RICHIBUCTO WIND PROJECT

Environmental Impact Assessment Registration

FINAL

November 2017

naturalforces

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Executive Summary

This Environmental Impact Assessment (EIA) has been prepared for the proposed Richibucto Wind Project by Natural Forces NB Inc. on behalf of the Proponent. The Proponent for the project will be Oinpegitjoig Wind Limited Partnership formed between Natural Forces NB Inc. and Pabineau Indian Band (Pabineau First Nation). The purpose of this document is to assess the potential environmental impact of the proposed Project on valued environmental components (VECs).

The Project is located on privately owned land in the Town of Richibucto with the access road proposed in the Village of Rexton. It is anticipated that the use of one Enercon E-126 wind turbine generator will be used for the project. This turbine is capable of producing 3.5 MW of electricity, enough to power approximately 900 New Brunswick homes.

Construction activities required for the Richibucto Wind Project will include clearing vegetation and grading for a new access road extending from Enterprise Street, crane pad and concrete turbine foundation construction, electrical laydown, installation of new distribution line, turbine delivery and erection, turbine commissioning, and site restoration and clean-up. Pre- construction activities are expected to begin in Q1 of 2018 and turbine commissioning is expected in Q4 2019.

Work completed as part of this EIA includes all 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. The Proponent has engaged the services of McCallum Environmental Ltd. who have completed Spring, Summer, and Fall surveying efforts. Field surveys completed include avian spring migration and breeding surveys, raptor surveys, waterfowl survey, bat detection, wetland delineation, and vegetation surveys. The results of these 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 a geotechnical study of ground conditions, an archaeological predictive model, species at risk potentials, current and future predicted climate comparisons, an electromagnetic interference study, and noise and shadow flicker assessments.

Further sections of this document outline consultation with federal, provincial, municipal, local and First Nations stakeholders which will be ongoing throughout the Project phases. A brief description of consultation efforts is provided, and a copy of the presentation made to the Mayors and Councils as well as the letter sent to all Mi'gmaq Chiefs has been included. The Proponent will submit additional information about their consultation efforts in a stand alone Public Consultation Plan that will include the Public Consultation Summary Report 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
- Birds, Bats and other 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

It has been determined that no significant residual effects are predicted after a thorough assessment of all identified VECs. However, the Proponent is committed to minimizing any potential for environmental impact as a result of the construction and operation of the Proposed Richibucto Wind Project and has therefore, outlined any post construction monitoring and mitigation details that may be required given the predicted impacts.

The location presented in this Final EIA has been modified in response to the Technical Review Committee concerns. A section has been included describing all previously considered locations as well as the considerations applied while micro-siting and modifying the turbine location.

The Proponent believes that the location demonstrated in this EIA reduces many environmental concerns while providing an excellent opportunity to transform an industrial brownfield site into a productive source of environmentally friendly renewable energy. The Richibucto 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

List of Tables

List of Appendices

List of Acronyms

ACCDC	Atlantic Canada Conservation Data Center
AMO	Abandoned Mine Openings
AR5	Assessment Report #5 (IPCC)
CLC	Community Liaison Committee
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
EIA	Environmental Impact Assessment
ECCC	Environment and Climate Change Canada
EMF	Electromagnetic Field
EMI	Electromagnetic Interference
ESA	Environmentally Significant Area
IBA	Important Bird Area
IDF	Intensity-Duration-Frequency (rainfall curves)
IEC	International Electrotechnical Commission
IPCC	Intergovernmental Panel for Climate Change
km	Kilometer
MBBA	Maritime Breeding Bird Atlas
MW	Megawatt
NBP	New Brunswick Power
OHS	Occupation Health and Safety (Act)
PID	Property Identification
PPA	Power Purchase Agreement
Project	Richibucto Wind Project
Proponent	Oinpegitjoig Wind Limited Partnership
RABC	Radio Advisory Board of Canada
RWP	Richibucto Wind Project
SAR	Species at Risk
SARA	Species at Risk Act (Canada)
SCADA	Supervisory Control and Data Acquisition
SOCI	Species of Conservation Interest
SODAR	Sonic Detection and Ranging
SPL	Sound Pressure Level
SVA	Subtended Vertical Angle

TRC	Technical Review Committee
VEC	Valued Environmental Component
WESP	Wetland Ecosystem Services Protocol
WTG	Wind Turbine Generator
ZVI	Zone of Visual Influence

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1.0 Proponent

1.1 Name

The Proponent for the project will be Oinpegitjoig (Win·beg·it·joig) Wind Limited Partnership formed between Natural Forces NB Inc. and Pabineau Indian Band (Pabineau First Nation). For clarification throughout this document, Natural Forces NB Inc (Natural Forces) is the developer acting on behalf of the Proponent.

1.2 Address

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 – Development Engineer at Natural Forces – apellerin@naturalforces.ca– (902) 422-9663

1.5 Property Ownership

The lands in which the project will reside are privately owned and are being leased to Natural Forces NB Inc. for the development of this project. A copy of the signed Notice of Option is provided in Appendix A.

1.6 Proponent Qualifications

The Proponent of the Richibucto Wind Project is the Oinpegitjoig Wind Limited Partnership. This Environmental Impact Assessment report has been prepared by Natural Forces on behalf of this partnership.

Natural Forces was established in 2001, and has offices located in Halifax, Nova Scotia and Vancouver, British Columbia. Composed of a small team, 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 l and ll which has an installed capacity of 150 MW.

In addition to the Kent Hills projects, Natural Forces developed, constructed, owns and operates the following eight wind farms in Nova Scotia in partnership with community groups or stakeholders as shown in Table 1-1.

Table 1-1: Natural Forces wind energy projects.

Project Name	Partnerships	Number of WTGs	Rated Capacity
Fairmont Wind Farm	Wind4All	2	4.6 MW
Hillside Boularderie Wind Farm	Wind4All Communities	2	4 MW
Pictou Landing Wind Farm	Pictou Landing First nation and Wind4All Communities lll	1	1.6 MW
Gardiner Mines Wind Farm	Cape Breton University	3	5.4 MW
Gaetz Brook Wind Farm	Wind4All Communities	1	2.3 MW
Barrachois Wind Farm	Wind4All Communities IV	2	4 MW
Aulds Mountain Wind Farm	Wind4All Communities ll	2	4.6 MW
Amherst Community Wind Farm	The Assembly of Nova Scotia Mi'Kmaq Chiefs and Wind4AllCommunities lll	2	6 MW

Natural Forces has successfully permitted all of their wind farms in both Nova Scotia and New Brunswick. Eight of the sites were required to follow provincially legislated Environmental Impact Assessment (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 partnered with abundant traditional knowledge from Pabineau First Nation, the Proponent is

confident the Richibucto Wind Project can be constructed and commissioned with minimal environmental impact on time and on budget.

2.0 The Undertaking

2.1 Name of the Undertaking

The name of the undertaking is the Richibucto Wind Project (Project or RWP).

2.2 Project Overview

The RWP as proposed, is a single wind turbine generator (WTG) project that anticipates using an Enercon E-126 turbine with a maximum hub height of 135m, approximate rotor diameter of 127m, and rated capacity of 3.5 MW. The Project is located in Kent County, approximately 3 km south west from the Town of Richibucto, New Brunswick and 1 km north of the Village of Rexton, New Brunswick.

It is anticipated that the RWP will require approximately 730 m of new access road to be built. A three-phase interconnection line on wooden power poles will follow adjacent to the access road. Road widths will be approximately 6 m wide and up to 15 m wide on turns and a 70m by 70 m crane pad will be required for turbine assembly.

The Proponent is developing the Project under New Brunswick's Embedded Generation program. The Embedded Generation program is integral to New Brunswick's 2011 *Energy Blueprint* and has been developed by NB Power (NBP) to introduce locally-based renewable electricity projects that are majority owned by eligible entities such as Aboriginal Businesses or Local Corporate Entities including Mi'gmaq band councils, Municipalities or their wholly-owned subsidiaries, Not-for-Profit Organizations, and Universities.

In acknowledgement of *New Brunswick Regulation 2015-60, Electricity from Renewable Resources Regulation - Electricity Act*, the RWP conforms to the requirements of having local ownership. Additionally, the project will be located within the province and is capable of connecting to the distribution system.

The proposed WTG location is situated on private lands just west of the Richibucto - Rexton Industrial Park. Currently, pre-construction activities are expected to begin in Q1 of 2018, clearing expected in Q3 2018 and project commissioning is expected by the end of 2019. It is likely that the Project will have an operational phase of 25 years.

The anticipated turbine type discussed above differs from the WTG specified in the Draft EIA where an E-141 was proposed with a hub height of 135m, rotor diameter of 141m, and maximum capacity of 4.2 MW. Variations between the Project proposed in the Draft EIA and the Final EIA will be presented in Section 2.5.5.

2.3 Project Need and Purpose

The New Brunswick *Energy Blueprint* (DERD, 2011) sets out clear requirements regarding the source of electricity to be supplied to the province. The purpose of this Project is to help achieve provincially mandated targets outlined in the *Energy Blueprint,* which requires the province of New Brunswick to achieve 40 percent renewable energy by 2020. The project is located near an Industrial Park and a town and village centre where there is an increase energy demand to power industrial activities and populated residential areas. Therefore, there is a need to provide additional safe, clean energy sources to help offset and meet industrial activities and increasing energy demands.

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 industry accounts for a significant 21% of global greenhouse gas emission, preceded only by energy (25%) and agriculture (24%). 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 RWP area is surrounded by the Industrial Park to the east and the Malpec Peat Moss Facility to the west, therefore the RWP is needed to help offset emissions from carbon based energy sources to make the area “greener”. Further, as the industrial park expands, the RWP will provide additional clean energy to the NBP grid to help meet the energy demand.

The land in which the WTG is proposed is excellent for it’s intended need as the turbine will reside on land zoned industrial and provides the Proponent with an opportunity to transform a brownfield site into a site that will provide an environmentally friendly source of renewable energy for the local community. The lands were previously used as a source of aggregate for local projects.

Additionally, the Project will enable local ownership in the wind farm through its partnership with Pabineau First Nations and provide the Nation with a stable revenue source for the duration of the Project’s operation. 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. According to Statistic Canada (2011), 20.5% of the Town of Richibucto's labour force and 22% of the Village of Rexton's labour force is unemployed. With relatively high unemployment rates in the Town and Village, there is a need for community economic development that can bring additional jobs to these communities.

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. Further, as previously mentioned, the New Brunswick provincial requirements are to produce 40% of its energy from renewable sources by the year 2020. With just over two years from this deadline, 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.

2.4 Project Location

The Project is located in the Town of Richibucto and in the Village of Rexton, Kent County, New Brunswick (Figure 2-1). The proposed WTG location is situated on existing privately-owned land located approximately 3 km south west of Richibucto's Town Centre, and the access road will cross two parcels located in the Village of Rexton. The parcel identification number (PID) for the land in which the WTG will reside is 25147802. The WTG location for the proposed RWP is 20T 355265m E; 5169414m N (64° 53' 30.8" W 46° 39' 45.5" N).

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 RWP, 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 RWP is an attractive site due to the wind resource, distance from dwellings and environmentally sensitive features, proximity to the NBP distribution system, industrial surrounding land uses, and previously disturbed ground conditions.

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 is shown in Figure 2-1 and Figure 2- 2.

- Technical Considerations;
    - Sufficient wind resource;
    - Regional topography;
    - Proximity to distribution system;
    - Geotechnical ground surveys; and

    - Turbine technology.
- Environmental Considerations;
    - Proximity to provincially regulated 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;
    - Available access to the land;
    - Current land use;
    - Future land use; and
    - Proximity to residential properties, communities and towns.
- Planning Considerations.
    - Zoning by-law regulations.

2.5.1 Technical Considerations

The RWP is located near the Richibucto River, approximately 8 kilometers to the mouth where it empties into the Northumberland Straight. As a result of the relatively flat regional topography and relative proximity to the coast, the Project site provides an attractive wind resource for a wind energy project.

Natural Forces has been in discussion with the distribution branch of NBP since 2013 regarding small distribution projects in New Brunswick and together it was identified that there is a suitable three-phase line located within the Richibucto- Rexton Industrial Park approximately 800 m from the turbine location. The end of this line on Enterprise Street will be used as the point of interconnection to the existing distribution grid as shown in Figure 2-7. NBP has reviewed the General Capacity Assessment Form and the Interconnection Application sent by the Proponent and has found no significant issues with the connection of the proposed WTG.

The Proponent has engaged the services of Stantec Consulting to conduct a geotechnical investigation to determine geophysical conditions and have provided recommendations for turbine design and construction.

Lastly, based on site specific measured wind data, the turbine availability, and the capacity available on the distribution grid, an appropriate turbine technology was chosen. This decision was also influenced by certain environmental considerations.

2.5.2 Environmental Considerations and Setbacks

Many environmental impacts associated with the construction and operation of a wind farm can be reduced or eliminated through proper screening during development. 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 following turbine setbacks have been adopted for the project:

- 60 m from all regulated and unmapped wetlands and watercourses;
- 1.2 km from all residential dwellings;
- 4.7 km to nearest Important Bird Area (IBA) and National Park (Kouchibouguac National Park);
- 55 km to the nearest Provincial Park (Parlee Beach)
- >5 km to known bat hibernacula;
- 3.97 km to nearest Ecologically Significant Area (ESA) (York Point Island);
- 1.8 km south of a protected wellfield;
- 1.17 km to nearest communication tower; and
- 23 km to the nearest Protected Natural Area (PNA) (Black River)

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. From this review, no plant species at risk were observed near the Project site. Fauna species at risk or high importance identified are discussed in Section 4.2.

Desktop studies and consultation with New Brunswick's Archaeological Services have determined there was a possibility of archaeological resources from a plane crash that occurred within 5 km of the Project. However, the Archaeological Services did not recommend conducting an archaeological field survey, and no debris was observed during site visits on the project site or during environmental surveys conducted.

2.5.3 Land Use Considerations

The participating landowners have made their lands available for the installation of one WTG, ancillary infrastructure, and the access road. A new driveway will be constructed from the existing Enterprise Street to gain private access to the WTG location. The access road will cross two parcels of privately owned land (PID 25141375 and PID 25280843). On one parcel, an easement is currently being secured and an Option to Lease has been acquired for the second parcel.

