fish

presence. Alteration of freshwater environments such as potential watercourse crossings on a tributary of Mill Creek and a tributary of Burchill's Brook for construction access and operational maintenance may also be required. These two potential crossings are both also anticipated to have fish presence. A fish survey will be conducted in the 2020 to determine the presence/absence of fish within those watercourses where in-stream work may be required, and where the watercourses are likely to support fish habitat.

Additional crossings may also be required on the smaller, ephemeral watercourses within the Project Study area. However, it is not anticipated those watercourses support fish and/or fish habitat. No crossings or other instream work is anticipated for Marsh Brook, nor Matthew's Cove Brook due to their location in respect to the Project Footprint.

According to the ACCDC records review, there are no records of fish SAR or SOCC that have been historically observed within 5 km of the proposed project area, thus is not anticipated to adversely affect rare aquatic species or aquatic SOCC or their habitat.

Table 5-17: Potential impacts and proposed mitigative measures for fish and fish habitat

Potential Impacts on Fish and Fish Habitat	Proposed Mitigative Measures
Loss or damage to fish and fish habitat during watercourse alteration.	• Fish surveys may be completed in 2020 to confirm watercourses supporting fish habitat when required; • All construction activities near watercourses will comply with the applicable regulations and guidelines such as the Fisheries Act; • All required watercourse crossings will comply with existing regulatory requirements including the New Brunswick Watercourse Alteration Specifications; and • Crossings should be located in areas that exhibit a stable soil type and where grades approaching the crossings will not be too steep.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to fish and fish habitat.

Significance of Residual Effects – The project design was modified to reduce impacts to watercourses. However, it is likely some watercourse crossings will be required on potential fish bearing bodies. Consultations will occur with DFO to determine if a HADD will be required. Where work is required within

a 30 m buffer, a WAWA permit will be obtained and all conditions will be adhered to. This will further help mitigate any direct and non-direct impacts to fish and fish habitat.

According to the ACCDC database, there have been no known observations of fish SOCC or SAR within 5 km of the Project Study area.

With the proposed mitigation measures, the BWP is not anticipated to adversely affect unique or sensitive aquatic habitat. The significance of residual effects on fish and fish habitat is predicted to be minor.

5.2.5 *Wildlife*

Information collected during field surveys has covered all habitat types and wildlife observations. Wildlife species including terrestrial and aquatic mammals have been identified in Section 4.2.5. In an effort to preserve wildlife habitat and ensure wildlife species remain unharmed, terrestrial and aquatic wildlife has been identified as a VEC.

A significant environmental effect would result if a considerable change to wildlife populations was the result of Project activities.

Boundaries – The spatial boundary is the entire Project site. The temporal boundary includes the construction phase focusing on clearing, grubbing and building the access roads, WTG crane pads and foundations, as well as the decommissioning phase focusing on site reclamation.

Discussion –All terrestrial mammals observed using the Project study area are common to the area. Small temporary disturbance may occur during construction activities, but it is anticipated individuals will return to the site during operation. As discussed in Section 4.2.5.2 some aquatic wildlife (i.e., Leather Back Sea Turtle and Fin Whale) has been historically observed and recorded within the ACCDC database. However, these species are within the marine environment, and are not going to be impacted by the Project.

Overall, the Project will decrease some wildlife habitat from the access roads and crane pads. While the construction phase presents potential for negative impact, once the decommissioning phase has started, land reclamation will restore the Project site to its previous state.

Table 5-18: Potential impacts and proposed mitigative measures for wildlife.

Potential Impacts on Wildlife	Proposed Mitigative Measures
Clearing and grubbing will result in the disturbance of wildlife habitat.	• There will be minimal land/habitat loss attributable to the construction phase as determined by desktop and field studies; • The access roads have been optimized to make use of existing roads at the Project site to reduce the amount of flora to be cleared; and • Location of the access roads will be optimized to reduce footprint and to avoid sensitive areas where feasible.
The Project Footprint will cause loss of habitat for terrestrial mammals.	• Desktop and field studies conducted suggest a minimal loss of habitat due to clearing, which is considered to have minimal impact on wildlife.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to wildlife.

Significance of Residual Effects – With the proposed mitigation measures employed the significance of residual effects on wildlife is predicted to be negligible.

5.2.6 *Vegetation and Habitat*

Information collected during field surveys has covered all habitat types. Habitat types have been identified in Section 4.2.6. In an effort to preserve local flora species and to ensure flora species of conservation interest remain unharmed, vegetation and habitat has been identified as a VEC.

A significant environmental effect would result if a considerable change to vegetation and habitat was the result of Project activities.

Boundaries – The spatial boundary is the entire Project site. The temporal boundary includes the construction phase focusing on clearing, grubbing and building the access roads, WTG crane pads and foundations, as well as the decommissioning phase focusing on site reclamation.

Discussion – There were five plants SOCC and/or SAC identified in the Project Study Area, and include Purple false foxglove, Coastal sedge, Wiegand's sedge, Loesel's twayblade, and Cloudberry. Of the five, the Coastal sedge, Wiegand's sedge, and Loesel's twayblade were given the ACCDC rank of uncommon but secure. Cloudberry was ranked by ACCDC as a 'numeric rank range', denoting uncertainty about the exact rarity. This species was also classified as secure by ACCDC. Coastal sedge and Wiegand's sedge

were only observed in one location within the Project Study Area. However, several hundred specimens of Coastal sedge were observed, while only a few of Wiegand's sedge (3 clumps) were observed. Loesel's twayblade was observed in small quantities (<20), in two locations of the Project Study area.

Purple false foxglove was ranked by ACCDC as extremely rare, and as 'may be at risk'. There were six general areas in which this species was observed in the hundreds throughout the Project Study Area, mainly in disturbed areas along the pipeline RoW, edges of roadways etc.

Of the above species, the Purple false foxglove is of greatest concern where it is considered extremely rare, and may be at risk by ACCDC. It is unlikely the existing species will be directly disturbed due to their exact locations. However, if additional species are located, a 30 m buffer will be applied surrounding the plant of SOCC or SAR. Where this plant species is thriving in previously disturbed areas, the disturbances at the Project site may help promote further growth.

There will be some loss of vegetation for the construction of turbines and the upgrading, widening, and construction of the access roads but any areas of temporary disturbance will be revegetated upon site clean-up. Additionally, after decommissioning the site will be reclaimed to its previous state.

Table 5-19: Potential impacts and proposed mitigative measures for vegetation and habitat.

Potential Impacts on Vegetation and Habitat	Proposed Mitigative Measures
Clearing and grubbing will result in the disturbance of vegetation and habitat.	• Additional field studies will be conducted in 2020 to verify any sensitive vegetation that falls outside of the 2019 Project Study Area, and within the Project Footprint; • There will be minimal land/habitat loss attributable to the construction phase as determined by desktop and field studies; • A 30m buffer will be placed around the observed plant SOCC (i.e., Purple false foxglove); • The access roads have been optimized to make use of existing roads, where possible, at the Project site to reduce the amount of flora to be cleared; and • Natural regeneration of the site will be promoted to replenish vegetation in some of the cleared areas that will not be needed during operation.

Potential Impacts on Vegetation and Habitat	Proposed Mitigative Measures
There is a risk of introducing invasive species through plant matter attached to construction equipment.	• Construction equipment will be cleaned prior to transportation and use to ensure that machinery is clean.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to vegetation and habitat.

Significance of Residual Effects – The Project will decrease the flora footprint from the access roads, crane pads, collector line, and substation. While the construction phase presents potential for negative impact, land that has been cleared and is not needed for operation will be allowed to naturally regenerate. Additionally, once the decommissioning phase has started, land reclamation will restore the Project site to its previous state. With the proposed mitigation measures employed, the significance of residual effects on flora is predicted to be minor.

5.2.7 *Significant and Sensitive Habitat*

Information collected during desktop and field surveys has covered all habitat types. In an effort to preserve this habitat, significant and sensitive habitat has been identified as a VEC.

A significant environmental effect would result if a considerable change to significant and sensitive habitat as the result of Project activities.

Boundaries – The spatial boundary is the entire project site. The temporal boundary includes the construction phase focusing on clearing, grubbing and building the access roads, WTG crane pads, foundations, and collector line as well as the decommissioning phase focusing on site reclamation.