There are no current uses on the proposed Project lands. Approximately 550m to the west of the proposed project is the Malpec Peat Moss Facility. Approximately 920m to the east is the Richibucto-Rexton Industrial Park. Approximately 300m to the North are old quarry pits that have filled in with water and immediately to the south is land with previously disturbed ground conditions from the Peat Facility. The Project lands have previously been used as a site for gravel quarrying. The Project lands have been zoned industrial and make the current location ideal for a WTG as the surrounding lands support industrial activities. The Proponent can transform a brownfield site into a productive source of environmentally friendly renewable energy.

2.5.4 Planning Considerations

According to the *Richibucto Zoning By-law*, the RWP is zoned "industrial" where a public utility is permitted (a copy of the zoning map and letter from the planning authority is attached in Appendix B). As defined by the provincial *Community Planning Act* a public utility "means any person owning, operating, managing or controlling an undertaking for the supply of electricity…". The Proponent and proposed Project work falls within this definition of public utility and is therefore determined a permitted use within an industrial zone in the Town of Richibucto. The Proponent has been in correspondence with the Kent County planning authorities and will be applying for a height variance. The WTG itself will be located solely within the Municipal Town of Richibucto, however, the access road will cross land owned by and located in the Village of Rexton. Consultation with both municipalities is ongoing.

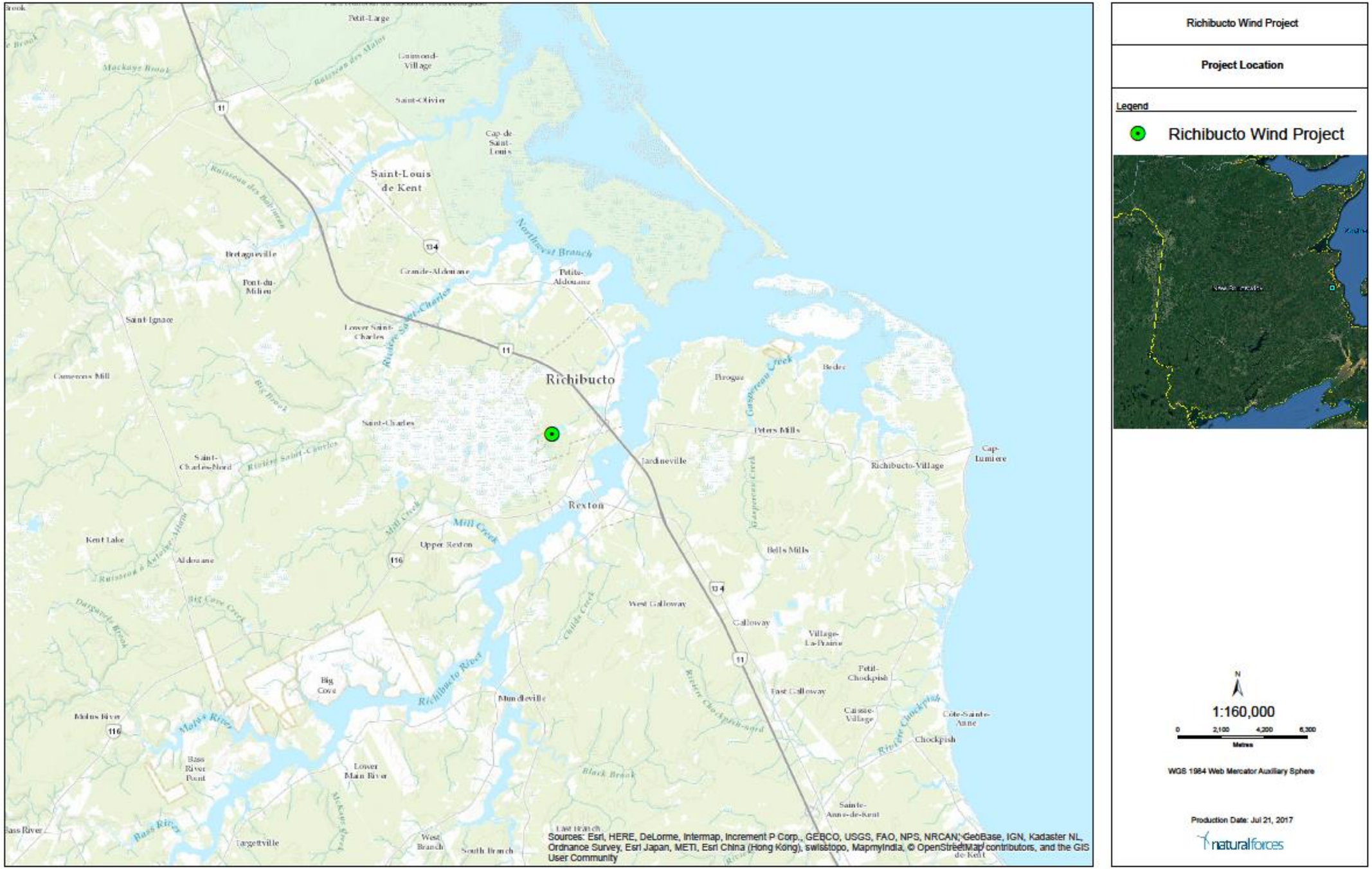

Figure 2-1: Project location.

Richibucto Wind Project

Proposed Project Layout

Legend

- Proposed Turbine
- Access Road and Crane Pad

Notes

N

1:7,000

0 120 240 360

Metres

WGS 1984 Web Mercator Auxiliary Sphere

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Figure 2-2: Proposed Project Layout

2.5.5 Previously Considered Locations

The general project site was selected in proximity to the Village of Rexton and the Town of Richibucto due to the initial assessment of the aforementioned technical, environmental, land-use and planning considerations.

Site finding for this Project was initially conducted using available desktop data. This search yielded the general proposed location in proximity to the Village of Rexton and the Town of Richibucto. After finding the best location regionally, further site finding was conducted, and discussions were held with landowners, the Town of Richibucto, the Village of Rexton and NB Power to decide on a smaller project area which included several land parcels within 1km of the proposed Project as presented in Section 2.4.

Field survey results, predicted modeling of noise and shadow flicker and discussions with members of the TRC created several iterations of the proposed Project. Two of the latest iterations considered for the project location are presented below.

Location A

Location A was originally considered for the WTG in part due to the straight access road and proximity to the three-phase line for interconnection on Enterprise Street. The location of this turbine was UTM Zone 20T 355138m E; 5168891m N (64° 53’ 36.25” W 46° 39’ 28.49” N) and is presented in Figure 2-3.

The straight access road allowed for minimal road widening required for turning large WTG components. The extension of the access road and three-phase line would have been similar distances as the current proposed location at approximately 850m.

After initial field surveys and site visits during the spring of 2017, it was determined that the turbine location and the proposed access road were identified as being within an unmapped wetland that extends from the peat facility to the west of this proposed location.

This location was revised as building this type of project in a wetland yields higher potential for environmental impacts. These impacts would arise from deviating water flow within the wetland. Avoidance, where possible, is always implemented and for the RWP there was dry land to the north of this location which presented favourable conditions.

Due to these factors, further micro-siting was undertaken which lead to the proposal of Location B as presented in the Draft EIA submitted in August 2017.

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Figure 2-3: Previously Considered Location A

Location B

Once it was determined that Location A and much of the surrounding area was an unmapped wetland, drone footage was recorded to obtain current and detailed aerial imagery to help make a better determination of the extent of the wetland and of the habitat types on the Project lands.

With the help from newly acquired data, McCallum Environmental Ltd. was hired to conduct field surveys to delineate the wetlands and classify the different habitat types. The results of these surveys as shown in Section 4.2.3, found that a dry upland forested habitat was located north of Location A. This area was deemed large enough to contain all the components of the turbine foundation and crane pad.

This forested area is bound to the west by a provincially regulated wetland and as such the WTG was then micro-sited to maintain a 30m wetland buffer as per the New Brunswick *Wetlands Conservation Policy*. Additionally, the WTG was micro-sited to allow the largest setback distance between homes and buildings to the WTG ensuring that potential noise and shadow flicker would not impact these receptors.

This created the location B which is at UTM Zone 20T 355246m E; 5169436 (64° 53’ 31.8” W 46° 39’ 46.2” N). This location was proposed in the Draft EIA submitted in August 2017 and is demonstrated in Figure 2-4.

Though this location maintained a 30m buffer between the regulated wetland and the WTG base, disturbances during construction were predicted to occur within the 30m buffer. Further, comments received by the TRC about the proximity to the regulated wetland brought about a new assessment of the Project’s location.

Current location

The new location currently proposed successfully enables all project works relating to the turbine to be completed outside of the 30m regulated wetland buffer reducing possible disturbance all while respecting the technical, environmental, land use and planning considerations required for a suitable wind energy project. Portions of the road will still cover some unmapped treed swamp wetland area, however as described in Section 4.6.5, flow will be maintained across the road to minimize impacts.

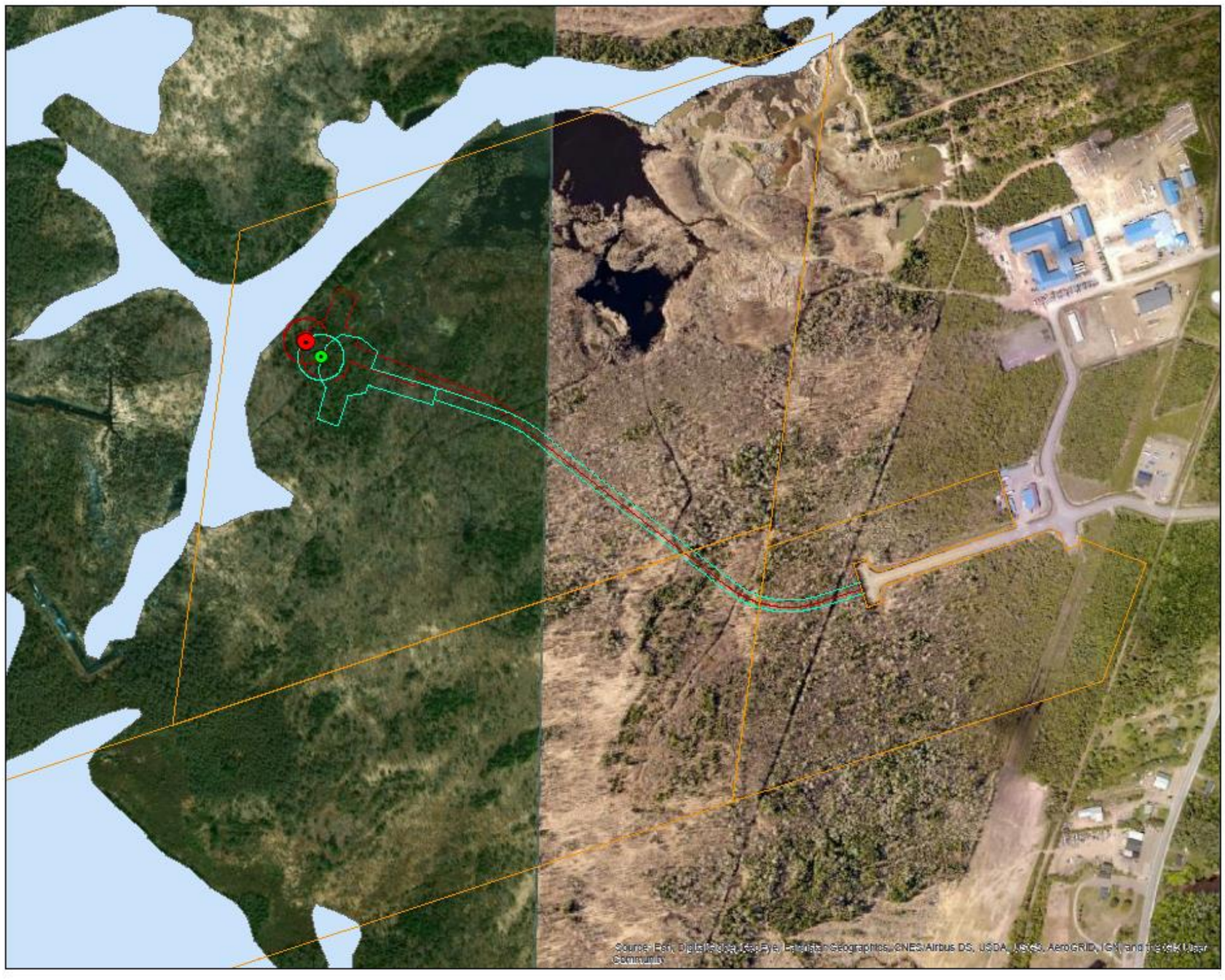
The new proposed location is 20T 355265m E; 5169414m N (64° 53’ 30.8” W 46° 39’ 45.5” N), approximately 30m southeast of Location B as demonstrated in Figure 2-4.

Turbine technology

The currently proposed WTG differs from the WTG proposed in the Draft EIA. Rotor swept area, rotor diameter and maximum hub height have all been reduced. Full details are outlined in Table 2-1.

Table 2-1: Turbine Model Comparison (Enercon, 2016)

	Enercon E-141 EP4 (Previously Proposed)	Enercon E-126 EP3 (Currently Proposed)
Rotor diameter	141 m	127 m
Swept area	15,614.5 m^2	12, 688 m^2
Rotations per minute	5 – 16 min^{-1}	4.4 – 11.5 min^{-1}
Cut out wind speed	28 – 49 m/s (Enercon storm control)	24 – 30 m/s (Enercon storm control)
Hub height	99m, 129m, 135m, or 159m	86m, 116m, or 135m
Max sound pressure level	105 dB(A)	106 dB(A)



Richibucto Wind Project

Previous Considered Location B

Legend

- Current Proposed Turbine
- Current Access Road and Crane Pad
- Previous Turbine Location B
- Previous Access Road and Crane Pad B
- Regulated Wetlands
- Property Parcels

Notes

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Metres

WGS 1984 Web Mercator Auxiliary Sphere

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Figure 2-4: Previously Considered Location B in Reference to the Current Location and Regulated Wetlands

2.6 Physical Components and Dimensions

2.6.1 Property

The dimensions of the parcel on which the WTG will be located (PID 25147802) are approximately 0.65 km by 0.82 km for a total area of 61.92 ha. The project lands also include two parcels in which the access road will cross. The first parcel has approximate dimensions of 0.36 km by 1.15 km for a total area of 37.3 ha (PID 25280843). The second access road parcel is approximately 0.33 km by 0.51 km for a total area of 13.6 ha (PID 25141375). The total area of land secured through Options is 98.22 ha and an additional easement for the second access road parcel will cover a 1.29 ha section of the 13.6 ha piece of land.

The approximate footprint of the Project is estimated at one hectare for the turbine base and crane pad, with an additional approximately one hectare required for the construction of the access road. Approximately 800 m of new road will be required to access the turbine. An extension to the 3-phase power lines located on Enterprise Street will follow the new access road. The project infrastructure can be viewed in Figure 2-7.

2.6.2 Surveying, Siting and Logistic Activities

Prior to the construction of the access road, foundation, and turbine installation, 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 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 and the local Municipalities in which the transportation will occur will be consulted 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 (if required). 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 one Enercon E-126/ EP3 WTG will be installed on site for the duration of the Project. The Enercon E-126/ EP3 has a total rated capacity of 3.5 MW. The turbine has a maximum hub height of 135m and rotor blade diameter of 127m.

Although the maximum hub height for the selected turbine is 135m, the hub height of this turbine comes in various heights and the height chosen for this project is yet to be determined. However, the maximum hub height has been used throughout this assessment to ensure a worst-case assessment. From base to blade tip the WTG will have a maximum height of approximately 198.5 m.

Enercon GmbH is a privately owned German based wind turbine manufacturer. Established in 1984, with production facilities around the globe, including Canada, Enercon is known within the industry to produce the most reliable wind turbines in the world. Enercon is the fourth largest wind turbine producer globally, and currently has over 25,000 machines in operation.

All Enercon WTGs 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 Enercon WTGs include 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 (Enercon, 2016). These reactive measures can protect the turbine from high and low temperatures, vibrations, oscillations and strain.

All Enercon turbines operating throughout North America are monitored 24-7 in real-time by a team of technicians at their North American Operations headquarters bases in Dartmouth, Nova Scotia. Natural Forces" operations team will also monitor the turbine from Halifax Nova Scotia. Enercon operation technicians will be based in New Brunswick and 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. The Enercon WTGs 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.

Additional WTG specifications are presented in Table 2-2 and are provided in Appendix C.

Table 2-2: Enercon E-126/EP3 specifications (Enercon, 2016).

Characteristic	Value
Rotor diameter	127 m
Swept area	12, 688 m^2
Rotations per minute	4.4 – 11.5 min^{-1}
Cut out wind speed	24 – 30 m/s (Enercon storm control)
Hub height	86m, 116m, or 135m
Max sound pressure level	106 dB(A)

A Lighting Plan for the Project 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 outlines 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 RWP but will be adjusted as per Transport Canada recommendations.

The standard required 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

Crane Pad

The installation of the WTG will require a crane pad 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 pad 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 pad 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.

Turbine Foundation

A concrete foundation approximately 15 m in diameter will be required for the WTG, similar to that shown in Figure 2-5 and 2-6. A detailed geotechnical investigation has been undertaken to establish the nature of the soil at the WTG location. A registered Engineer will design the foundation to match the soil conditions. Foundation will most likely be a gravity (inverted "T") design, designed by Enercon.

The construction of the reinforced concrete foundation 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 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 landowner. 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: Construction of a concrete foundation at Natural Forces' Fairmont Wind Farm.

Figure 2-6: Finished concrete foundation for Natural Forces' Fairmont Wind Farm in Nova Scotia

2.6.5 Access Road

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

The upgrade and extension of the access road 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 road formation. The internal site road 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.

The access road is estimated to cover approximately 0.79 ha of unmapped treed swamp wetland habitat and will be designed and constructed to ensure flow between wetland habitat is maintained likely making use of geotextiles, large aggregate and culverts. The access road will be designed by a professional engineer with appropriate experience in building roads in wet areas.

2.6.6 Civil and Electrical Works

The electricity produced from the WTGs will be stepped up to match the line rating of the local distribution grid by a transformer located in the base of the WTG. The electricity will then be conducted via insulated electrical cables through cable ducts cast into the WTG foundation routed out to new power poles on site, and then to the new point of connection to the existing NBP distribution system.

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 cable will leave the WTG foundation below grade. This will be installed according to the design engineer's specification. Typical design would require the cable 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 1 foot below the finish grade.

The overhead cabling configuration will be similar to the standard 12 m wooden utility poles found throughout the surrounding area. 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 landowner and be in accordance with applicable safety standards.

2.6.7 Interconnection to Grid

Natural Forces has been in discussion with the distribution branch of NBP and have identified a three-phase line at the end of Enterprise Street as a point of interconnection to the distribution grid. NBP has reviewed the General Capacity Assessment and interconnection Application submitted by the Proponent for the proposed RWP and no significant issues were found with the chosen WTG. The next step in the interconnection process will be the completion of an NBP system impact study.

Figure 2-7 presents the approximate location of the interconnection to the NBP grid at the end of the proposed access road and the Enterprise Street intersection. Additionally, the nearest substation is also provided in Figure 2-7. Any new electrical lines will follow the access road and has been included in the area of study during field surveys. All new electrical lines will likely be overhead.

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Richibucto Wind Project

Point of Interconnection

Legend

- Proposed Turbine
- Access Road and Crane Pad
- Point of Interconnection

Notes

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Metres

WGS 1984 Web Mercator Auxiliary Sphere

Production Date: Nov 24, 2017

naturalforces

Figure 2-7: Point of Interconnection on Enterprise Street.

2.6.8 WTG assembly and installation

The main WTG components include the tower sections, nacelle, hub and blades. Towers are normally delivered in four large sections if using steel towers or numerous smaller sections if using the pre-cast concrete variety. The overall erection process for the WTG will take approximately two to six days, depending on the wind conditions, and would not start until suitable wind conditions prevail. Further wind resource assessments will help determine when suitable conditions will be available.

Once delivered, the tower sections will be erected in sequence on the WTG foundation 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 tower 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 list 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.

2.6.9 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 and fine graded, and given a pleasing appearance.

2.7 Construction Details

The approximate proposed schedule for the construction activities is presented in Table 2-3. Pre-construction activities are expected to start in Q1 of 2018 with additional onsite surveying occurring in Q2. Clearing activities are expected to begin in Q3 of 2018 with operation of the RWP estimated in Q4 2019.

After the initial clearing activities for the construction of the RWP are complete the following main construction activities will occur:

- Construction of access road, lay down area and crane pad;
- Pouring of turbine foundation;
- Installation of power poles, power lines and underground electrical;
- Turbine erection;
- Commissioning of the WTG; 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 WTG will take approximately two to six days, 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 but will be minimized.

Table 2-3: Schedule of construction activities.

Construction Activity	Estimated Timeline
Pre-Construction Activities	Q1-Q2 2018
Tree Clearing and Grubbing	Q3 of 2018
Construction of access road and crane pad	Q4 of 2018
Construction of electrical works	Q2 of 2019
Construction of turbine foundation	Q3 of 2019
Wind turbine assembly and installation	Q3 of 2019
Removal of temporary works and site restoration	Q4 of 2019

2.7.1 Site Access

A new access road will be required and designed to start from Enterprise Road located in the industrial park allowing the project to use existing infrastructure and minimize its footprint. Enterprise Street intersects Main Street which is located less than one kilometer from Highway 11. It is anticipated that Enterprise Street will be the entry point for all workers, construction equipment and WTG components for the duration of the construction phase. 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 Department of Transportation and Infrastructure and the Village of Rexton and all necessary permits will be acquired before commencing work.

2.7.2 Clearing and Grubbing

It is anticipated that clearing and grubbing activities will occur outside of the breeding bird season. 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. Should ground nesters be found to reside in the project area, nest searches will be conducted should there be a delay between clearing activities and construction activities that may impact ground nesters.

Any merchantable timber cleared 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. It is not likely that any construction, excavation or grading will be required in important wildlife habitat or ESA's as none were identified onsite through desktop or field reviews. Further, the project location has been adjusted to ensure all disturbances associated with the Project construction remains outside of the 30m regulated wetland buffer. Some construction will involve crossing unmapped wetlands for interconnection and for the construction of the access road. 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.

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 road will be used for periodic maintenance and safety checks. A comprehensive Supervisory Control and Data Acquisition (SCADA) system will be installed within the turbine for remote monitoring and control of the wind turbine, which will minimize the need for on-site personnel. The SCADA system ensures safe efficient operation of the turbine 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 turbine by the turbine 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.

2.9 Decommissioning

The RWP will be in operation for approximately 25 years. The lifetime is based on the duration of the Power Purchase Agreement (PPA) signed between NBP 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 WTG 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 road 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 RWP. The Proponent has agreed to a 25-year PPA with NBP which is consistent with the WTG life expectancy of approximately 25 years. 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: Landowner Consent – Signed Notice of Option
- Appendix B: Zoning Map and Letter from Planning Authority
- Appendix C: Turbine Specifications
- Appendix D: McCallum Environmental Field Results
    - Habitat – Section 2
    - Vegetation – Section 3
    - Wildlife – Section 4
    - Avian – Section 5
    - Bats – Section 6
    - Aquatic Environment – Section 7
    - Species at Risk and of Special Concern – Section 8
- Appendix E: Archaeology Resource Impact Assessment
- Appendix F: Noise Impact Assessment
- Appendix G: Shadow Flicker Assessment
- Appendix H: Environmental Protection Plan
- Appendix I: Complaint Resolution Plan
- Appendix J: Stakeholder Consultation
    - Mayor and Council Presentations
    - Letter to Mi'gmaq Chiefs
    - Canada Post Admail Distribution
    - Open house Newspaper Advertisements
- Appendix K: Permit Applications Or Approvals
    - Navigation Canada Application
    - Transport Canada Approval Application
    - Met Tower Building Permit
    - Navigation Canada Approval – Location A
    - Transport Canada – Location A

3.0 Approach to the Assessment

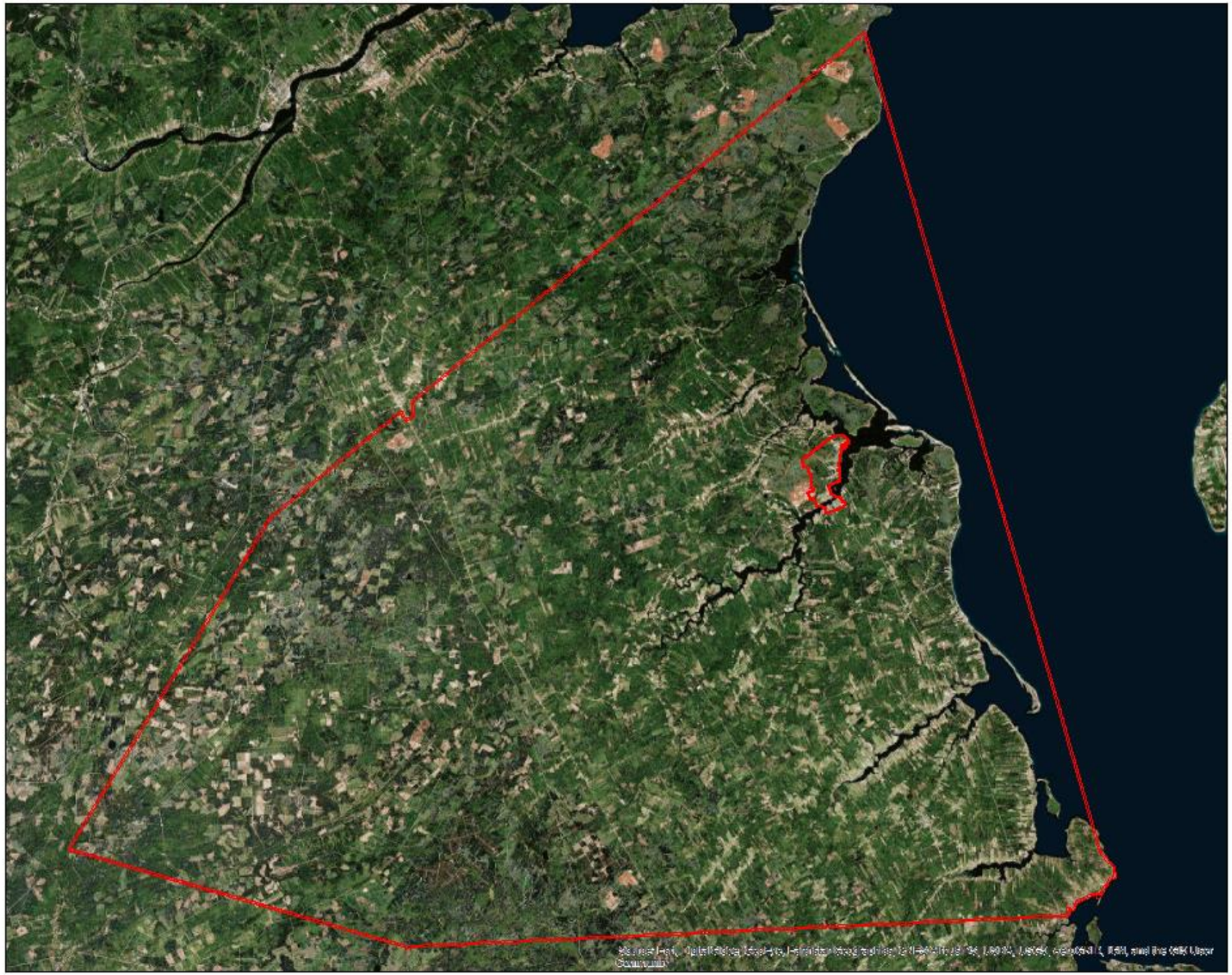
This section outlines the Project scope by identifying Valued Ecosystem Components (VECs) relevant to the current development determined through consultation with local stakeholders, the TRC, and provincial regulators. For each VEC the study methodology is outlined to provide a clear understanding of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

Regional Study Area – refers to all of Kent County

Local Study Area – refers to the region of Kent County encompassing the Town of Richibucto and the Village of Rexton (Figure 3-1)

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

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 (Figure 3-2).



Richibucto Wind Project

Assessment Areas

Legend

Local Study Area

Regional Study Area

Notes

The Regional study area is comprised of the whole of Kent County.

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Metres

WGS 1984 Web Mercator Auxiliary Sphere

Production Date: Nov 23, 2017

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Figure 3-1: Assessment Areas as Used Throughout the Environmental Impact Assessment.

Figure 3-2: Visual Representation of the Project Footprint 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 RWP 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 was 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, TRC comments 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 Projects 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 residential wells in the local study area. Additionally, the geotechnical survey conducted by Stantec Consulting as part of the geophysical assessment provided further insight into the ground water conditions in the Project footprint.