Discussion – Installation of the proposed collector line may require working within 30 m of a wetland or watercourse. There are two Provincially Significant Wetlands identified within the Local Study Area. However, they are greater than the 500 m setback (NBDOE 2009, NBDNR 2012) required for wind farms, and do not impact any Project infrastructure and/or Project Footprint. The Musquash Estuary, located just west of the Project site, is considered an MA, or an area with rich diversity of species and/or special features. A 300 m buffer is recommended in siting wind farms to protect MAs (NBDOE 2009, NBDNR 2012). The placement of a 300 m buffer on Musquash Estuary overlaps the boundary of the Local Study Area. However, it does not interfere with the Project Footprint. There are no other MAs or ESAs that encroach on the local study area for this Project. The areas near the sightings of the Purple false foxglove do present sensitive habitat. However, it is discussed in Section 4.2.6.6. In summary, the Project Footprint does not interact with any ESAs or MAs.

Table 5-20: Potential impacts and proposed mitigative measures for Significant and Sensitive Habitat.

Potential Impacts on Significant and Sensitive Habitat	Proposed Mitigative Measures
Clearing and grubbing may result in the disturbance of significant and sensitive habitat.	• The Project footprint is setback a sufficient distance (i.e., >500 m) from any coastal wetlands, MAs, or ESAs reducing potential impacts

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to sensitive and significant habitat.

Significance of Residual Effects – Some work may be required within a 30 m wetland or watercourse buffer and this impact is addressed in Section 5.2.3. There have been no other areas of sensitive or significant habitat observed within the project site. The project is not expected to have any impacts on these features as none were identified.

5.3 Assessment of Socio-economic VEC Impacts

5.3.1 *Archaeological Resources*

Based on the potential for the presence of archaeological resources after reviewing the spatial database predictive model, initial documentary research, and the pedestrian survey, there are indications that a portion of the footprint has a high potential for the presence of archaeological remains. The high potential areas are associated with Turbines 5 to 9, and where the access roads cross MC, BB and FC. As a result, archaeological resources have been identified as a VEC.

A significant environmental effect would result if a considerable change to archaeological resources was the result of project activities.

Boundaries – The spatial boundary for this VEC is the entire Project site. The temporal boundary is the construction phase where ground disturbance is likely to occur.

Discussion - Shovel test pits have been recommended by Archaeological Prospectors and will be completed at the proposed turbine locations of high potential and along the access roads where they cross the watercourses. Results of the shovel test pits will be submitted as an addendum to this EIA.

Table 5-21: Potential impacts and proposed mitigative measures for archaeological resources.

Potential Impacts on Archaeological Resources	Proposed Mitigative Measures
Direct impact to cultural resources during construction activities, such as blasting and excavation.	• Archaeological test pits will be excavated in areas of high potential, and upon completion, will be submitted as an addendum; • Avoidance is the preferred method of mitigation in all instances where archaeological resources are present; • Construction workers working within 80m of a watercourse will be advised of the higher potential for archaeological resources; and • Should any archeological resources, including but not limited to an archaeological object, burial object, or human remains, be encountered by chance during construction, all activities are to stop and the Archaeological Services Branch will be contacted as soon as practical via (506) 453-2738 to determine a suitable method of mitigation.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to archaeological resources.

Significance of Residual Effects – The proposed collector line crosses areas of medium- high potential for archaeological resources. Shovel tests will be completed in areas where ground disturbance is expected (i.e., turbine locations) and if archaeological resources are observed, avoidance of resources will be implemented. In the unlikely event that archaeological resources are observed that cannot be avoided, further consultation with New Brunswick's Archaeological Branch will occur. Further, any resources observed by chance during the construction phase will be reported as soon as feasible. With the mitigation proposed, the significance of residual effects on archaeological resources is expected to be negligible as it is expected that should any resources be found onsite, that they can be successfully avoided.

5.3.2 *Electromagnetic Interference*

There is the potential that the turbine rotor may interfere with the transmission and receiving of telecommunication signals from telecommunication towers. The desktop Electromagnetic Interference

Study identified two land mobile radio towers, one cellular tower, and four microwave radio links that could be impacted by the BWP. Consultation has been initiated with the system owners closest to the proposed BWP turbine locations, which are NB Power, Bell Mobility, and Rogers Communications. The proponent will continue to work with the system owners to ensure the BWP will not cause any interference.

Transport Canada and Navigation Canada have been consulted. Aeronautical Assessment and Land Use Proposal applications have been submitted for evaluation of the proposed location. Transport Canada has approved the entire site. Navigation Canada has provided preliminary approval of the site, given that the final turbine layout is submitted once determined. The Department of National Defence has been notified about the proposed Project location, and no objections have been received. The RCMP was also notified of the proposed Project and identified no issues.

As indicated in Section 4.3.2, there are several radar towers in the region, including the CCG marine communications and traffic services radio tower site atop Red Head Mountain near Mispec Point. Any wind turbine located within 60 km of a vessel traffic radio tower could affect vessel radars. Therefore, CCG were consulted and responded indicated that no interference issues were anticipated with the location. The proposed turbines are over 50 km away from the nearest seismoacoustic monitoring array; therefore, according to RABC, no further consultation is required (RABC, 2007).

A significant environmental effect would result if considerable electromagnetic interference was caused by project activities.

Boundaries – The spatial boundary consists of the local area including the proposed BWP and neighbouring communication infrastructure and microwave radio links. Temporal boundaries include the operation phase of the Project.

Discussion – An electromagnetic interference assessment has been completed to locate the communication infrastructure and microwave radio links in the area. Appropriate consultation and recommended clearance buffers have been calculated for the towers and links between communication towers based on the RABC guidelines. Consultation is ongoing with the relevant system owners.

Over the past few years, there has been growing concern over public safety in relation to possible exposure to electromagnetic fields (EMFs) from wind turbines. Electric fields are generated by a difference in voltage, while magnetic fields are generated when there is a flow of electric current. A higher voltage and greater current will result in larger EMFs (WHO, 2017).

EMFs can occur naturally in the environment and are generated from every electrical distribution line that connects to homes and from all household electronic devices. A study conducted in 2014 (McCallum et al.) found that EMFs generated by wind turbines do not present a health concern to the public and that EMF levels surrounding wind turbines are found to be lower than levels found around homes from the use of common household electrical devices.

EMFs generated by wind turbines do not pose any health concerns and are not considered a potential impact to public health and safety.

Table 5-22: Potential impacts and proposed mitigative measures for electromagnetic interference.

Potential Impacts of Electromagnetic Interference	Proposed Mitigative Measures
WTG operation may interfere with telecommunication and/or radar communication infrastructure	• Consultation with the relevant system owners is ongoing, as recommended by CanWEA and RABC's guidance document – *Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar System*; • A desktop EMI assessment was conducted following the RABC guidelines and using expert knowledge of the consultant; • Ongoing discussions with system owners will identify the interference that may be caused by the turbines and with the communication of their systems; • Wind turbines will be sited appropriately following discussions and consultation with system owners to avoid impact zones altogether if practical or minimize interference to an acceptable level as deemed appropriate by the system owners and the Proponent; • Land Use Proposal application has been submitted to and approved by Navigation Canada to ensure that the Project does not pose any hazard to their navigational systems; • The Canadian Coast Guard have been contacted; • Aeronautical Assessment application has been submitted and approved by Transport Canada; and • The Department of National Defence and the RCMP have also been consulted.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to electromagnetic interference.

Significance of Residual Effects – The significance of residual effects on telecommunication and radar communication is expected to be negligible. The proponent is continuing to work with the system owners to ensure this outcome.

5.3.3 *Land Use and Property Value*

The proposed BWP is located on crown land and a license will be obtained for the purpose of developing the proposed BWP. Lands surrounding the Project parcel are a mix of rural consisting of residential communities, and industrial. There are more than 100 residences along Lorneville Road that border the property in which the Project will occur. However, those residences are all outside the 500 m setback for turbine siting (NBDOE 2009, NBDNR 2012). As a result, land use and property value have been identified as VECs.

A significant environmental effect would result if a considerable change to land use, or property devaluation was the result of project activities.

Boundaries – The spatial boundaries include the proposed WTG location. The temporal boundary includes all phases of the Project including construction, operation and decommissioning.

Discussion – Two RoWs pass through the Local Study Area, and come in close proximity to the Project Footprint. In addition, there is an area in which the SJMFC use as a landing strip for their remote control airplanes, located at the end of Patty's Hill Road. Consultation has been underway with concerned parties (i.e., Saint John Industrial Parks, Irving Oil, and SJMFC) to determine Project impacts if any, and potential setbacks that may be required.

The current local study area is primarily zoned rural, except for the land along King William Road, which is zoned medium industrial. In addition, there is a small section zoned Heavy Industry alongside Paddy's Hill Road, and a small portion zoned Pit/Quarry along Burchill Rad. The Proponent has submitted an application for rezoning with the City of Saint John.