3.2.2 Geophysical

A desktop and geotechnical field survey was conducted to identify appropriate construction materials and processes required for the construction of the RWP. The geotechnical field survey involved drilling two boreholes near the proposed turbine location and along the proposed access road, three auger probes in the area surrounding the turbine foundation, in-situ electrical resistivity testing, and laboratory testing.

Boreholes were drilled September 14th, 2017 and advanced to a depth of one and a half times the foundation diameter (~30m). If bedrock was encountered, the borehole extended 4m into the bedrock. Overburden soils were sampled continuously, and soil samples were sent to Stantec's Moncton Laboratory for classification and testing. A perforated PVC stand pipe was installed in one borehole to measure groundwater. The ground water was further tested for soluble sulphate content to determine the water and soil aggressiveness towards concrete. This geotechnical survey will determine information about the soil, bedrock, and groundwater conditions to aid in the design of the proposed WTG.

3.2.3 Atmospheric Conditions

A desktop review of historical climate data has been conducted by consulting the Rexton, New Brunswick ECCC weather station and the New Brunswick's Future Climate Predictions based on the IPCC 5th Assessment Report (AR5) (Roy & Huard, 2016). Data collected includes maximum, minimum, and average

temperatures, and rainfall and snowfall amounts 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 has also been compiled, however, the nearest weather station that collects fog and visibility data is in Moncton, New Brunswick. To obtain more relevant data to the Richibucto region, Environment Canada's Handbook on Fog and Fog Forecasting (Toth et al., n.d.) was consulted to determine general fog hours per year and fog days per year.

3.2.4 Wind Resource

A desktop review of the wind atlases for the project region has been conducted to determine preliminary wind speeds in the Project study area. A detailed wind resource assessment program at the RWP was initiated on May 25, 2017 with the installation of a 60m meteorological mast (met mast) containing anemometers at 40 m, 50 m and 60 m above ground level. The instrumentation on the meteorological mast measures wind direction, wind speed, temperature, relative humidity and atmospheric pressure. With the installation of a met mast in Spring 2017, sufficient wind data will be collected to accurately assess the wind resource prior to proposed construction activities in 2019. A wind resource assessment will be completed at the 12-month mark of data acquisition.

3.2.5 Noise Impact Assessment

A noise impact assessment was conducted for the proposed WTG location to assess the impact of wind turbine generated noise on houses and buildings near the project site during the operational phase of the project. The Town of Richibucto 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, n.d.) states noise impact studies must include all dwellings 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. By assuming conservative

estimates of factors contributing to the propagation of the sound pressure levels (SPL) created by the WTGs, the model results represent a worst-case scenario.

As the anticipated turbine that will be used on site is an Enercon E-126/ EP3 WTG which has a maximum hub height of 135m, a WTG hub height of 135 m was used as a maximum height for the assessment. Based on the calculated sound power levels provided by the manufacturer, the loudest SPL at the hub height will be 106 dB(A).

In this noise assessment, all receptors within 2.5 km of the turbine were used in the model to predict the maximum noise level that could be expected when the turbine is operational. The input parameters and the assumptions for the assessment are included in the full noise impact assessment attached in Appendix F.

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

Shadow flicker

A shadow flicker impact assessment has been completed for the RWP to assess the potential impact of shadow flicker on the regional area within a 2.5 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 Town of Richibucto 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, n.d.) 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. In addition to the worst-case scenario a "real-case" scenario has also been completed using inputs more representative of the nearest buildings. Instead of using 3 x 3m windows with a greenhouse effect, windows were modelled using 1.5m high by 1 m wide facing a southward direction as determined from field visits. Details on input parameters are included in the full shadow flicker impact assessment provided in Appendix G.

Photomontage

ReSoft Ltd WindFarm software was used to create photomontages of the RWP. Three locations were chosen in the local study area to present a predicted view of the WTG using a maximum worst-case 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.

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 -blade tip) would 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 or obstructions, and therefor is modeled as a worst-case scenario.

3.3 Approach to Biophysical VEC Surveying

3.3.1 Avian Survey

Site Sensitivity

Using the matrix provided in the *Wind Turbines and Bird: A Guidance Document for Environmental Assessment.* (Environment Canada, 2007), and the document *A Guide to Environmental Impact Assessment in New Brunswick* (DELG 2012) and its associated additional information document: *Additional Information Requirements for Wind Turbine*s (Environment and Local Government) the overall level of concern category associated with the Project was determined. The matrix matches the sensitivity of the site and the size of the proposed facility to rank projects into one of four possible categories of "Level of Concern" listed below:

- Category 1 – Lowest level of risk;
- Category 2 – Moderate level of risk;
- Category 3 – Elevated level of potential risk; and
- Category 4 – Relatively high level of potential risk.

For each category, recommendations are provided in the guide documents previously mentioned on the nature and extent of the baseline information and follow-up measures that should be used as part of a projects avian survey. The "level of concern" is therefore relative to other wind energy projects and does not reflect the threat to birds/bats posed by wind energy in comparison to other types of projects.

Based on the parameters within the guidelines and as described below, the Project should be classified as having a "High" potential sensitivity. (Environment Canada, 2006). The criteria for a potential sensitivity of "High" are as follows:

- having landform factors that concentrate species (e.g., shoreline, ridge, peninsula or other landform that may funnel bird movement) or significantly increase the relative height of the turbine;
- a coastal island, or less than 5 km inland from coastal waters;
- an area of large local bird movements (between habitats) or is close to significant migration staging or wintering area for waterfowl or shorebirds;
- an area recognized as provincially or nationally significant for habitat conservation and/or protection;
- Having increased bird activity from the presence of an area recognized as nationally and/or provincially important habitat for birds (e.g., a National Wildlife Area, Migratory Bird Sanctuary, Important Bird Area, National Park, or similar area protected provincially or territorially because of its importance to birds); and
- Containing species of high conservation concern (SAR or SOCI).

The primary reasoning behind defining this Project as highly sensitive is the Project's location relative to coastal waters and an IBA. It should be noted, however, that the habitat within the Project study area is not suitable for those species which depend on the IBA for instance, colonial nesting species such as the Common Tern, or coastal nesting species such as the Piping Plover.

Based on the guideline documents, the facility size for the RWS is considered small.

With a high site sensitivity and small facility size, the "Level of Concern" for this Project is deemed Category 2. Projects in this category present a moderate level of potential risk to wild species and/or their habitat(s), and require basic surveys, usually spread over a one-year period, to obtain quantitative information on wild species and habitats on the site and to identify any potential mitigation measures to minimize environmental impacts during construction.

Field Methodologies

Avian field monitoring programs were completed by an expert birder to meet the expectations of a Category 2 Project. All surveys have been designed in consultation with officials from New Brunswick's Department of Energy and Resource Development (DERD) and CWS. Monitoring protocols conform to the CWS document *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* and have been sent to CWS for review prior to the commencement of field surveys for commenting. The following surveys were completed:

- Spring migration monitoring (April 19, April 28, May 13, May 22, 2017);
- Raptor Survey (Monitored for presence during all field visits)
- Breeding bird and Common Nighthawk (June 13 and 30, 2017);
- Fall migration monitoring (August 29, September 12 and 25, 2017); and,
- Waterfowl Surveys (October 17, 25 and November 1)

Seven point count locations were selected within, and surrounding the Project study area for all standard seasonal surveys. CWS guidance recommends that migration stopover transects be completed during spring and fall migration periods. However, due to the shape and limited size of the Project study area, it was determined that Point Count surveys would be more effective at determining avian usage of the Study Area and surrounding landscape. Spacing requirements between point counts did not allow for all point counts to fit within the Project study area boundaries. The habitat is relatively consistent throughout the entire Project study area facilitating the establishment of point counts outside of the Project study area allowing field teams to complete surveys in a greater diversity of habitats.

Surveys began at, or within, half an hour of sunrise and were completed within four-and-a-half hours or by 10:00 a.m., whichever came first. Ten-minute point counts were completed at each survey location, during all seasonal surveys except where noted otherwise (i.e. Common Nighthawk Surveys, Waterfowl Surveys).

Weather conditions were monitored for all avian surveys and confirmed to be within the parameters required by monitoring programs such as ECCC's Breeding Bird Survey. Bird observations were recorded at four distance regimes, within a 50m radius, 50 to 100 m radius, outside the 100m radius, and flyovers. For each point count, a record was made of the start time, and a hand-held GPS unit was used to geo-reference its location. General observations including the temperature, visibility, wind speed, date, start and end time and point count were also recorded. Bearings were taken for priority species observed both during dedicated survey periods and incidentally.

Bird species were identified based on functional bird groups to understand how each group of birds is using the Project study area. These functional groups include:

1. **Waterfowl:** Ducks, geese, or other large aquatic birds, especially when regarded as game;
2. **Shorebirds**: Waders, from the Order Charadriiforms;
3. **Other water birds**: Includes seabirds (i.e. marine birds), grebes (Order Podicipediformes), loons (Order Gaviiformes), Ciconiiformes (i.e. storks, herons, egrets, ibises, spoonbills, etc.), pelicans (Order Pelicaniformes), flamingos (Order Phoenicopteriformes), Gruiformes (i.e. cranes and rails), kingfishers. gulls and dippers (the only family of passerines considered waterbirds);
4. **Diurnal Raptors**: Birds within the families Accipitridae (i.e. hawks, eagles, buzzards, harriers, kites and old-world vultures), Pandidonidae (i.e. Osprey), Sagittariidae (i.e. Secretary bird), Falconidae (i.e. falcons, caracaras, and forest falcons), Cathartidae (i.e. new world vultures), and one species from the Order Strigiformes (i.e. Hawk Owl);
5. **Nocturnal Raptors**: Birds of the Order Strigiformes (i.e. owls; with exception of the Hawk Owl, which is a diurnal species of owl);
6. **Passerines**: Any bird of the Order Passeriformes, which includes more than half of all bird species. This is with exception of the dippers, which are a passerine considered a waterbird; and,
7. **Other Landbirds**: Birds within the Orders Galliformes (i.e. quail, pheasant, and grouse), Columbiformes (i.e. pigeons and doves), Cuculiformes (i.e. cuckoos), Caprimulgiformes (i.e. nighthawks and whip-poor-wills), Apodiformes (i.e. swifts and hummingbirds), and Piciformes (i.e. woodpeckers, flickers and sapsuckers).

Common Nighthawk

The Common Nighthawk prefers to nest in gravelly substrates and is best detected while foraging for insects shortly after sunset. Suitable habitat is available for this species within lands adjacent to the Project study area (existing quarry area, cut blocks, and road side clearings), therefore dedicated surveys for the Common Nighthawk were conducted from mid- to end of June at either dawn (1 hour before sunrise to 30 minutes after sunrise) or dusk (30 minutes before sunset to an hour after sunset), as described in the Common Nighthawk Survey Protocol (Saskatchewan Ministry of Environment, 2015).

Two survey point locations were surveyed on June 13, and repeated on June 30, 2017, in conjunction with the regular breeding season surveys. Survey point 1 is located in a cleared area adjacent to the abandoned quarry approximately 620m east of the proposed turbine location. This area comprises a gravelly disturbed substrate, and no tree cover. Survey point 2 is located in a regenerating cut block approximately 600m southeast of the proposed turbine and comprises regenerating saplings and a disturbed herbaceous groundcover. A call playback was used to detect the presence of Common Nighthawk, within a radius of 800m from the survey location. A three-minute passive point count was conducted at the point count location, followed by a call playback which included 30-seconds of the conspecific Common Nighthawk call followed by 30-seconds of silence (or passive surveying), repeated for three-minutes (i.e. three times). The total time spent at the survey point was a minimum of six-minutes during each breeding season survey.

Waterfowl

Given the Project's location in proximity to wetlands, and in a peninsula between Mill Creek, the Richibucto River, Richibucto Harbour, the Northwest Branch, and the Saint Charles River, watch counts for waterfowl have been completed during the fall of 2017. Watch counts were conducted in accordance with guidance detailed in the *Recommended Protocols for Monitoring Impacts of Wind Turbines and Birds* (CWS, 2007).

Two locations were selected, based on the vantage point they provide over the Project study area and proximity to waterbodies which may be used by passing waterfowl. Survey timing was based on tide events (2 completed during high tide, 1 completed during low tide). During each watch count survey, 2 hours were spent at each of the two locations. Surveys were completed on October 17th, October 25th, and November 01, 2017.

3.3.2 Bat Survey

Bat monitoring was designed using the protocols described in *Bats and Wind Turbines: Pre-siting and Pre-construction Protocols* (Lausen et al., 2010), and *Pre-construction Bat Survey Guidelines for Wind Farm development in New Brunswick* (DERD, 2009).

The goal of the bat monitoring was to provide a representative sampling of bat activity across the Project study area. Specifically, the recommended surveys were designed to determine:

1. Species occurrence and diversity
2. Activity levels (e.g., relative abundance, seasonal timing, daily timing)

A desktop review for known bat hibernacula in the local study area was completed. The Department of Energy and Resource Development (DERD) provided a database of known mine openings in New Brunswick. This database was reviewed for all of Kent County to identify any potential for bat hibernacula. The Atlantic Canada Conservation Data Centre (ACCDC) report and the *Government of Canada Species at Risk Act Recovery Strategy* for bats were also consulted.

During habitat surveys, ecologists were also looking for any signs of habitat that could support winter bat hibernation such as caves, abandoned mines/shafts or other sub-grade access features. In addition, habitat observations were also collected to determine appropriate bat monitoring locations discussed in the following section.

Wildlife Acoustic SM4BAT FS Bioacoustic Recorders (SM4BAT) were installed, monitored, and data was collected weekly. Acoustic bat monitoring was conducted to evaluate relative activity patterns by species or species groups over the monitoring period across the Project study area.

Three SM4BAT detectors were set up on the dates indicated in Table 3-3.

Table 3-3: Bat Detector Location and Active Period

Unit	BM 1	BM 2	BM 3
UTM NAD83	20T 355779.00, 5169512	20T 355678, 5169145	20T 355186, 5169442
Installed/Monitoring Start	13 June 2017	13 June 2017	24 September 2017
Monitoring Ended	13 October 2017	13 October 2017	13 October 2017
Height Installed Above Ground Level	13.4 meters	13.4 meters	4 meters
Detector nights	117	112	19

Monitoring Period

Bat Monitors 1 and 2 were installed on June 13, 2017 and ran continuously through to the Fall migratory season with collection on October 13, 2017. Data collection ceased due to a malfunction in BM1 on Sept. 29, 2017, and BM2 on Sept. 24, 2017. Data collection was re-established during the following equipment check on Oct. 4, 2017. Bat Monitor 3 was installed on September 24, 2017 and no malfunctions occurred during its monitoring period. All bat monitors were collected from the field on October 13, 2017.

The detectors were programmed to record bat passes from a half an hour before sunset, to a half an hour after sunrise to determine relative activity patterns by species or species groups over the monitoring period.

Location

In the document *Pre-Construction Bat Survey Guidelines for Wind Farm development in NB* (DERD, 2009), it is stated that:

> *"Survey stations are stationary points that are positioned in such a way as to provide adequate coverage of the spatial distribution of the proposed wind turbine placements (e.g., if known, survey stations should be established at sites where wind turbines are proposed to be constructed, to the extent possible; if turbine locations are not known, survey stations should cover the full spatial extent of the site and all habitat types)"*.

The dominant habitat type across the landscape was determined from habitat surveys to be a closed canopy mixed-wood forest. There are subtle changes in dominant species present throughout the

forested habitat, although not abrupt enough to alter the relationship between presence or abundance levels of bats. Forest gaps constitute an important microhabitat for the majority of bat species foraging on aerial insects: bats with high flight speed, low maneuverability known to forage in open space or in open forests, used forest gaps like some species known to be edge specialists (e.g., *Pipistrellus* sp.) (Froidevaux *et al*, 2014).

In their paper discussing the influence of habitat structure on the ability to detect ultrasound using bat detectors, Patriquin et al. (2003) state that there is a reduced probability of call identification in sites where the detection volume includes substantial amounts of vegetative structure, the structure itself may alter ultrasound propagation and, with it, call detection or quality.

Furthermore, at the time of bat monitor installation, the turbine location was unknown, therefore, based on the habitats observed within the Project study area, one monitoring station was erected on the edge of habitat that was consistent across the landscape (i.e. mixed-wood forest), as well as in an open area to the northeast of the site located in close proximity to open water which has formed from an old quarry.

Bat Monitor #1 (BM1) was erected adjacent to the edge of the mixed-wood forest, and in close proximity to adjacent areas of open water as shown in Figure 3-3. These features are contiguous with the graminoid fen wetland delineated behind the proposed turbine location. The bat monitor location is elevated 13.4 meters above the ground, although likely in excess of 16 meters from the water level in the adjacent ponds. This presents favorable siting conditions as it extends the vertical and horizontal detection zone of the monitor from the open water/edge habitat, which bats typically frequent.

Bat Monitor #2 (BM2) is located in a clearing, on the edge of the mixed-wood forest in eastern portions of the Project study area as shown in Figure 3-4. The location of the monitor adequately represents the mixed-wood habitat across the Project study area, while also maximizing the ability to record bat activity in a cleared area.

Subsequently, once the proposed turbine placement had been determined, a third bat monitor (BM3) was installed within the graminoid fen habitat to the west of the proposed turbine location as shown in Figure 3-5. As such, this represents the closest location to the proposed turbine (~120m) of the three monitor locations which are shown in relation to the turbine in Figure 3-6.

The data collected at the bat monitoring locations was anticipated to provide an accurate estimation of species and relative abundance in the landscape surrounding the proposed turbine.

Figure 3-3: Location of Bat Monitor #1.

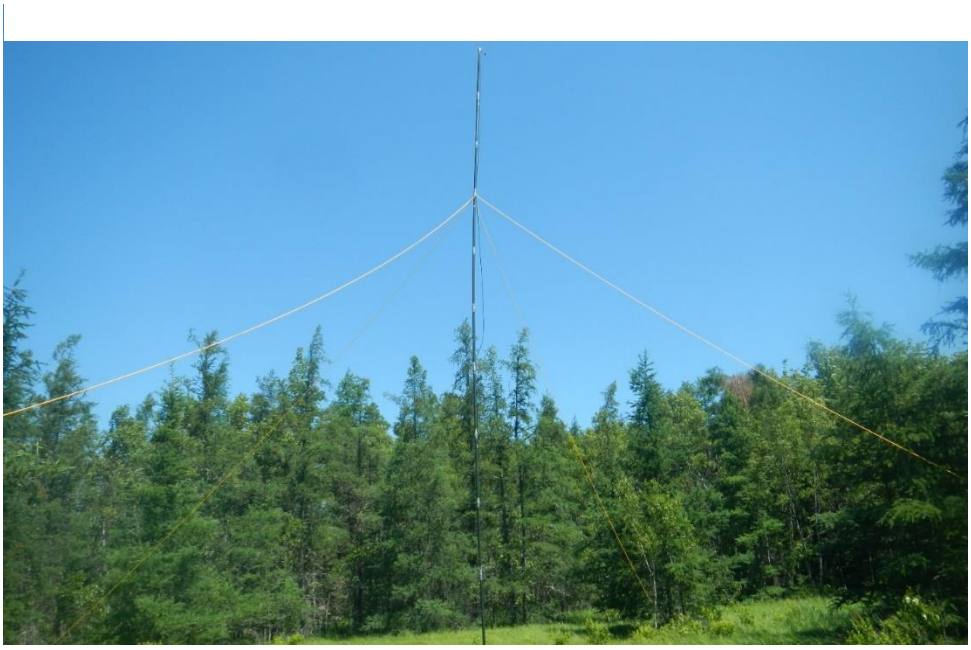

Figure 3-4: Location of Bat Monitor #2.

Figure 3-5: Location of Bat Monitor #3.

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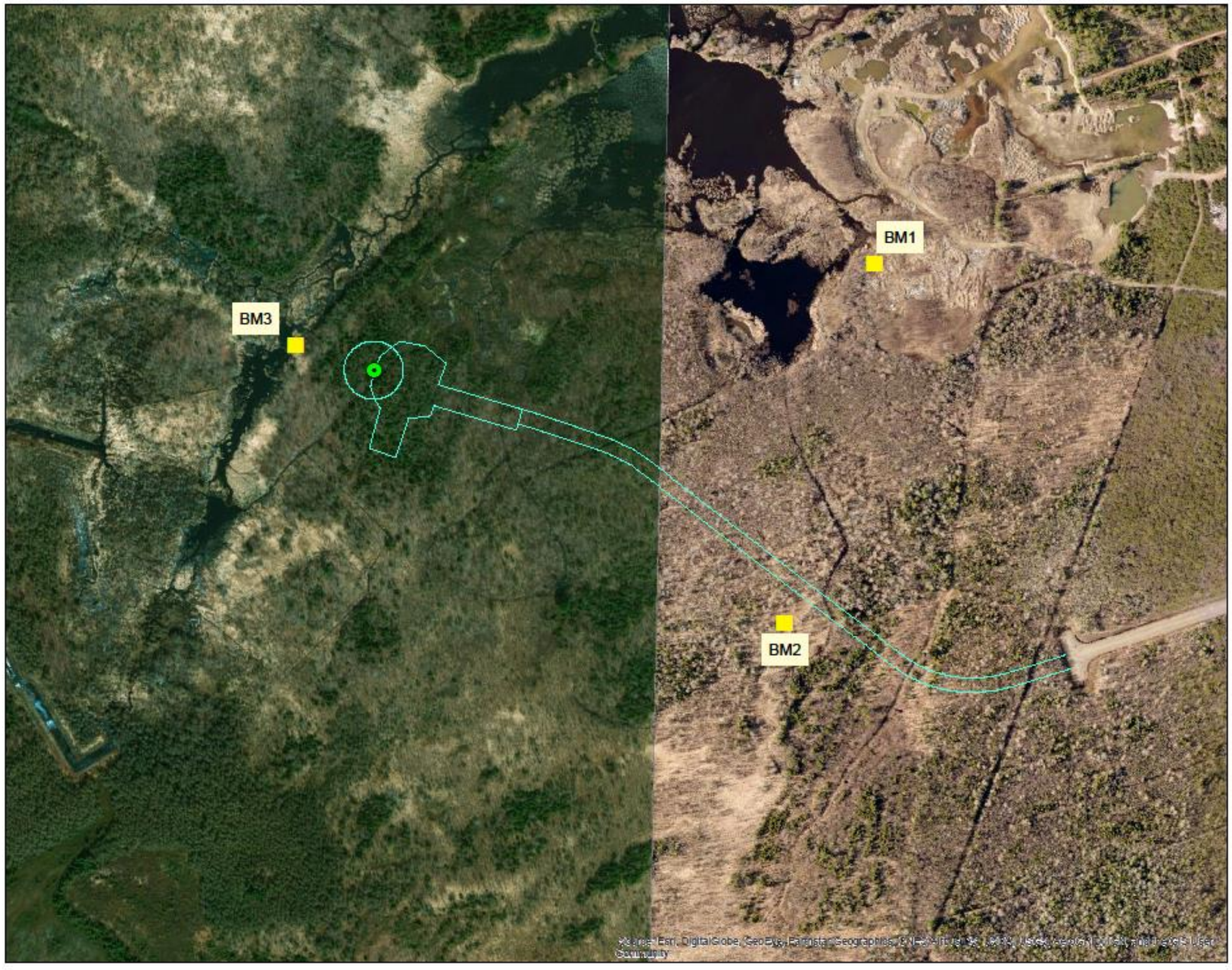

Richibucto Wind Project

Bat Monitoring

Legend

- Bat Monitors
- Proposed Turbine
- Access Road and Crane Pad

Notes

N

1:5,500

0 120 240 360

Metres

WGS 1984 Web Mercator Auxiliary Sphere

Production Date: Nov 14, 2017

naturalforces

Figure 3-6: Location of Bat Monitors in reference to the Project Footprint.

Analysis

SM4BAT detectors were used to record ultrasonic bat calls through a transducer (microphone) and record them on a compact flash card for later download and analysis. The analysis required two specialized software systems (Kaleidoscope Pro and Analook) to identify recorded bat passes to species or species group.

Where echolocation recordings could be identified, species were classified as:

- EPFU - *Eptesicus fuscus* (Big brown bat)
- LABO - *Lasionycteris borealis* (Eastern red bat).
- LACI - *Lasiurus cinereus* (hoary bat);
- LANO - *Lasionycteris noctivagans* (silver-haired bat);
- MYLU - *Myotis lucifugus* (little brown bat)
- MYSE - *Myotis. Septentrionalis* (Northern long-eared myotis)
- PESU – *Perimyotis subflavus* (Tricolored bat)

Due to insufficient calls/pass or overlap in identifying call characteristics, passes that could not be identified to species were grouped into the following categories:

- EPFU/LANO - *Eptesicus fuscus Lasionycteris noctivagans* (silver-haired bat/big brown bat);
- LABO/PESU - *Lasionycteris borealis/Perimyotis subflavus* (Eastern red bat / Tricolored bat),
- Myotis – *Myotis lucifugus/Myotis. Septentrionalis* (little brown bat/Northern long-eared myotis),
- LowF – Low frequency bats include (LACI/LANO/EPFU)
- HighF – High frequency bats include (LABO/MYLU/MYSE/PESU)

3.3.3 Wetland and Watercourse Survey

A wetland and watercourse assessment began with a desktop review of available data for the Project area. The desktop review was then used to identify areas with a high potential for wetland habitat and were incorporated into the field survey strategy. As defined by the *New Brunswick Clean Water Act*:

Wetlands are land that:

> (*a*) either periodically or permanently, has a water table at, near or above the land's surface or that is saturated with water, and
>
> (*b*) sustains aquatic processes as indicated by the presence of hydric soils, hydrophytic vegetation and biological activities adapted to wet conditions.

A watercourse in New Brunswick is defined as:

A feature in which the primary function is the conveyance or containment of water, described as being:

> *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).*

Desktop Review

A desktop review of the general project area was conducted to identify location and extent of potential wetlands and watercourses. Information was reviewed from the following sources:

- Geo NB Data Catalogue
- Wetlands Data Layer
- New Brunswick Hydrographic Network Data Layer
- Draft Wetlands Reference Map
- Aerial imagery; and
- Topographical maps

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.

Field Survey

Field surveys were conducted in June 2017 across the Project study area to confirm presence of mapped wetlands and watercourses, according to the New Brunswick's *Clean Water Act* definitions. Through research and consultation on the provincial EIA process it is understood that WTGs must be setback a minimum of 30 meters from provincially regulated wetlands and watercourses; the field assessment was conducted in a conservative manner to aid in micro-siting in order to maintain this setback.

Wetlands

Wetland delineation was completed based on micro-topography, and observed surface hydrology, vegetation and soils by qualified wetland delineators. Wetland boundaries were documented using an

SXBlue GPS unit and hand-held field computer capable of sub 1m accuracy. Any inlet and outlet streams or other features associated with each wetland were marked during the delineation process and walked and mapped. Observations were made on wetland types, water flow path, dominant vegetation communities (and Species at Risk or of Conservation Interest, if present), fish habitat potential and characterizations, and wetland functions.

Due to the proximity of the identified wetlands to proposed Project infrastructure, wetland functional assessments were completed. The analysis of wetland function was completed for each wetland using the Wetland Ecosystem Services Protocol (Atlantic Canada) (WESP) wetland evaluation technique. The WESP process involves the completion of three forms; a desktop review portion that examines the landscape level aerial conditions to which the wetland is situated, and two field forms. The process serves as a rapid method for assessing individual wetland functions and values. WESP addresses 17 specific functions which wetlands may provide. The specific wetland functions are individually allocated into grouped wetland functions and measured for "functional" and "benefit" scores. Wetland function relates to what a wetland does naturally (i.e., water storage), whereas wetland benefits are benefits of the function, whether it is ecological, social, or economic. The highest functioning wetlands are ones which have both high 'Effectiveness' and 'Benefit' scores for a given function. WESP enables a comparison to be made between individual wetlands within a region to gain a sense of the importance each has in providing ecosystem services.

Watercourses

Watercourses were documented using an SXBlue GPS unit and hand-held field computer capable of sub 1m accuracy. Physical parameters such as location and average width and depth were recorded for watercourses and drainage ditches that were encountered. Each feature that was encountered was photographed.

3.3.4 Fish and Fish Habitat

Desktop and field surveys were conducted by McCallum Environmental Ltd. to identify wetlands and watercourses within the Project study area. Observations were made on fish habitat quality and fish habitat potential for each identified feature.

3.3.5 Wildlife

During 2017 field surveys, incidental observations of wildlife outside of avian, bats, and fish were recorded to determine predicted impacts on terrestrial mammal and herpetofauna species. Observations of terrestrial mammal species included such features as dens and nests, scat, tracks, and forage evidence.