A review of the available literature found that there were no correlating negative associations between wind farms and property value. In 2010 a study in the Municipality of Chatham-Kent, Ontario was prepared to assess the effects of wind energy on real estate values. This report was prepared in accordance with the *Canadian Uniform Standards of Professional Appraisal Practice* for the Appraisal Institute of Canada (Canning et al., 2010). The report is widely recognized in the wind industry as a thorough study and demonstrates what many other studies also indicate. The study found that it was highly unlikely that a relationship exists between wind farms and the market values of rural residential real estate (Canning et al., 2010).

A recent study by the University of Guelph analyzed more than 7,000 home and farm sales that occurred between 2002 and 2010 in Melancthon Township, Ontario, which saw 133 turbines erected between 2005

and 2008. Of the 7,000 homes and farms, 1,000 were sold once, and some multiple times. Co-authors, Richard Vyn and Ryan McCullough concluded that the turbines in question have not impacted the value of the surrounding properties. Further, the nature of the results, which indicate a lack of significant effect, is similar across both rural residential properties and farm properties (Vyn & McCullough, 2014).

Table 5-23: Potential impacts and proposed mitigative measures for property value & land use.

Potential Impacts on Property Value & Land Use	Proposed Mitigative Measures
Land use of the project site where the turbine is proposed will change from forested areas to a source of renewable energy	• Although some habitat may be lost temporarily through the construction, it is likely that it will regenerate quickly. The land use changes are predicted to be positive: no mitigation is proposed.
Current land use may be impacted during the construction and operation of the Wind Farm	• Consultation with residents will occur; • Consultation with Saint John Industrial Parks and Irving Oil will occur to determine potential setbacks on RoWs; • Reach out to the Saint John Model Flying Club to discuss the Project; • Determine if re-zoning will be required for the new development; and • When forestry activities are occurring onsite, extra caution will be taken on roads.
Public concern that property value may decrease as a result of the Project	• Recent real estate value studies have consistently determined no correlation between proximity to wind farms and property devaluation (Canning et al., 2010); and • Education through public consultation can be effective in providing factual, relevant information to alleviate the concerns of local residents.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to land use and property value.

Significance of Residual Effects – The significance of residual effects on land use and property value is expected to be negligible.

5.3.4 *Transportation, Vehicular Traffic and Pollution*

During construction of the access roads and WTG foundations, there will be an increase in truck traffic on the roads leading to and from the Project site. During delivery of the WTG components, delivery of oversized loads may slow traffic flow. As a result, vehicle traffic and pollution have been identified as a VEC.

Boundaries – The spatial boundaries are all roads that will be used through the construction phase of the Project and the Project site. The temporal boundaries are those associated with the construction phase of the Project.

Discussion – Oversized loads will be associated with the delivery of WTG towers, blades, nacelles, and the cranes required for erection. These deliveries are anticipated to be subject to movement orders as agreed upon with governing authorities.

Some pollution is expected during the construction phase via transportation of materials and construction machinery. However, vehicle related emissions will be minimized by turning engines off when feasible to reduce idling and by sourcing local materials where possible. During the construction phase, there will also be elevated noise levels due to the increase in traffic and heavy machinery. However, with sufficient setbacks from dwellings, elevated noise levels due to construction will not be significant and is not likely to impact surrounding communities.

The nearest turbine is located 519 m from Highway 1, more than double the height of the turbines proposed.

Table 5-24: Potential impacts and proposed mitigative measures for vehicular traffic and pollution.

Potential Impacts on Vehicular Traffic and Pollution	Proposed Mitigative Measures
Vehicular traffic may increase as a result of construction activities and transportation of WTG components to the Project site.	• Every effort will be made to ensure that oversized loads are delivered during times of lowest traffic to mitigate traffic jams; • Determine and enforce a speed limit to reduce unnecessary emissions and enhance worker safety; • Minimize idling of vehicles where possible; • Construction equipment and vehicles will be kept up to standards and in good working order to reduce inefficiencies; • Contractor car-pooling will be encouraged; • The Proponent or the appropriate contractor will consult with DTI as early as possible regarding the permits and

Potential Impacts on Vehicular Traffic and Pollution	Proposed Mitigative Measures
	approvals required for the construction of the BWP to ensure sufficient time is provided to process the permits; • Vehicle movements will follow traffic control guidelines outlined in the Work Area Traffic Control Manual for delivery of materials on provincial roads; • The Proponent or appropriate contractor will develop a Transportation Plan to be reviewed by DTI to receive approval and all applicable permits will be obtained for work within right-of ways, temporary road widening, and construction of the access road; • All trucks will adhere to legal load limits on New Brunswick roads including spring weight restrictions when applicable, though construction is estimated to begin in the fall; • Loads will be thoroughly checked and secured for delivery to minimize potential for spillage and any spills will be promptly removed following applicable safety procedures; and • If possible or practical, use other transportation means to minimize roadway usage where possible (i.e., Spruce Lake Barge Facility and or Port Saint John).
Vehicle traffic and use of equipment has the potential for accidental spillage of hazardous materials such as fuel, oils and hydraulic fluids during construction, operation and decommissioning phases.	• Equipment shall be kept in good working order and maintained so as to reduce risk of spill/leaks and to avoid water contamination; • Spill response kits will be provided on site for each piece of equipment to ensure immediate response to a potential waste release and will be stocked with supplies to handle a worst-case scenario in surface or groundwater;

Potential Impacts on Vehicular Traffic and Pollution	Proposed Mitigative Measures
	• Routine maintenance, refueling and inspection of machinery will be performed off-site or on level ground onsite; and • Corrective measures will be implemented immediately and reported to the DELG's Saint John Regional Office at (506) 658-2558 or outside of business hours to the Canadian Coast Guard's environment emergencies reporting system at 1-800-565-1633.
Local air quality may be affected through fugitive dust from the access road during construction and decommissioning	• Fugitive dust during dry weather conditions may be controlled with the application of water.
Local air quality may be affected through tailpipe emissions from construction vehicles and machinery	• All vehicles and machinery will comply with current emission standards and will be used efficiently, minimizing distances travelled whenever possible.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to vehicular traffic and pollution.

Significance of Residual Effects – The time frame in which an impact to traffic may occur will be temporary, and combined with the proposed mitigative measure of avoiding high traffic times; the significance of residual effects on vehicular traffic is expected to be negligible.

5.3.5 *Public Health and Safety*

Public health and safety are of the greatest concern in the development of a Project such as the BWP. During the construction, operation and decommissioning phase the protection of workers and the public's health and safety is protected under the provincial Occupational Health and Safety Act (OHS). It is best practice to consider a 'worst case scenario' when developing a health and safety policy/plan, as a result, health and safety has been identified as a VEC.

A significant environmental effect could result if a considerable change to health and safety was the result of project activities.

Boundaries – The spatial boundary includes the Project site and for the sake of ambient noise and ambient light, a 4,000 m radius from the WTGs. The temporal boundaries include all phases of the Project.

Discussion - Proper setbacks have reduced the risk to public health and safety from noise and shadow flicker impact, possible fires, ice throw and malfunction. Technological considerations including a built-in heating system to detect and melt ice from the blades to reduce ice throw will be implemented. Further a lightning protection system will conduct electrical surges away from the nacelle to prevent fires. This system includes wiring around and throughout the turbine to transport and dissipate the surge to the ground.

Consultation with applicable aviation authorities has occurred, and the turbine lighting will conform to Transport Canada requirements for aviation safety. Project worker safety is also of the utmost importance and is protected under the provincial OHS Act while safe work practices will be encouraged onsite during the construction phase. In the unlikely event of an incident impacting worker and/or resident safety, sufficient resources exist within the area to provide support and response (i.e., police, fire, ambulance etc). Any such response associated to the Project would not impact the ability of the area's incident responders, or drain existing responding services.

Table 5-25: Potential impacts and proposed mitigative measures for health and safety.

Potential Impacts on Public Health and Safety	Proposed Mitigative Measures
During extreme cold weather events there is the potential for ice to build up and throw ice from the WTG blades.	• WTGs are equipped with ice-detection systems on each blade; • WTGs are designed to shut down in the case of ice-buildup; • When ice is detected the blade has a heating mechanism that will effectively melt the ice to mitigate ice-throw; and • Personal Protection Equipment (i.e., hard-hats) will be worn when near the WTGs.
During extreme weather events, there is the potential for electrical fires within the turbine nacelle through lightning strikes.	• WTGs are equipped with lightning protection that, in the unlikely event of a lightning strike, will dissipate the lightning current to the ground.
Potential aviation hazard to low flying aircraft.	• Application process with NAV Canada's Land Use Proposal Submission Form to ensure that the Project does not pose any hazard to the navigational systems of NAV Canada.
Increase in vehicular traffic may have the potential to affect public safety.	• Efforts will be made to ensure that oversized loads are delivered during times of lowest traffic to mitigate road traffic.