No targeted herpetofauna surveys were undertaken due to the unsuitable habitat present within the Project study area for priority herpetofauna species (wood turtle and snapping turtle). According to the ACCDC, wood turtle and snapping turtle are not documented within 5km of the Project study area. The fen wetland habitat to the west of the proposed turbine was evaluated for snapping turtle habitat, and

potential wood turtle habitat was evaluated in watercourses during surface water field surveys in 2017. Broadly, incidental observations of herpetofauna across the Project study area were documented during all field surveys completed through 2017, especially during the wetland delineation and evaluation, and watercourse evaluation. Specific focus was given to identifying priority species, especially those identified as having appropriate habitat within the Project study area through the desktop evaluation for priority species.

3.3.6 Vegetation and Habitat Survey

In May 2017, a desktop habitat assessment was completed within the Project study area. Using available forestry and wetlands databases, habitat survey routes were created with the goal of assessing all of the major habitat types and landscape features throughout the Project study area, and to inform necessary targeted surveys for the remaining baseline environmental field program. Forestry cover data was obtained from the DERD Forest Inventory database accessed through GeoNB. Forest cover polygons included in the database are interpreted from aerial imagery on a 10-year cycle.

The survey team completed the habitat assessment within the Study Area encompassing the proposed access road and turbine in June 2017. The survey followed a meandering transect that reached all major habitat types expected within the Project study area. The habitat survey focused on assessing upland habitats, as detailed evaluation of all wetland habitat is completed as part of the surface water evaluation.

Vascular plant surveys focused on identifying general vegetative communities, with particular focus on identifying priority species. Early and late botany surveys were completed concurrently with wetland and habitat surveys throughout the Project study area in June and August 2017. The priority list created for the RWP was consulted before completing botany surveys.

Field biologists searched for species which are indicators of nutrient rich, fertile soils, and species which are likely to frequent wetland habitat. These habitats have higher potential for rare species presence. The vegetation survey was extended beyond the Project study area boundary to also encompass the fen wetland to the west of the proposed turbine.

3.3.7 Sensitive and Significant Habitat

During field surveys, any sensitive or significant habitat was identified including any wetlands, watercourses, IBA's, endangered fauna and/or flora, and associated critical habitat. The ACCDC was consulted to determine any ESA's, 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
- Protected Natural Areas
- Protected Watersheds
- Protected Wellfields
- Provincial Parks
- Wildlife Refuges

3.4 Approach to Socio-economic VEC Studies

3.4.1 Archaeological Impact Assessment

The New Brunswick's Archaeological Spatial Database and Archaeological Services was consulted during a desktop review for possible archaeological resources within the project site. Consultation with New Brunswick Department of Tourism, Heritage, and Culture's Archaeological Services Branch have occurred, and it was determined that a field survey was not required. However, through consultation with the Department of Tourism, Heritage and Culture, the Proponent recognizes that areas within 80m of a waterbody and 100m of a confluence contain elevated archaeological potential. The Archaeological Spatial Database predictive model results are included in Appendix E.

3.4.2 Electromagnetic Interference Study

An impact assessment of the proposed RWP was completed on the performance of existing 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, 2007)*. The desktop and field study were initiated by completing a search of the Industry Canada database to identify all licensed radio systems within 35 km of the proposed Project.

Based on radio links that were identified, an assessment of the potential impact was completed by calculating the recommended clearance corridor between the turbine and radio links using the RABC protocol. The recommended clearance corridor (also known s the Fresnel zone) was determined for each radio link that crosses near the Project site, to determine whether a proposed turbine is within this buffer and could pose interference between the radio links.

Applications to Transport Canada and Land Use Proposal forms for Navigation Canada have been submitted and the Department of National Defence has been notified about the proposed Project. Applications for the previously considered Location A were approved. The current location is approximately 500m north of Location A. Therefore, no issues are expected for the current proposed location, however, updated applications were submitted to ensure compliance.

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, 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.

The latest Statistics Canada data was reviewed to determine the average value of land and properties 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 an updated review on any links will provide science based information during consultation activities.

3.4.4 Vehicle Traffic and Pollution

A list of expected vehicle movements and types of vehicles to be used during the construction phase have been compiled. After further analysis and specific WTG selection, delivery routes will be determined, and a Transportation Plan will be developed in consultation with the Department of Transportation and Infrastructure. The Transportation Plan will be included in the Construction Environmental Management Plan developed prior to construction activities. Possible congestion or problem areas will be identified as well as residential roads that may be affected.

3.4.5 Public Health and Safety

A comprehensive review of possible health and safety concerns has been included in this assessment. 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 inhouse construction manager who oversees construction activity 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 RWP 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 Town of Richibucto and the Village of Rexton. 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 and 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 whether any 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 and 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 normally 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.

4.0 Existing Environment

4.1 Existing Physical VECs

4.1.1 Ground Water

There are no residential wells, protected wellfields or protected watersheds within 500m of the proposed WTG. As well, no residential wells were identified on the Online Well Log System within 1km of the proposed WTG. Further, as the WTG will be setback over 900 m from all buildings and 1.2km from residential dwellings, the project is not likely to interfere with well systems that were not identified if present. In referencing the GeoNB Protected Wellfield Data, a protected wellfield was located 1.8 km north of the project lands. However, due to this distance, the project is not expected to interfere with this wellfield.

The geotechnical survey measured static groundwater elevation in a standpipe installed in a borehole on September 29, 2017. Groundwater was measured at approximately 1.05 meters below ground surface. This groundwater sample was submitted to RPC in Fredericton, New Brunswick for soluble sulphate content analysis in accordance with Canadian Standards Association (CSA) A23.1-14. The results indicate low sulphate content in the groundwater at less than 1 mg/L. Table 3 of CSA A23.1-14 indicate the threshold for requiring protection against sulphate attack is a minimum of 150 mg/L. Details about the geotechnical report are available upon request.

4.1.2 Geophysical

The project site is located just west of the Richibucto-Rexton Industrial Park. The regional land in this area is visibly flat with minimal slope and variability. The project lands only vary a few meters in elevation from 7-12m. A desktop review has determined the geology of the site to be composed of Late Carboniferous rock defined as course-to-fine grained, terrestrial, and clastic sedimentary rocks. More specifically, the project site is part of the Pictou Group's Richibucto Formation (Smith, 2008). The overburden of the industrial park is described as consisting of sand, gravel, and clay aggregate posing no restrictions to potential development. The overburden described from the desktop review performed by Natural Forces is similar to that found by Stantec Consulting during their geotechnical survey.

The field survey conducted by Stantec Consulting found the subsurface conditions present in the Project study area consist of a layer of root mat and topsoil, approximately 0.1 meters thick which was encountered over sand with gravel and varying amounts of silt and clay in the boreholes. The sand extended approximately 0.25 to 0.76 meters below grade and was underlain by bedrock. Bedrock encountered in the borehole locations consisted of a highly to moderately weathered sandstone bedrock. Bedrock was sampled with standard coring techniques and was augured from depths of approximately 0.3 to 3.0 meters below grade. Recommendations for turbine design and foundation have been provided from Stantec Consulting regarding the Geotechnical survey.

4.1.3 Atmospheric Conditions

Historic climate data was taken from an Environment Canada weather station located in Rexton, New Brunswick located approximately 1.5 km from the Project site. The data collected from Environment Canada can be found in Table 4-1 and represents climate averages and weather extremes.

Table 4-1: Rexton, New Brunswick Atmospheric Conditions (Environment Canada, 2016).

Parameter	Time Period	Data Source	Value
Average Daily Temperature (°C)	Yearly Average (1981-2010)	Environment Canada	5.6
Extreme Maximum Temperature (°C)	August 19, 1935	Environment Canada	39.4
Extreme Minimum Temperature (°C)	January 19, 1925	Environment Canada	-39.4
Average Total Rainfall (mm)	Yearly Average (1981-2010)	Environment Canada	837.1
Maximum Daily Rainfall (mm)	October 25, 1933	Environment Canada	124.5
Average Annual Snowfall (cm)	Yearly Average (1981-2010)	Environment Canada	266.8
Maximum Snow Depth (cm)	February 24, 1944	Environment Canada	61.0

Historic and Predicted Rainfall

Due to the wet conditions near the proposed WTG location during Spring conditions, potential changes in rainfall amounts due to climate change could require additional storm water management techniques. As such, the ECCC's Rexton weather station data was reviewed to determine historic rainfall amounts as shown in Table 4-2. 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 4-1.

Table 4-2: ECCC Rexton Station data for historic precipitation amounts (ECCC, 2017)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg (mm)	98.4	78.0	94.6	78.7	104.0	80.2	93.2	84.6	100.5	100.1	103.6	88.2
Extreme Daily (mm)	69.9	76.7	64.3	74.9	69.0	61.7	88.9	99.1	97.8	124.5	72.4	56.6

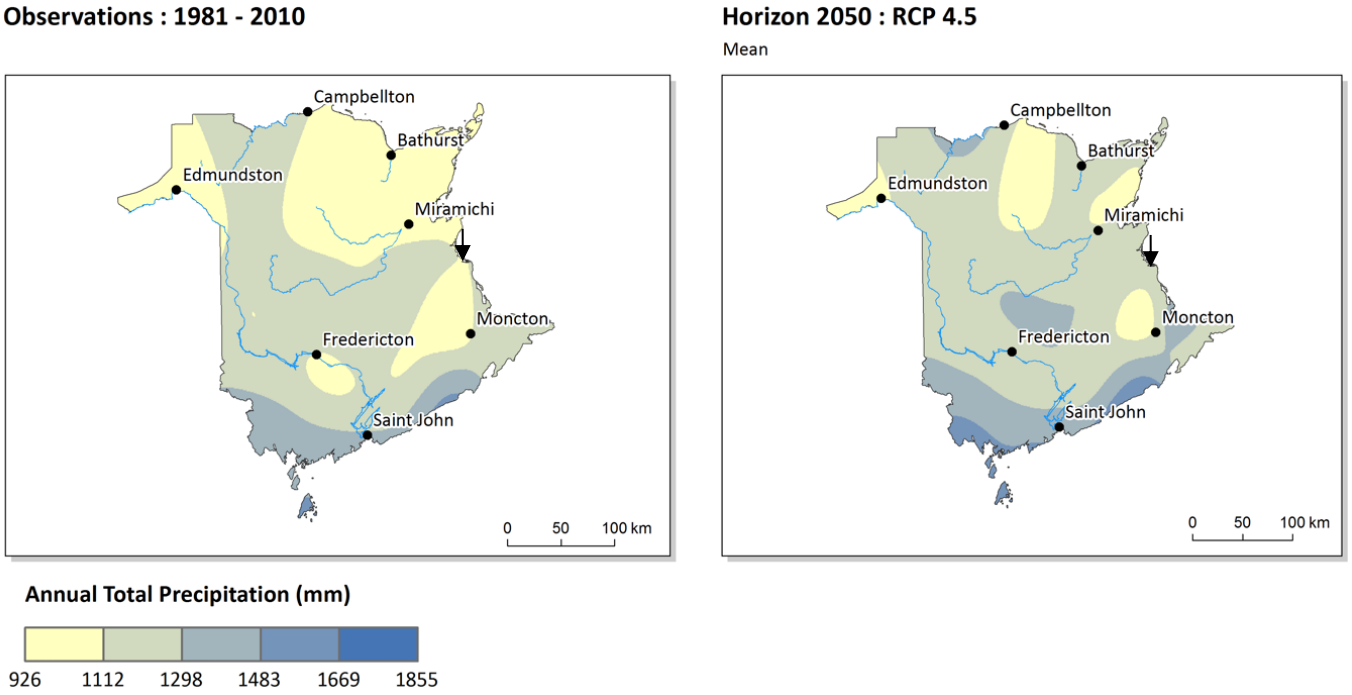

Figure 4-1: Annual Total Precipitation for the province of New Brunswick showing historical data (left) and Predicted 2050 data (right) to show the predicted precipitation near the end of the project lifespan (Roy & Huard, 2016).

Figure 4-1 demonstrates that the proposed project location will see an increase in precipitation as a result of climate change. The black arrow in the maps outline that the project location will increase in precipitation amounts from the 926-1112mm range annually to a possible 1112 – 1298mm. As Table 4-2 demonstrates, the Rexton weather station receives approximately 1103.9 mm of precipitation annually, predicted changes then result in a potential 0.7% - 15% increase in annual precipitation amounts.

In addition to these predictions, the Proponent researched Intensity-Duration-Frequency (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 4-3 and Table 4-4) and graphs for the closest weather station to the proposed location (Bouctouche), total precipitation and intensity was found to increase by a maximum of 25% over all timeframes and return periods and is predicted to increase, on average, by approximately 15% from historic levels similar to the New Brunswick IPCC Assessment Report #5 predictions.

Table 4-3: University of Western Ontario's IDF Tool for Historic Rainfall Levels from the Bouctouche, NB weather station (i.e. a 5-minute rainfall intensity of 62.92mm/h normally occurs every 2 years) (UoWO, 2014).

T (years)	2	5	10	25	50	100
5 min	62.92	87.45	103.69	124.21	139.43	154.54
10 min	52.93	79.56	97.19	119.46	135.99	152.39
15 min	43.97	65.39	79.50	97.50	110.79	123.99
30 min	29.62	40.41	47.56	56.59	63.29	69.94
1 h	19.48	26.50	31.15	37.03	41.39	45.72
2 h	13.28	17.64	20.52	24.17	26.88	29.56
6 h	7.08	8.65	9.69	11.01	11.98	12.95
12 h	4.23	5.31	6.02	6.93	7.60	8.26
24 h	2.42	2.96	3.32	3.77	4.11	4.44

Table 4-4: University of Western Ontario's IDF Tool for Predicting Future Rainfall Levels from the Bouctouche, NB weather station during the years 2020-2050 using the moderate Representative

Concentration Pathway of 4.5 W/m2 by the year 2100 (i.e. a 5-minute rainfall intensity of 74.89mm/h is expected to occur every 2 years now) (UoWO, 2014).

T (years)	2	5	10	25	50	100
5 min	74.89	103.10	121.43	144.40	160.62	175.86
10 min	65.93	96.55	116.44	141.38	158.99	175.57
15 min	54.42	79.06	95.07	115.13	129.30	142.60
30 min	34.88	47.30	55.37	65.48	72.62	79.34
1 h	22.90	30.99	36.24	42.82	47.46	51.84
2 h	15.41	20.42	23.68	27.76	30.64	33.36
6 h	7.84	9.65	10.83	12.30	13.34	14.32
12 h	4.76	6.00	6.81	7.82	8.53	9.20
24 h	2.68	3.30	3.71	4.22	4.57	4.91

From the historical and predicted rainfall amounts in the 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 WTG. Specifically, as noted in Section 2.5.5 the very first location considered for this project was in an unmapped wetland. Due to the wet conditions encountered on the Project lands during the spring and the predicted rainfall increase, a large swath of upland forested habitat was chosen for the proposed location. The increase in precipitation has been predicted to occur mainly in the summer months where the site was observed to be dry. It is expected that the large amount of wetland habitat in the greater area surrounding the turbine location will aid in absorbing additional precipitation predicted during this time. The slight increase in elevation of the turbine location will also provide additional protection.

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. 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. The Project is located

near industrial buildings and 3km from the Town of Richibucto centre. Light pollution from the industrial park and from the Town and Village centres can be considered significant sources of artificial light.

According to the internationally-accepted definition of fog, it consists of suspended water droplets or ice crystals near the Earth's surface that lead to a reduction of horizontal visibility to below 1 km (NOAA, 1995). ECCC's database of Canadian Climate Normals 1971-2000 was consulted to provide baseline fog data relevant to the Project region. However, the nearest weather station that collects this data is located in Moncton, New Brunswick (ECCC, 2017) and may not be an accurate representation of the project region. Based on the data presented in Table 4-5 fog can be expected to occur 1.96% of the time throughout the duration of an average year.

Table 4-5: Moncton, New Brunswick fog data average from 1971-2000 (ECCC, 2017).

Month	Hours with visibility less than 1 km	% of foggy weather*
January	18	2.4
February	19.5	2.9
March	24.2	3.3
April	18.4	2.6
May	12.5	1.7
June	10.4	1.4
July	11.3	1.5
August	9.5	1.3
September	9.8	1.4
October	9.7	1.3
November	12.6	1.8
December	15.7	2.1
Annual	**171.8**	**1.96 %**

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

Moncton is located 63 km south of the project and could resemble inland conditions near the project. In an attempt to obtain data more relevant to the project region, Environment Canada's Handbook on Fog

and Fog Formation Forecasting was consulted and it was determined that while the majority of New Brunswick receives between 30-60 fog days annually. From this assumption, it was calculated that the Richibucto area receives approximately 100 – 200 hours of fog per year equivalent to receiving fog 1.1% - 2.2% of the time, consistent with Moncton data.

4.1.4 Wind Resource

The New Brunswick wind atlas was used in the preliminary site finding exercise and indicates an approximate wind speed of 6.0 – 8.0 m/s at 80 m (NB Wind Atlas, 2017; Figure 4-2) for the Regional area. Preliminary data collected from the installed meteorological mast (Figure 4-4) indicate the prevailing wind at the Project site location to be coming from the southwest (Figure 4-3).

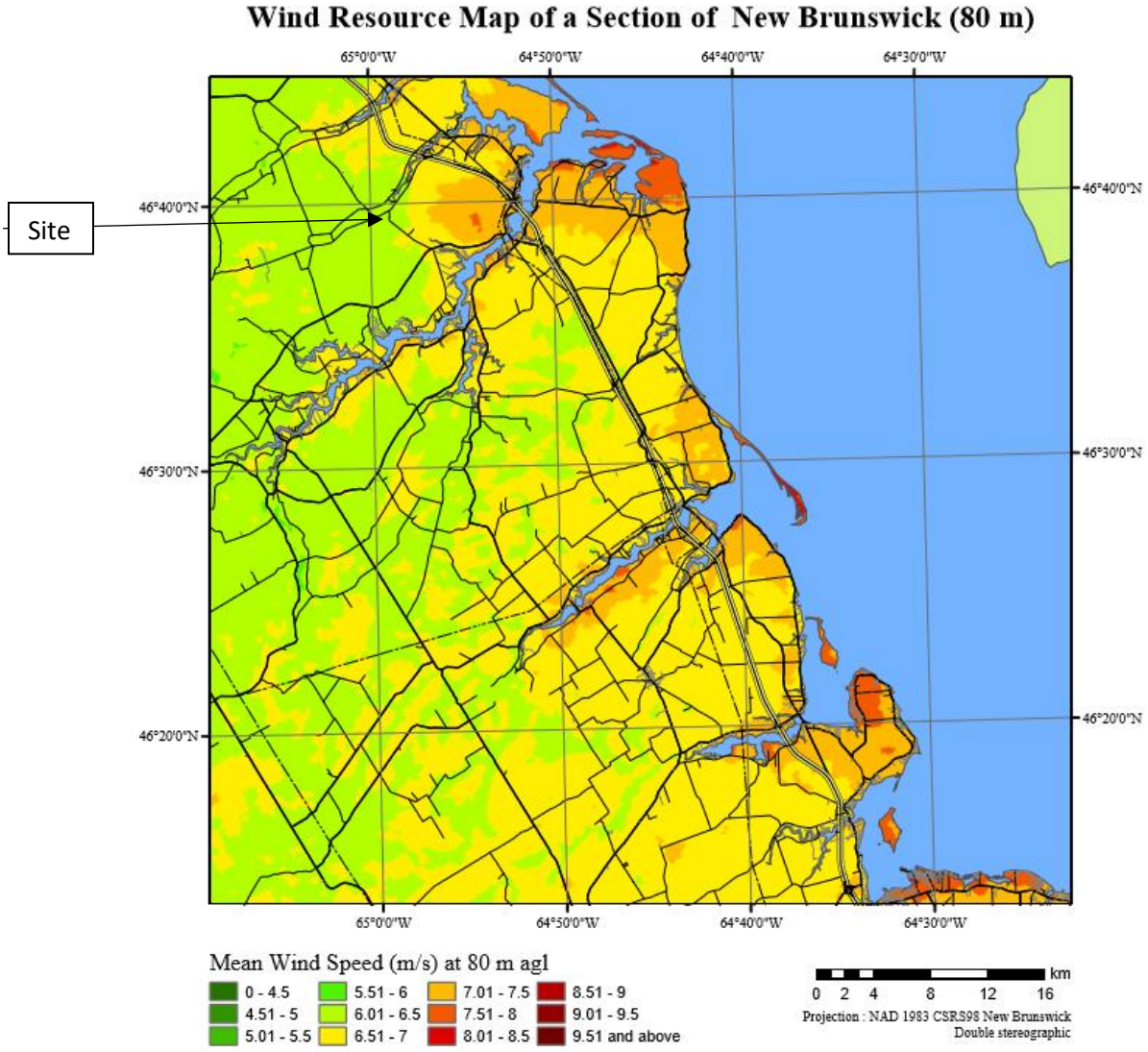

Figure 4-2:The Government of New Brunswick's wind atlas demonstrating the project site is located in an area with wind speeds between 7.01-8 m/s.

Figure 4-4: The 60m Met Tower installed in May 2017

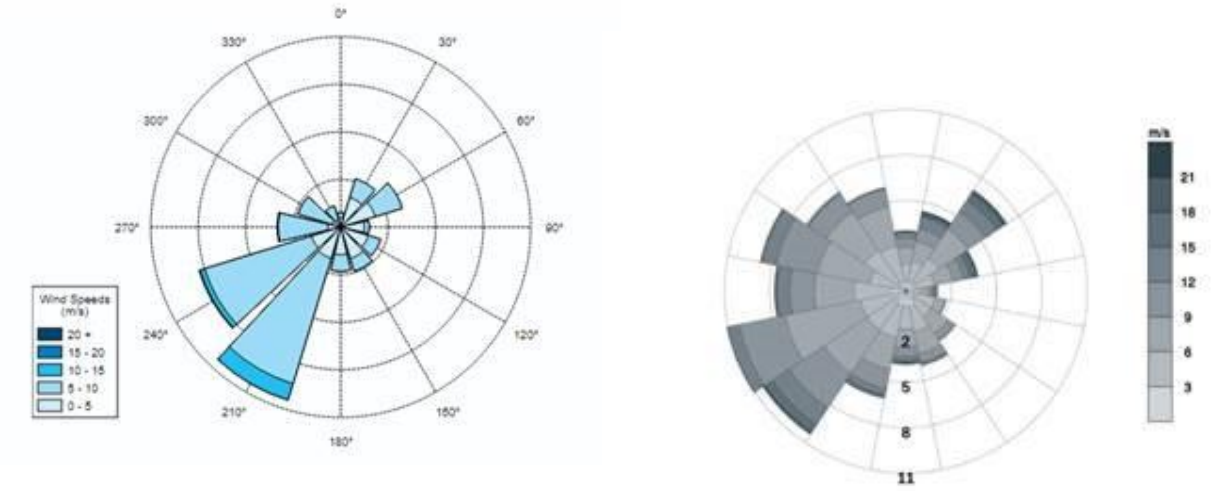

Figure 4-3: Wind Rose created from data collected from the installed met tower from June – July 1017 (left and annual data collected from www.vortexfdc.com (right) demonstrating prevailing winds from the southwest.

4.1.5 Existing Noise

Existing Ambient Noise

The area proposed for the RWP is located within an industrial park and therefore, ambient noise levels in the area are generally elevated. Activity currently in the area consists of peatland harvesting, lumber yards, sheet metal manufacturers (Imperial Manufacturing Group), and roof, wall, and flooring contractors (Atlas Structure Systems).

Just outside of the Industrial Park lies Main Street which is the main route through the Town of Richibucto and the Village of Rexton. Elevated levels of traffic in this area will also increase existing ambient noise levels surrounding the proposed project.

Additionally, as the site was chosen for it's excellent wind resource, particularly windy days can greatly increase existing ambient noise levels.

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 wind. In terms of health, at sufficiently high levels, infrasound can be dangerous; however, it is grossly inaccurate to conclude that infrasound, at any level, causes health risks (HGC Engineering 2006).

A recent study conducted by 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. At., 2012).

4.1.6 Existing Visual Aesthetics

The landscape surrounding the RWP is generally flat and consists of the Industrial Park, Shopping Centers, residential neighbourhoods. The current visual aesthetics of the landscape can be viewed in the following photos which are later demonstrated with the proposed turbine.

As shown in Figures 4-5 to 4-7 the landscape is not pristine in that the are various utility poles that obstruct the landscape in addition to a large water tower visible in Figure 4-6.

Figure 4-5: Landscape view in the direction of the turbine from Main Street near Mooney Street.

Figure 4-6: Landscape view from a Centennial Avenue in Jardine Ville on the other side of the Richibucto River.

Figure 4-7: Landscape view from Bonar Law Avenue.

4.2 Existing Biophysical VECs

4.2.1 Avian

A review of the Canada IBA database was completed and the breeding bird square (20LS56) was reviewed from the Maritime Breeding Bird Atlas (MBBA) to support bird survey design and methodology. The MBBA grid results are included in Appendix D.

The Project study area provides nesting, foraging and roosting habitats for a diversity of species, particularly passerines and other land birds. With the exception of the open fen to the west of the proposed turbine, and open bodies of water in the abandoned quarry to the north of the Project study area, the Study Area itself provides very limited habitat for water birds and waterfowl.

The nearest IBA is the Kouchibouguac NP Sand Islands, located approximately 5km northeast of the Project study area (IBA NB003, Bird Studies Canada, 2012). The Kouchibouguac National Park Sand Spits and Barrier Islands are located on the east coast of New Brunswick adjacent to the Northumberland Strait. Much of the area is low and flat with the dominant vegetation being beach grass and strand wheat.

The habitats provided within this IBA are not consistent with habitat available within the Project study area. The IBAs are principally associated with coastal colonial nesting species and shorebirds dependant on exposed mudflats or sandy beaches.

The closest significant migration staging area for waterfowl and shorebirds is also the Kouchibouguac National Park Sand Islands, which is the location of the nearest known tern and gull colony. The Kouchibouguac River (a tidal inlet) is the nearest waterbody to the Project study area, approximately 1.5km to the east and there are no migratory bird sanctuaries within 50km of the Project study area.

Baseline assessments for birds were completed from April through November 2017. A total of 1304 minutes (21 hours, 44 minutes) of surveys were completed over three seasons. These surveys resulted in the observation of 846 individuals, representing 72 species within the Project study area and lands adjacent to the Project study area. Across all survey seasons a total of six priority species were observed during dedicated survey periods. These species include the Peregrine Falcon (*Falco* peregrinus), Bald Eagle (*Haliaeetus* leucocephalus), Rusty Blackbrid (*Euphagus* carolinianus), Olive-sided Flycatcher *(Contopus cooperi*), Eastern Wood Pewee (*Contopus virens*) and Killdeer (*Charadrius vociferous*). A summary of all combined seasonal surveys is provided in Table 4-6 and Figure 4-8.

Table 4-6: Summary Results of all Seasonal Bird Surveys Conducted in 2017.