Potential Impacts on Public Health and Safety	Proposed Mitigative Measures
Shadow flicker may affect human health.	• This potential impact has been addressed in the Shadow Flicker and Visual Aesthetics Section 5.1.6., and will be further addressed through Visual Impact Assessment and Zone of Visual Influence Studies.
Noise impact may affect human health.	• This potential impact has been addressed in the Noise Section 5.1.5., and will be further addressed via noise impact assessments.
Potential for accidents and malfunctions pose a risk to workers and the public's health and safety.	• The OHS Act will be followed.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. No cumulative effects are expected to occur with respect to health and safety.

Significance of Residual Effects – Based on Project planning and design, the top priority has been health and safety. This is to make every reasonably possible effort to eliminate any negative potential impacts the Project may have on the public's health and safety. By following the proposed mitigative measures as well as regulatory guidelines pertaining to health and safety, the significance of residual effects on health and safety is expected to be negligible.

5.3.6 *Community and Local Economy*

During the Project phases, there will be a significant amount of money spent within Saint John, New Brunswick. During the development, the need for contractors and trades will be required and the Proponent will make every effort to utilize local companies to promote the local economy.

A significant effect would result if a considerable change to local economy was the result of project activities.

Boundaries – The spatial boundary is any area, business and individual that may observe a financial impact from the Project. The temporal boundary includes all phases of the Project.

Discussion – The project is expected to bring jobs to the local community through the use of accommodations and services during onsite work and through local hiring of contractors. This is expected to be beneficial for the area as high unemployment rates have been observed in the area. The installation of the WTGs may also provide tourism benefits for the area as people may come through to view the project.

Table 5-26: Potential impacts and proposed mitigation measures for community and local economy.

Potential Impacts on Community and Local Economy	Proposed Mitigative Measures
The proposed Project will provide economic development opportunities for the local communities and New Brunswick.	• The proposed project will support community economic development through hiring local consultants and contractors, the use of local services such as accommodations, restaurants and fuels, and will be required to pay municipal taxes; and • Community economic development is a positive impact: no mitigation is required.

Cumulative Effects – There are no other operating or proposed wind farms within a 10 km radius from the project site. The wind farm will provide clean, renewable energy to regions within Saint John.

Significance of Residual Effects – The Proponent will, when appropriate, make every effort to utilize local services and products, which is in line with the Proponents ideology of community-based projects. The predicted effects of this Project on the local economy are positive and as a result of the provincial taxes and economic spinoff, the significance of residual effects on local economy is expected to be beneficial.

5.4 Effect of Environment on Project

5.4.1 *Extreme Weather and Climate Change*

Severe weather events could potentially damage the WTGs due to conditions exceeding the operational design of the WTGs. High winds, extreme temperatures and icing on blades all have the potential to shut down the WTGs. Extreme weather events that could occur in the Saint John, New Brunswick region are listed in Table 5-27.

Table 5-27: Extreme events and climate change, associated effects and mitigation.

Weather Event	Effect	Mitigation
Extreme wind	• Damage to blades	• Automated control system would initiate shut down.
Hail	• Damage to blades	• Appropriate WTG maintenance.

Weather Event	Effect	Mitigation
Heavy rain and flooding	• Flooding of road and project site	• The project has been sited on an elevated ridgeline and the roads will be designed to maintain water flow where needed to prevent flooding and wash-outs from current precipitation levels and to mitigate risks associated with predicted increases in precipitation from climate change. Appropriate storm water management will also be implemented.
Heavy snow	• Damage to WTG components	• Automated control system would initiate shut down.
Ice storms	• Icing on blades resulting in potential ice throw	• Automated control system would initiate shut down procedures and initiate the blade heating system.
Lightning	• Potential for fires within nacelle of WTGs	• Lightning protection system would conduct electrical surge away from nacelle.

The Proponent recognizes the vulnerability of this project in the face of climate change. However, careful design measures have been implemented based on the Project's location and the Project's technology to protect the Project from potential changes in extreme weather over the 25 year operational phase resulting from climate change.

Extreme weather events have been considered while selecting the proper technology and the proper turbine model for its specific location. Using the most advanced technology will help ensure the turbine can withstand these events and that appropriate mitigation measures will be activated during the events. Examples of such mitigation measures include but are not limited to shutting down the turbine by pitching the blades, and rotating the hub to help avoid damage to the machinery.

Additionally, for extreme events occurring in the winter months, technology is now available that detects the formation of ice on the blades and triggers an automatic heating process to melt the ice ensuring the turbine will not suffer damages caused by ice accumulation.

5.4.2 *Turbine Icing*

Ice accumulation on WTG blades can occur during the winter months when the appropriate conditions of temperature and humidity exist, or during certain extreme weather conditions, such as freezing rain (Seifert et al., 2003). In the event that ice builds up on the WTG blades, there are two types of risks possible: the first is ice throw from an operating WTG, and the second is ice fall from a WTG that is not in operation.

When a WTG is in operation, it is assumed that ice may collect on the leading edge of the rotor blade and detaches regularly due to aerodynamic and centrifugal forces (Seifert et al., 2003). The distance that the ice will be thrown from the moving WTG blade will vary depending on the wind speed, the rotor azimuth and speed, the position of the ice in relation to the tip of the blade, as well as characteristics of the ice fragment.

In a Canadian study titled *Recommendations for Risk Assessments of Ice Throw and Rotor Blade Failure in Ontario* (LeBlanc et al., 2007) ice throw was investigated to determine the individual risk probability for an individual to be struck by ice thrown from an operating WTG. The following parameters and assumptions were used:

- Rotor diameter of 80 m;
- Hub height of 80 m;
- Fixed rotor speed of 15 RPM;
- Ice fragment is equally likely to detach at any blade azimuth angle and 3 times more likely from the blade tip than the rotor;
- Ice fragments have a mass of 1 kg and frontal area 0.01 square meters;
- All wind directions are equally likely; and
- Ever-present individual between 50 m and 300 m (donut shaped buffer around WTG), individual equally likely in any given 1 square m within that area.

The statistical analysis found that individual risk probability for an individual is 0.000000007 strikes per year or, 1 strike in 137,500,000 years. For an individual to be ever-present in the defined area, this assumes that the individual would be outside during the unpleasant weather necessary for icing conditions. This analysis does not take into account the presence of trees that could provide shelter from potential ice throw (Seifert et al., 2003). The turbine selected for the Burchill Wind Project will likely have different specifications than used in this example; however, this should be used as a general example to understand the incredibly low probability of an individual being struck by ice throw.

As with trees, power lines, masts, and buildings, ice can accumulate on a stationary WTG, and will eventually be released and fall to the ground. Depending on the rotor position of the stationary rotor, different fall distances along the current prevailing wind will occur (Seifert et al., 2003). The blade system would be initiated prior to the initiation of a stationary WTG should ice be detected.

5.5 Summary of Impacts

Based on the completed VEC analysis, the project effects have been determined. A summary of the VEC assessment has been presented in a table with the following assessment criteria:

- Nature – positive (+), negative (-), or No impact where no impact is predicted;
- Magnitude – order of magnitude of the potential impact: small, moderate, large;
- Reversibility – reversible (REV) or irreversible (IRR);
- Timing – duration of impact, short for construction or decommissioning and long for Project operation or longer;
- Extent – spatial extent of the impact, local, municipal, provincial etc.; and
- Residual Effect – negligible, minor, significant, and beneficial or no impact as described in Section 3.5.

Table 5-28: Summary of Identified VECs.

	Nature	Magnitude	Reversibility	Timing	Extent	Residual Effect
Ground Water	-	small	REV	Short	Local	Minor
Geophysical	-	small	REV	Long	Local	Negligible
Atmospheric Conditions	+	moderate	REV	Long	Provincial	Beneficial
Wind Resource	+	small	REV	Long	Local	Beneficial
Noise	-	small	REV	Long	Local	Negligible
Shadow Flicker & Visual Aesthetics	-	small	REV	Long	Local	Minor
Avian	-	To be determined	REV	Long	Local	To be determined
Bats	-	To be determined	REV	Long	Local	To be determined
Wetlands & Watercourses	-	small	REV	Short	Local	Minor
Fish & Fish Habitat	-	small	REV	Short	Local	Minor
Wildlife	-	small	REV	Short	Local	Negligible
Vegetation & Habitat	-	small	REV	Short	Local	Minor
Sensitive & Significant Habitat	No Impact	N/A	N/A	N/A	N/A	No Impact

	Nature	Magnitude	Reversibility	Timing	Extent	Residual Effect
Archaeological	-	small	IRR	Short	Local	Negligible
Electromagnetic Interference	-	small	REV	Long	Local	To be determined
Land Use & Property Value	-	small	REV	Long	Local	Negligible
Vehicular Traffic & Pollution	-	small	REV	Short	Local	Negligible
Public Health & Safety	-	small	IRR	Long	Local	Negligible
Community & Local Economy	+	moderate	REV	Long	Provincial	Beneficial

6 Stakeholder Consultation

The New Brunswick EIA process has required minimum public engagement standards outlined in Section 6 of the *Guide to Environmental Impact Assessment in New Brunswick* developed by the DELG that must be applied when consulting with stakeholders who may be affected by the proposed development.

As part of this process, members of the public will have an opportunity to review and submit comments on the project's registered EIA document. After receiving final comments from all stakeholders, a Public Consultation Summary Report will be submitted within 30 days of the EIA public notice. Stakeholder comments will be considered by the Minister of Environment and Local Government while making their final decision to offer a certificate of determination to the proponents of the project.

The appropriate stakeholder consultation and engagement process required to meet the relevant EIA approval conditions will occur simultaneous as other engagement efforts occur. The engagement activities described in the following section have provided and will continue to provide an opportunity to facilitate meaningful dialogue between various stakeholders and the Project Proponent; and to provide accurate information pertaining to the Project in an open and transparent fashion. A comprehensive stakeholder engagement list has been formed and will be kept up to date as further stakeholders express their interest in the Project throughout its lifetime.

6.1 Community

6.1.1 *First Public Meeting*

An open house was held on the 24th of September, 2019 to provide preliminary project information to the community. The meeting was advertised via Canada Post Admail, a service offered that facilitates the distribution of invitations/flyers to a defined geographic location. Advertisements have been distributed and were received by residents the week prior to the meeting. A copy of this advertisement will be provided in the Public Consultation Summary Report. Advertisements were also displayed in local

newspapers. As well, invitations were sent to special interest groups and businesses near the Project. Open house attendance was tracked by a sign in sheet.

Questionnaires were distributed to attendees at the open house to express any concerns regarding the BWP and to provide contact information for the stakeholder list. The open house format was held as an open discussion where posters with Project relevant information was displayed with Proponent representatives present to answer questions and discuss public concerns.

Following the open house, the proponent addressed any questions or concerns from the questionnaires through telephone, email, letters and personal meetings. Additionally, the Proponent will frequently review the concerns from the public and post them in the FAQ section of the Project website. All questions, concerns, and responses will be compiled and included in the Public Consultation Summary Report to be submitted during the EIA review period.

A second open house will be held following a similar process during the EIA review process in March 2020. Representatives will be present on behalf of the Proponent and information presented will be adapted based on the concerns that the public has voiced to provide information that directly addresses these concerns. The comments addressed during the second open house and through the EIA review process will be included as part of the Public Engagement Report that will be submitted to DELG following the commenting period.

6.1.2 *Website*

Websites have proven to be an excellent way to make project information available for the general public to access and stay up to date on the progress of wind farm developments. The website has and will be updated periodically and used to inform the general public, right-holders, and stakeholders about all aspects of the proposed development. Website content and updates will include some or all of the following items:

- Purpose of the project;
- Project details and progress;
- Contact information for Natural Forces;
- Notices for public information sessions;
- Photos of the Project location and turbine types;
- Progress reports on the EIA;
- FAQ section that addressed concerns identified during consultation activities;
- Construction activity notifications;
- Online questionnaire and comment form; and
- Media and Press Release related material.

The BWP website can be accessed with the following link: https://www.naturalforces.ca/burchill-wind-project.html

6.1.3 *Newsletters*

Previous wind farms developed by the Proponent included newsletters as a key engagement tool to update and inform the local community on recent Project activities. The Proponent may circulate newsletters via email, website, and Canada Post to the community throughout the 2020, 2021 and 2022 calendar years.

6.1.4 *Newspaper Advertisements*

Advertisement will be placed in local newsletters to offer additional information to residents regarding the Project and upcoming events. The advertisement will also detail benefits of the Project as well as contact information for the Proponent.

6.1.5 *Community Liaison Committee*

A Community Liaison Committee (CLC) acts as an advisory body to a project proponent by providing input on existing or potential concerns the community may have with respect to the Project. In the event that ample interest arises in the project, the formation of a CLC will be considered to facilitate communication between the community and a project proponent.

A CLC typically consists of a few members of the community who have been nominated by the community to act as representatives on the CLC. Other members of the CLC may include First Nations, economic development organizations, municipal councillors and members of other community groups.

6.1.6 *Issues Resolution*

The Proponent has drafted a Complaint Resolution Plan as part of this EIA document. This plan will cover what community members should do and whom to contact should there be negative impacts affecting the community members or the environment caused by the BWP development. The Complaint Resolution Plan is located in Appendix I.

6.2 Aboriginal Peoples

The following section will highlight the efforts that have been made to date to engage and consult with First Nations communities and organizations whom may be impacted by the Project. As well, the section will discuss the steps anticipated to further engagement efforts with the Nations. The details of specific correspondence and discussions will be included in an Indigenous Consultation Report that will be submitted to DELG.

To begin the engagement and consultation process with the Indigenous People of New Brunswick, the Proponent initiated contact with Aboriginal Affairs Secretariat (AAS) in August 2019.

Natural Forces sent an introductory letter to all Wolastoqey Chiefs, and Passamaquoddy Recognition Group in August 2019. As well, an email was sent to the WNNB. The letters included details on the Project

and the Proponent and included contact information for Natural Forces who would be conducting First Nation Engagement.

Once Natural Forces was awarded the Project through SJE's Request for Proposal, an updated letter was again sent to all Wolastoqey First Nation Chiefs in New Brunswick and the Passamaquoddy Recognition Group.

In October 2019, WNNB was contacted to understand their interest in conducting a Land and Resource Use Study. As part of this Study, Natural Forces met with several Elders and Land Users in November 2019 on site to discuss the Project, answer questions and tour the Project Site.

Also, in November 2019, AAS completed an Initial Assessment for the Project. As part of the Initial Assessment AAS sent letters to the Chiefs of the Wolastoqey Nations in New Brunswick.

Correspondence with First Nations and AAS will be summarized in the Indigenous Consultation Report and will be submitted to DELG. The engagement and consultation efforts conducted to date are the start of the process. Ongoing engagement and consultation efforts and activities will continue throughout all phases of the Project. As such, the First Nation Consultation Report will be updated periodically.

6.3 Public and Aboriginal Concern

Comments and concerns that have been received from open house questionnaires, individual discussions, Indigenous consultation, local residents and other stakeholders relating to the Project and project activities have been compiled. The majority of these concerns have been addressed in this EIA, while others have been addressed directly at the open house, through telephone conversations, emails, letters and one on one meetings. Following the open house in September, one-on-one discussions and other community engagement events, all concerns raised will be identified and presented in the Public Consultation Summary Report and the Indigenous Consultation Summary Report. The Proponent is committed to addressing, to the best of their abilities, all concerns pertaining to this proposed development and wind energy projects in general raised by local residents, community members and First Nation people.

Consultation will continue throughout the life of the Project. During the registration and public review period of the EIA document, the Proponent will be available within the community to answer questions and explain the content to community members.

6.4 Regulatory

The Proponent has been in consultation with Municipal, Provincial, and Federal Government bodies regarding the proposed BWP, and will continue to do so throughout the development of the project.

6.4.1 *Municipal Consultation*

The Proponent has had formal and informal meetings to discuss the proposed Project. A presentation was made to the Saint John City Council and Natural Forces has been present and answered questions in meetings for the Planning Advisory Committee. Meetings with the councillors for the Lorneville area were held prior to being awarded the Project by SJE and will continue throughout the Project's lifespan.

The correspondence between the Proponent and municipalities has and will be recorded and included in the Public Consultation Summary Report.

6.4.2 *Provincial Consultation*

The Proponent has met and discussed with various provincial organizations about the development of the BWP. The scoping of this EIA document was designed in consultation with the DELG, DNRED, DTI and the Department of Aboriginal Affairs. Consultation topics included:

- Submission process and timelines;
- Pre-registration consultation;
- Consultation efforts; and
- Scoping and guidance of wildlife surveys and studies to conduct as part of the Project EIA;

The proponent will maintain dialogue with provincial authorities when necessary throughout the duration of the Project.

6.4.3 *Federal Consultation*

The Proponent has consulted or consulted guidance documents and databases from various Federal Government entities regarding the development and construction of the BWP. ECCC, CWS, Navigation Canada, Transport Canada, and the DND were contacted. Similar to their provincial counterparts, federal regulators have provided guidance in the preparation of this document, Project planning, and design.

The Proponent will continue to engage Federal regulators, when required, throughout the development, construction, and operation of the BWP as appropriate.

7 Follow Up Monitoring and Mitigation

The purpose of this section is to describe the follow-up ecological field surveys, management plans, and consultation, which the Proponent is committed to undertake should it be required during the construction, operation or decommissioning phases of the Project.

7.1 Post-Construction Monitoring

A post-construction monitoring plan will be developed and implemented by a third-party consultant in consultation with DNRED, DELG and CWS and will follow the *Post-Construction Bat and Bird Mortality*

Survey Guidelines for Wind Farm Development in New Brunswick (DERD, 2011). The bird and bat monitoring plan will be designed to obtain information on the impacts to species and habitat use for birds and bats for a minimum of two years from the time the turbines become operational. This plan will typically involve point count surveys at various locations around the site as well as mortality studies. An annual report will be provided to authorities outlining the study methodologies and results of these post construction studies. These reports will also be posted on the project website for public review.

7.2 Mitigation

7.2.1 *Bats*

Active turbine mitigation at wind farms can lead to a significant decrease in bat fatalities. The mitigation involves increasing the turbine rotor 'cut-in' speed, essentially preventing the rotor from spinning at low wind speeds when bats are most active.

A mitigation scenario for this site may involve increasing the rotor cut-in speed from 2 m/s to 5 m/s, from half hour before sunset to half hour after sunrise, during months of high bat migration activity. Migration activity onsite will be confirmed once the pre-construction surveys are completed. An addendum to this EIA will be submitted with the final results of the bat studies.

The Proponent may commit to active mitigation should the post construction carcass searches reveal higher than normal mortality levels of migratory tree bats on site. Currently, it is industry standard to conduct post construction carcass searches for at least two years at wind farms operating in the Maritimes to determine the mortality levels at the wind farm site.

As there is already a mechanism in place to conduct post construction carcass monitoring, the Proponent will use this mechanism to review and assess the results of the post construction surveys. Should it be determined, in consultation with DNRED and other bat researchers that in fact the wind farm is producing higher than normal bat fatalities, the Proponent, in collaboration with DNRED and DELG will discuss and implement an active mitigation program, the ultimate aim of which is to reduce bat fatalities on site.

7.2.2 *Birds*

To support the post-construction monitoring and ensure impacts are addressed appropriately, an Adaptive Management Plan will be developed and will be implemented in consultation with DELG and applicable TRC members to mitigate any impact to birds from the BWP. The purpose of this Adaptive Management Plan is to address the risk of impacts to migrant avian species due to the turbine's proposed height.

The Adaptive Management Plan will:

- support science-based management of the Project to ensure wildlife and habitat impacts resulting from the Project are avoided, minimized, or offset;

- improve the understanding of interaction between wind turbines and migrant avian species using evidence-based monitoring results in the field; and
- ensure that mitigation measures are implemented as required and that these measures are evaluated and continually improved.

Mitigation proposed as part of the Adaptive Management Plan may include the following:

- Cause and effect analysis;
- Extended monitoring program;
- Increased reporting frequency;
- Blade feathering;
- Compensation for fatalities; and,
- Extended monitoring program to determine mitigation effectiveness.

In addition to post-construction carcass monitoring and implementing an Adaptive Management Plan, the Proponent is participating in a regional radar and acoustic study to identify patterns of bird movements across the Province of New Brunswick. This study will examine the patterns of movements of birds migrating through New Brunswick in a comprehensive regional study led by Phil Taylor with Acadia University and Bird Studies Canada. The goal is to describe:

- How the altitudinal density of migrant birds varies with topography, coastlines, time of year and weather;
- How migrants behave in different weather conditions (*i.e.,* storms and fog); and
- How migrants use specific topographical features in New Brunswick such as the St. John River Valley and the Fundy coast.

This study will also help better inform the wind industry about avian populations and migration patterns when siting wind farms in the future.

7.2.3 *Shadow Flicker Mitigation*

As required in the *Additional Information Requirements for Wind Turbines* report for New Brunswick, a description of the mitigation measures to be used to mitigate effects on sensitive receptors has been presented. Though no shadow flicker impacts are expected that exceed provincial regulations, mitigation can be implemented should observed impact be higher than predicted. These measures include, turbine relocation and screening of receptors using vegetation and awnings.

7.2.3.1 Tracking Shadow Flicker

Should receptors experience shadow flicker and formalize a complaint, the complaint will be addressed following the Complaint Resolution Plan. The steps included in the Complaint Resolution Plan describe the study that will occur following a complaint. To begin, the specific date, time, and local weather conditions will be noted for each incident of shadow flicker as well as the duration of the event. Following this step, the Operation Team for the project will determine the direction of the wind relative to the

receptor and the wind speed during the event. Finally, the details of the event will be tracked to analyze the specific conditions that cause shadow flicker at a receptor.

If the conditions causing shadow flicker are reoccurring and causing issues at the receptor, screening using vegetation and awnings may be considered to mitigate the situation.

7.2.3.2 Screening

Screening efforts are a feasible and effective mitigation measure for reducing shadow flicker impact. It is proposed that if receptors experience an annoyingly high amount of shadow flicker impact during operation, the Proponent could use screening methods that will provide shade to buildings and windows, effectively reducing shadow flicker annoyance.

Screening can be accomplished with existing vegetation, revegetation, and planting additional vegetation to the area which is experiencing shadow flicker. Similar, and sometimes better, results can be obtained by installing awnings over windows if it would be preferred by those experiencing the impact.

8 Approval of the Undertaking

8.1 Federal

Federal environmental permits may be required for the BWP for such as activities that may require a harmful alteration, disruption or description of fish habitat permit. Approval from Navigation Canada, Transportation Canada, and the DND will be required for aviation and military safety.

Consultation with Federal authorities has been ongoing with Navigation Canada, Transport Canada, and the Department of National Defence.

8.2 Provincial

The EIA process, as required under the provincial *Clean Environment Act* is a Proponent-driven, self-assessment process. The Proponent is responsible for determining if the EIA process applies to the Project, what category the Project belongs to and when the EIA process should be initiated.

Under Section 31.1 of the *Clean Environment Act*, the *Environmental Impact Assessment Regulations* classify new Projects or 'Undertakings' under one of three categories, Category 1, 2, or 3 undertakings. According to Schedule A of these regulations, all electric power generating facilities with a production rating of three megawatts or more falls within paragraph (b) and is classified as a Category 1 undertaking. The rated capacity for the BWP is 20 - 40 MW and is therefore a Category 1 undertaking.

Numerous guidance documents were referred to in the preparation of this EIA. All guidance documents used throughout this report are provided in Section 11.

8.3 Permitting

A number of provincial permits are required to progress the various stages of development and construction of a wind farm. A list of the required provincial permits is shown in Table 8-1, although additional permits may be required following continued stakeholder consultation.

Table 8-1: Federal and provincial permitting requirements.

Permit Required	Permitting Authority	Status
Archaeology Field Research Permit	Provincial Tourism Heritage and Culture	To be obtained
Special Move Permit	Provincial Transportation and Infrastructure	To be obtained
Highway Usage Permit	Provincial Transportation and Infrastructure	To be obtained
Access Road Permit	Provincial Transportation and Infrastructure	To be obtained
Transportation Plan	Provincial Transportation and Infrastructure	To be completed by appropriate contractor
Environmental Impact Assessment	Provincial Department of Environment and Local Government	In Progress
Work Within a Highway Right of Way	Provincial Transportation and Infrastructure	To be obtained
Watercourse and Wetland Alteration	Provincial Environment and Local Government	To be Obtained
Harmful Alteration Disruption and/or Destruction Authorization	Department of Fisheries and Oceans	To be obtained if required.
Aeronautical Obstruction Clearance Permit	Transport Canada	In Progress
Land Use permit	Navigation Canada	In Progress

Permit Required	Permitting Authority	Status
License of Occupation to Explore	Energy and Resource Development	Being assigned to Natural Forces
Option Agreement	Energy and Resource Development	Being assigned to Natural Forces
Crown Land Wind Farm Lease	Energy and Resource Development	To be obtained
License of Occupation for Construction and Operation	Energy and Resource Development	To be obtained
Work permit	Energy and Resource Development	To be obtained
Cutting Permit	Energy and Resource Development	To be obtained

Table 8-2 lists the municipal permits and authorizations required. Additional permits may be required following further consultation with municipal stakeholders.

Table 8-2: Municipal permitting requirements.

Permit Required	Permitting Authority	Status
Building Permit	City of Saint John	To be obtained
Development Permit	City of Saint John	To be obtained

9 Signature

Table 9-1 below defines the concluding signature of this EIA for Natural Forces Development Limited.

Table 9-1: Signature Declaration

EIA TO BE CONDUCTED BY:	Natural Forces Development Limited
PROPONENT:	
PROPONENT SIGNATURE:	 Robert Apold, Director
DATE:	February 11, 2020

10 Closure

Many adaptation and mitigation options can help address climate change though no single option is sufficient by itself. Substantial emissions reductions over the next few decades and a near zero emissions of carbon dioxide and other long-lived greenhouse gasses by the end of the 21st century is required to limit warming to below 2°C relative to pre-industrial levels (IPCC, 2014). The BWP and other similar projects represent an integral part of a global effort to reach these reduction targets.

A thorough analysis of the Project components and activities has been carried out for the construction, operation and decommissioning phases of the Project. Baseline existing environmental characteristics of the region, with the exception of bat surveys, fall bird surveys that are still ongoing, archaeological shovel tests, and monitoring the collection line access routes have been documented and the VEC's have been assessed. Consultation has been undertaken with a wide variety of stakeholders to gauge the full range of impacts and concerns with regards to the Project. The impact of the Project on the local environment has been evaluated based on these criteria. Mitigative measures have been presented and adopted in an effort to reduce the significance of residual impact as a result of the Project's activities. Cumulative effects of the Project on the environment due to other regional Projects and activities have also been identified and assessed. From the data presented thus far in the EIA process, there are no significant residual environmental effects predicted for the construction, operation, and decommissioning phases of the proposed BWP.

The following benefits would result due to the BWP and are considered as advantages of the Project:

- Production of emission-free energy, which will displace energy produced from fossil fuels in New Brunswick;
- Help New Brunswick meet its renewable energy regulations and targets for 2020;
- Help decrease anthropogenic induced climate change, which has been proven beyond a doubt to be putting our entire human civilization at risk;
- Increased revenue for the province and City of Saint John through payment of annual property taxes by the Project Proponent;
- Increased revenue for local businesses due to activities surrounding the construction, operation and decommissioning phases of the Project; and
- Creation of additional employment in the region during the entire Project life.

The BWP provides an excellent opportunity to transform fragmented habitat into a productive source of renewable energy providing source diversity while meeting increasing energy demands. The Proponent wishes to develop the proposed BWP with the intent of helping New Brunswick meet its renewable energy regulations and targets while providing local economic benefits. The Proponent is pleased to provide this EIA to the Environmental Science & Protection Division of the DELG and looks forward to working with provincial regulators to progress the BWP to a construction ready stage.

11 Works Cited

Adamus, P.R. (2018) Manual for the Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC). Accessed via: <*https://www.researchgate.net/publication/323993053_Manual_for_Wetland_Ecosystem_Services_Protocol_for_Atlantic_Canada_WESP-AC_Non-tidal_Wetlands. Accessed: July 2018>.*

Arnett, E. B., Brown, W. K., Erickson, W. P., Fielder, J. K., Hamilton, B. L., Henry, T. H., . . . Tankersley, R. D. (2008). Patterns of bat fatalities at wind energy facilities in North America. *Journal of Wildlife Management 72(1)*, 61-78.

Archaeological Services Heritage Branch (2012) Guidelines And Procedures For Conducting Professional Archaeological Assessments In New Brunswick.

Atlantic Canada Conservation Data Centre (2017) Rarity ranks and legal status by province. Accessed via *<http://www.accdc.com/en/ranks.html>*

Baerwald, E. F., D'Amours, G. H., Klug, B. J., & Barclay, R. M. (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. *Current Biology 18*, R695-696.

Barr, S. and C. White, (2005) Bedrock Geology of the Musquash Area (NTS 21 G/01), Saint John, Charlotte and Kings Counties, New Brunswick. New Brunswick Dept. of Natural Resources. Plate 2005-26 (Revised 2015).

Bird Studies Canada (2010) Second Atlas of Breeding Birds of the Maritime Provinces. Available at <*https://www.mba-aom.ca/jsp/summaryform.jsp?squareID=20LR27&start=1&lang=en* >

Bird Studies Canada (2018) Important Bird Areas of New Brunswick. Available at <*https://www.ibacanada.ca/mapviewer.jsp?lang=EN>*

Burchill Wind Energy Project (2019) Saint John Energy. Retrieved from: *<https://prismic-io.s3.amazonaws.com/sje-corp-site%2F8f795a5b-3e5b-4097-96e1-d6f77ca107a2_saint+john+energy+infographic_aug29+2019.pdf>*

Canadian Wildlife Service (2007a) Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds. 33p.

Canadian Wildlife Services (2007b) Wind Turbines and Birds: A guidance Document for Environmental Assessment. 45p.

Canning, Simmons, AACI, FRI, CMR, PLE (February 2010). Wind Energy Study – Effect on Real Estate Values in the Municipality of Chatham-Kent, Ontario.

City of Saint John (CSJ). 2016. The City of Saint John Zoning By-law 2014, ZoneSJ. Office consolidation October 31, 2016. 298p. A copy of the document was obtained online at: *<http://www.saintjohn.ca/site/media/SaintJohn/The%20City%20of%20Saint%20John%20Zoning%20By-law%20(Office%20Consolidation%20October%2031,%202016).pdf>*

Department of Environment and Local Government (2019) Additional Information Requirements for Wind Turbines. Retrieved from: *<http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/SectorGuidelines/WindTurbines.pdf>*

Department of Environment and Local Government (2018) A Guide to Environmental Impact Assessment in New Brunswick. Available at: *<http://www.gnb.ca/0009/0377/0002/0002-e.asp>*

Department of Environment and Local Government (2012) Watercourse and Wetlands Alteration Technical Guidelines. Sustainable Development, Planning and Impact Evaluation Branch. Available at: *<http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Water-Eau/WatercourseWetlandAlterationTechnicalGuidelines.pdf.>*

Department of Environment and Local Government (2004) Additional Information Requirements for Wind Turbines. Retrieved from: *<http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/SectorGuidelines/WindTurbines.pdf>*

Department of Energy and Resource Development (2017) General Status of Wild Species. Available at: *<http://www2.gnb.ca/content/gnb/en/departments/erd/natural_resources/content/wildlife/content/GeneralStatusWildSpecies.html>.*

Department of Energy and Resource Development (2011) The New Brunswick Energy Blueprint. Retrieved from: *<http://www2.gnb.ca/content/dam/gnb/Departments/en/pdf/Publications/201110NBEnergyBlueprint.pdf]>*

Department of Energy and Resource Development (2011) Post-Construction Bat and Bird Mortality Survey Guidelines for Wind Farm Development in New Brunswick. Retrieved From: *<http://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/Wildlife/WindPower-PostConstructionBatAndBirdMortalitySurveyGuidelinesForWindFarmDevelopment.pdf>*

Department of Energy and Resource Development (2009) Pre-Construction Bat Survey Guidelines for Wind Farm Development in NB. Retrieved from: *<http://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/ForestsCrownLands/BATS_PreConstructionBatSurveyGuidelinesForWindFarmDevelopmentInNB.pdf>*

Ecosystem Classification Working Group. 2007. Our landscape heritage: the story of ecological land classification in New Brunswick. Department of Natural Resources online resource.

Electricity from Renewable Resources Regulation (NB Reg. 2015-60) - Electricity Act

Environmental Impact Assessment Regulation – Clean Environment Act

Environmental Laboratory (1987) Corps of Engineers Wetlands Delineation Manual. Waterways Experiment Station Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. NTIS No. AD A176 912.

Environment and Climate Change Canada (2018a) General Nesting Periods for Migratory Birds. Available at *<https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html>*

Environment and Climate Change Canada (2018b) Species at Risk Public Registry. Available at *<http://www.sararegistry.gc.ca/sar/index/default_e.cfm>*

Environment and Climate Change Canada (2018c) Canadian Nightjar Survey Protocol. 2018. Accessed at: *<http://wildresearch.ca/wp-content/uploads/2015/10/National-Nightjar-Survey-Protocol-WildResearch.pdf>*

Environment Canada. 2019. Canadian climate normal 1971-2000 station data. Data for the Saint John A weather station (Saint John Airport). The data were obtained online at: *<http://climate.weather.gc.ca/climate_normals/results_e.html?stnID=6250&lang=e&dCode=1&province=NB&provBut=Go&month1=0&month2=12>*

Environment and Climate Change Canada (2015) Recovery Strategy for Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat (*Perimyotis subflavus*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. ix + 110 pp.

Environmental Policy (2017) Saint John Energy. Retrieved From:
https://sje-corp-site.cdn.prismic.io/sje-corp-site/e727a0bf-e737-495c-b9c6-2cfde3cabfef_Env+Policy+V5+200123+-+approved.pdf

Gasset, N., Y. Gagon, M. Mallet, and G. Poitras. 2007. Wind Resource Maps of New Brunswick. Copies of the map were obtained online at: <http://www2.gnb.ca/content/gnb/en/departments/erd/energy/content/resource_maps/wind.html>

HGC Engineering (2007) Wind Turbines and Sound: Review and Best Practice Guidelines. Retrieved from: <http://scotianwindfields.ca/sites/default/files/publications/ canwea_wind_turbine_sound_study-final.pdf>

HGC Engineering (2006) Wind turbines and infrasound. Submitted to CanWEA. Retrieved from: <http://www.prowind.ca/downloads/Resources/CanWEA_Infrasound_Study_Final.pdf>

Hinds, H.R. (2000) Flora of New Brunswick. 2nd edition. University of New Brunswick, Fredericton, New Brunswick. 695 pages.

Horton K.G., Van Doren B.M., Stephanin P.M., Hochachka W.M., Farnsworth A., Kelly J.F. (2016) Nocturnally migrating songbirds drift when they can and compensate when they must. *Scientific reports*: 21249.

Intergovernmental Panel for Climate Change (IPCC) (2014) Summary for Policymakers. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Johnson, S.C., M.J. McLeod, S.M. Barr, and C.E. White. 2005. Bedrock geology of the Saint John area (NTS 21 G/08), Saint John, Kings, Queens, and Charlotte Counties, New Brunswick. New Brunswick Department of Natural Resources; Minerals, Policy, and Planning Division. Plate 2005-31.

Kearney, J. (2012, November). Interview by Andy MacCallum [Personal Interview]. Lighting effects on migratory birds.

LeBlanc, Marc, Garrad Hassan. (2007) Recommendations For Risk Assessments of Ice Throw and Rotor Blade Failure in Ontario; CanWEA Municipal issues and wind energy workshop.

Lohse, H. (1977) *Granular Aggregate Resources of Musquash Map Area 21 G/1, New Brunswick*. Province of New Brunswick, Mineral Resources Branch. Topical Report 77-2.

Mabee T.J., Cooper B.A., Plissner J.H., Young D.P. (2006) Nocturnal Bird Migration over an Appalachian Ridge at a Proposed Wind Power Project. *Wildlife Society Bulletin.* 34: 686-690.

McCallum, L. C., Whitfield-Ashlund, M. L., Knopper, L. D., Ferguson, G. M. and Ollson, C. A. (2014) Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern? *Environmental Health,* 13(9).

McCunney et al., (2012) Wind Turbines and Health. *A critical review of the scientific literature.* From the Department of Biological Engineering (Dr. McCunney), Massachusetts Institute of Technology.

New Brunswick Archaeological Services Unit. (2012) *Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick.* Archaeological Services Unit, Fredericton.

New Brunswick Department of Energy (NBDOE). (2009). The New Brunswick Developer's Guide to Renewable Energy. 107p. A copy of the document was obtained online at: *<http://www2.gnb.ca/content/dam/gnb/Departments/en/pdf/Publications/DeveloperGuideRenewableEnergy.pdf>*

New Brunswick Department of Environment and Local Government (NBDELG). Undated. Understanding the law, a guide to New Brunswick's Watershed Protected Area Designation Order. A copy of the document was obtained online at: *<http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Water-Eau/WaterClassificationRegulation.pdf>*

New Brunswick Department of Natural Resources (NBDNR). 2012. Allocation of Crown Lands for wind power projects. Report: CLM 017 2005. 24p. A copy of the document was obtained online at: *<http://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiX476t0fPXAhWpQ98KHXg1AJAQFggnMAA&url=http%3A%2F%2Fwww2.gnb.ca%2Fcontent%2Fdam%2Fgnb%2FDepartments%2Fnr-rn%2Fpdf%2Fen%2FPublications%2FCLM0172005.pdf&usg=AOvVaw3s7W9M2v5J8uaaM8kYjw3O*

New Brunswick Department of Post-Secondary Education, Training, and Labour (NBDPSETL). 2013. New Brunswick regional profile: southwest. A copy of the document was obtained online at: *<http://www2.gnb.ca/content/dam/gnb/Departments/petl-epft/PDF/Publications/NBRP3_Southwest.pdf>*

New Brunswick Wind Atlas (2017) The New Brunswick Wind Atlas. Retrieved from: *<http://www2.gnb.ca/content/gnb/en/departments/erd/energy/content/resource_maps/wind.html>*

Patterson, J.W. (2012) Evaluation of New Obstruction Lighting Techniques to Reduce Avian Fatalities. Technical Report for the U.S. Department of Transportation.

Peel, M.C., B.L. Finlayson, and T.A. McMahon. 2007. Updated world map of the Köppen-Geiger climate classification. *Hydrol. Earth Syst. Sci.*, 11: 1633-1644.

Purdue University (2000) Noise Sources and Their Effects. Accessed via <*https://www.chem.purdue.edu/chemsafety/Training/PPETrain/dblevels.htm>*

Radio Advisory Board of Canada (RABC) and Canadian Wind Energy Association (CanWEA) (2007) Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines on Radiocommunication, Radar and Seissmoacoustic Systems. Retrieved from: <*http://docs.wind-watch.org/rabc-canwea-technicalinformationguidelinesrepotentialimpactofwindturbines_2.pdf]>*

Rampton, V.W., R.C. Gauthier, J. Thibault, and A.A. Seaman. 1984. Quaternary Geology of New Brunswick. *Geological Survey of Canada, Memoir*: 416.

Robichaud, B. and Mullock, J. (2001) The Weather of Atlantic Canada and Eastern Quebec. Accessed via <*http://www.navcanada.ca/EN/media/Publications/Local%20Area%20Weather%20Manuals/LAWM-Atlantic-EN.pdf*>

Roy, P. and Huard D. (2016) Future Climate Scenarios - Province of New-Brunswick. Montreal: Ouranos.

Seifert, H. Et al. April 9-11, (2003) Technical Requirements for Rotor Blades Operating in Cold Climate; BOREAS VI, Phya, Finland.

Sullivan, R.G., Kirchler L. B., Lahti, T., et al (2012) Wind Turbine Visibility and Visual Impact Threshold Distances in Western Landscapes.

Sustainability Policy (2017) Saint John Energy. Retrieved From: <*https://prismic-io.s3.amazonaws.com/sje-corp-site%2Fbd65abd6-49bb-4a14-b47d-9427633bf2dd_sustainability+policy+oct+25.pdf*>

Transport Canada (2017) STANDARD 621 – Obstruction Marking and Lighting Standard. Chapter 12 Wind Turbines and Wind Farms. Retrieved from: <*http://621.homestead.com/RDIMS-_5179714-v8-CAR621_TEXT_ENGLISH.pdf].*>

University of Western Ontario (UoWO) (2014) IDF CC Tool for deriving rainfall Intensity-Duration-Frequency Curves for future climate scenarios. Accessed via: http://www.idf-cc-uwo.ca/

US Department of Transportation (1995) Highway Traffic Noise Analyses and Abatement: Policy and Guidance. U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning, Noise and Air Quality Branch, Washington, D.C.

United States Environmental Protection Agency (1974) Protective Noise Levels. Office of Noise Abatement and Control. Washington, D.C.

Urban Strategies Inc. 2011. PlanSJ, City of Saint John Municipal Plan. A copy of the document was obtained online at: <*https://www.saintjohn.ca/site/media/SaintJohn/Municipal%20Plan%20for%20web%202012-01-12.pdf*>

Washington State Department of Transportation (2017) Biological Assessment Preparation for Transportation Projects – Advanced Training Manual. Chapter 7 – Noise Impact Assessment. Accessed via <*http://www.wsdot.wa.gov/NR/rdonlyres/448B609A-A84E-4670-811B-9BC68AAD3000/0/BA_ManualChapter7.pdf*>

Webster, J.C. 1930. An Historical Guide To New Brunswick (Revised Edition). New Brunswick Government Bureau of Information and Tourist Travel. 100 p.

World Health Organization (2017) Electromagnetic Fields (EMF). Accessed via http://www.who.int/peh-emf/about/WhatisEMF/en/