Code	Common Name	S rank	Group	Abundance	Frequency	Surveys Observed*
ABDU	American Black Duck	S5B, S4N, S5M	1	6	4	Sp, Br
ALFL	Alder Flycatcher	S5B, S5M	6	1	1	CONI
AMCR	American Crow	S5	6	64	13	Sp, Br, Fa, WF
AMGO	American GoldFinch	S5	6	14	14	Sp, Br, Fa
AMRE	American Redstart	S5B, S5M	6	6	6	Sp, Br, Fa
AMRO	American Robin	S5B, S5M	6	70	23	Sp, Br, Fa, CONI, WF
AMWO	American Woodcock	S5B, S5M	2	1	1	CONI
BADO	Barred Owl	S5	5	1	1	Sp
BAEA	Bald Eagle	S4, NBSARA Endangered	4	3	1	WF
BAWW	Black and White Warbler	S5B, S5M	6	22	22	Sp, Br, Fa
BBWA	Bay-breasted Warbler	S4B, S4S5M	6	1	1	Br
BCCH	Black-capped Chickadee	S5	6	68	50	Sp, Br, Fa, CONI, WF
BEVI	Blue-headed Vireo	S5B, S5M	6	15	15	Sp, Br, Fa
BLBW	Blackburian Warbler	S5B, S5M	6	1	1	Br
BLJA	Blue Jay	S5	6	43	35	Sp, Br, Fa, WF
BRCR	Brown Creeper	S5	6	4	4	Sp, Fa
BTBW	Black-throated Blue Warbler	S5B, S5M	6	1	1	Sp
BTNW	Black-throated Green Warbler	S5B, S5M	6	2	2	Sp, Fa
BWHA	Broad-winged Hawk	S5B, S5M	4	4	1	Fa
CAGO	Canada Goose	SNAB, S5M	1	33	16	Sp, Fa, WF
CEDW	Cedar Waxwing	S5B, S5M	6	2	1	Br
COGR	Common Grackle	S5B, S5M	6	11	8	Sp, Br

Code	Common Name	S rank	Group	Abundance	Frequency	Surveys Observed*
COLO	Common Loon	S4B, S4M, S4N	3	15	11	Sp, Br, Fa
CORA	Common Raven	S5	6	6	5	Sp, Br, Fa
CORE	Common Redpoll	S5B, S5M	6	7	2	Sp
COYE	Common Yellowthroat	S5B, S5M	6	34	29	Sp, Br, Fa, CONI
CSWA	Chestnut-sided Warbler	S5B, S5M	6	4	3	Sp, Br
DEJU	Dark-eyed Junco	S5	6	3	3	Sp, Br
DOWO	Downy Woodpecker	S5	7	3	3	Sp, Fa
EAPH	Eastern Phoebe	S4B, S4M	6	1	1	Sp
EWPE	Eastern Wood Pewee	S4B, S4M (*SC*)	6	1	1	Br
FOSP	Fox Sparrow	S4B, S5M	6	1	1	Sp
GCKI	Golden-crowned Kinglet	S5	6	26	24	Sp, Br, Fa
GRJA	Gray Jay	S4	6	4	2	Sp, WF
HAWO	Hairy Woodpecker	S5	7	9	9	Sp, Fa, WF
HETH	Hermit Thrush	S5B, S5M	6	28	26	Sp, Br, Fa
HOME	Hooded Merganser	S4B, S5M	1	1	1	WF
KILL	Killdeer	S3B, S3M	6	2	2	Sp, Fa
LEFL	Least Flycatcher	S5B, S5M	6	1	1	Sp
LEYE	Lesser Yellowlegs	S4M	2	8	2	WF
MALL	Mallard	S5B, S4N, S5M	1	1	1	Fa
MAWA	Magnolia Warbler	S5B, S5M	6	9	8	Sp, Br, CONI
MERL	Merlin	S5B, S5M	4	1	1	Sp
MODO	Mourning Dove	S5B, S5M, S4N	7	3	3	Sp, Br
NAWA	Nashville Warbler	S5B, S5M	6	18	16	Sp, Br, CONI
NOFL	Northern Flicker	S5B, S5M	6	14	14	Sp, Br, Fa, WF
NOPA	Northern Parula	S5B, S5M	6	17	17	Sp, Br, Fa

Code	Common Name	S rank	Group	Abundance	Frequency	Surveys Observed*
OSFL	Olive-sided Flycatcher	S3B, S3M (*T*)	6	1	1	Br
OSPR	Osprey	S4S5B, S5M	4	2	2	Fa
OVEN	Ovenbird	S5B, S5M	6	4	4	Sp, Br
PAWA	Palm Warbler	S5B, S5M	6	1	1	Fa
PEFA	Peregrine Falcon	S1B, S3M, NBSARA Endangered, SARA SC	4	1	1	WF
PUFI	Purple Finch	S4S5B, SUN, S5M	6	33	27	Sp, Br, Fa, WF
RBNU	Red-breasted Nuthatch	S5	6	45	31	Sp, Br, Fa, WF
RCKI	Ruby-crowned Kinglet	S4B, S5M	6	5	5	Sp, Fa
REVI	Red-eyed Vireo	S5B, S5M	6	14	14	Br, Fa, CONI
RTHU	Ruby-throated Hummingbird	S5B, S5M	6	1	1	Br
RUBL	Rusty Blackbird	S3B, S3M, NBSARA & SARA SC	6	1	1	WF
RUGR	Ruffed Grouse	S5	7	13	13	Sp, Br, Fa, WF
RWBL	Red-winged Blackbird	S4B, S4M	6	4	3	Sp
SNBU	Snow Bunting	S5B, S4M	6	2	1	WF
SOSP	Song Sparrow	S5B, S5M	6	5	2	WF
SWSP	Swamp Sparrow	S5B, S5M	6	11	11	Sp, Br, CONI
SWTH	Swainson’s Thrush	S5B, S5M	6	2	2	Br
TRES	Tree Swallow	S4B, S4M	6	1	1	Sp
UNWO	Woodpecker	n/a	7	10	8	Sp, Fa
WISN	Wilson’s Snipe	S3S4B, S5N	7	1	1	WF
WODU	Wood Duck	S4B, S4M	1	2	2	Br
WTSP	White-throated Sparrow	S5B, S5M	6	27	23	Sp, Br, Fa, CONI
WWCR	Whit-winged Crossbill	S5	6	19	2	WF

Code	Common Name	S rank	Group	Abundance	Frequency	Surveys Observed*
YBSA	Yellow-bellied Sapsucker	S5B, S5M	7	17	16	Sp, Br, Fa
YRWA	Yellow-rumpled Warbler	S5B, S5M	6	30	27	Sp, Br, Fa
Total:	72 Species			846		
*Sp: Spring Migration, Br: Breeding Season, Fa: Fall Migration, CONI: Common Nighthawk Surveys, WF: Waterfowl Surveys.						

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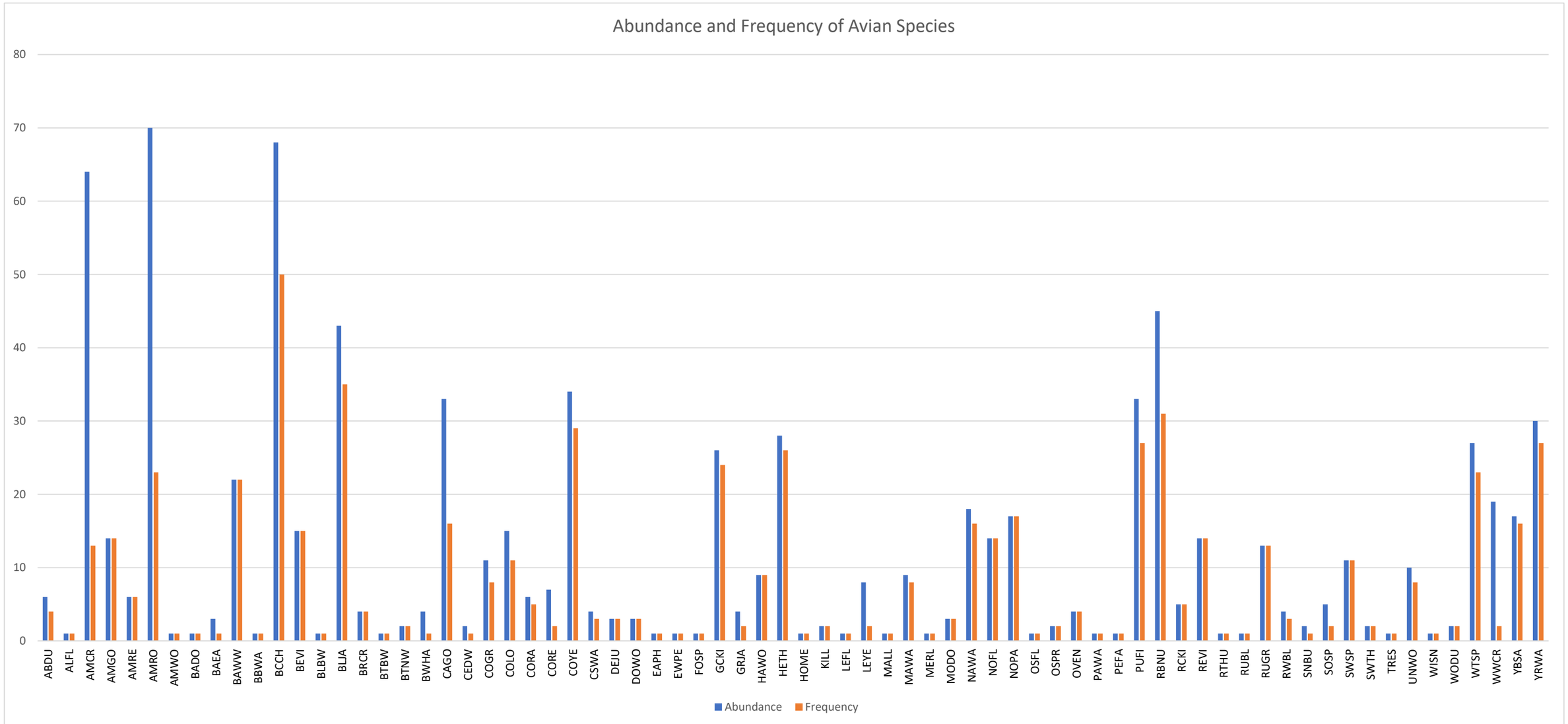
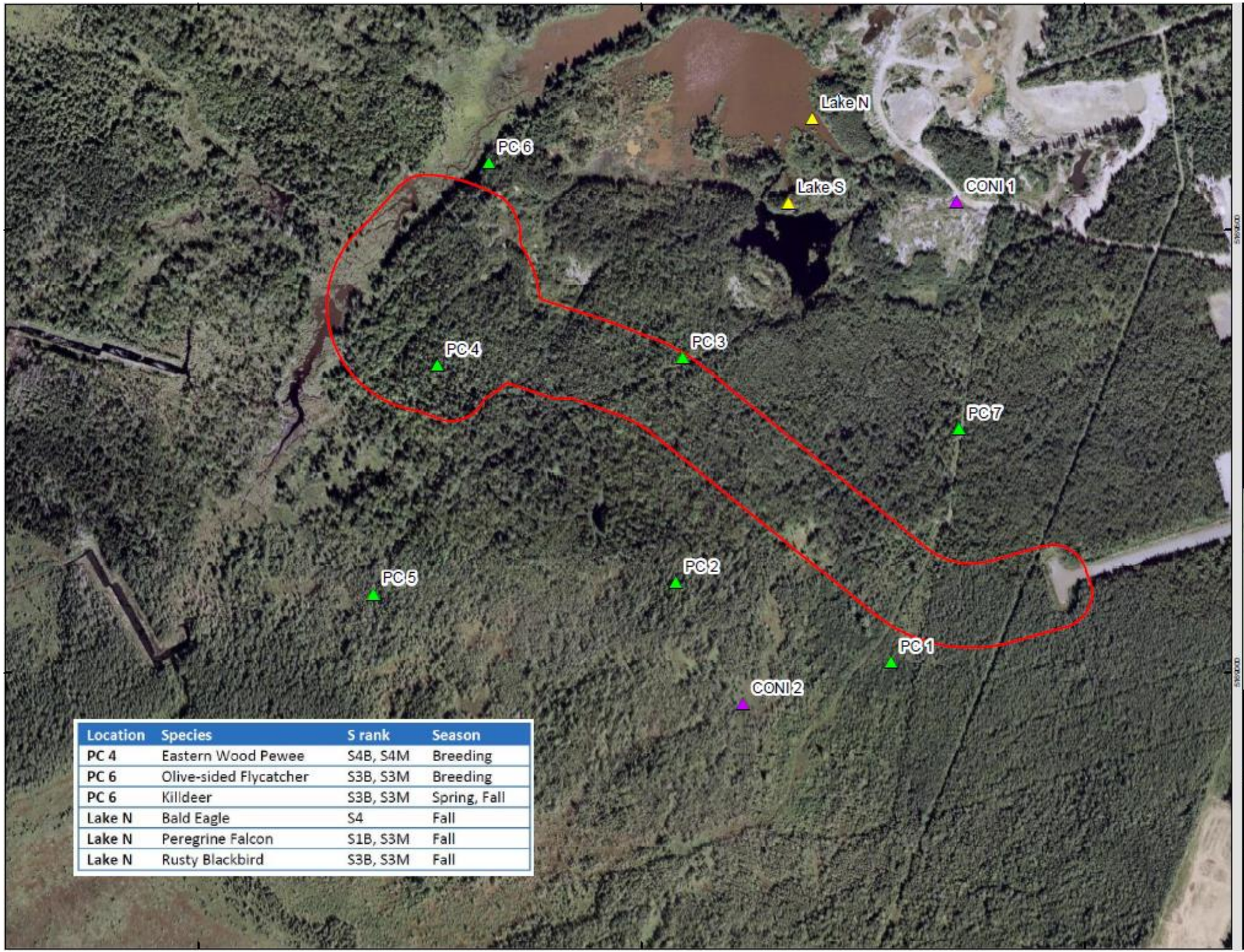


Figure 4-8: Abundance and Frequency of bird species identified during all 2017 field surveys.



Location	Species	S rank	Season
PC 4	Eastern Wood Pewee	S4B, S4M	Breeding
PC 6	Olive-sided Flycatcher	S3B, S3M	Breeding
PC 6	Killdeer	S3B, S3M	Spring, Fall
Lake N	Bald Eagle	S4	Fall
Lake N	Peregrine Falcon	S1B, S3M	Fall
Lake N	Rusty Blackbird	S3B, S3M	Fall

Prepared For:

natural forces

FIGURE 4

Richibucto Wind Project
Bird Survey Locations

Location:
Richibucto, Nova Scotia

Bird Survey Type
- Common Nighthawk Survey
- Point Count
- Waterfowl Watch
- Study Area Boundary

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 62.5 125 250 m

1:4,000 Scale when printed @ 11" x 17"

Drawn By: LP Date: 2017-11-13

McCallum Environmental Ltd.

Figure 4-9: Point Count Avian Survey Locations.

Spring Migration

Seven point count locations were surveyed during the spring bird migration period (Figure 4-9). During spring migration, 318 individuals, representing 48 species, were observed during the dedicated survey periods. One Killdeer (*Charadrius vociferous*, ranked S3M, S3M) was observed at point count #7 on May 13th 2017. No species at risk were observed during spring migration surveys.

Passerines comprised 79% of all individuals observed, which is expected based on the forested habitat present within and adjacent to the Project study area. Other land birds (such as Woodpeckers, grouse, etc) were the next most abundant bird group representing 11% of individuals observed, followed by waterfowl (9% of individuals). Black-capped Chickadee (*Poecile atricapillus*) was the most abundant species observed (n=29), followed by Canada Goose (*Branta canadensis*, n=23), Hermit Thrush *(Catharus guttatus*, n=18) and Purple Finch (*Carpodacus purpureus,* n=18). The majority of observations (97%) were of one or two individuals, and the largest group of birds observed was five Canada Geese, and five Common Redpoll, both observed at point count #1 on April 19th, 2017. No obvious concentration of ducks or shorebirds was observed.

Breeding Season

The same seven point count locations surveyed in the spring migration surveys were surveyed during the breeding season. During the breeding point count surveys, 120 individuals representing 20 species were observed. One Olive-sided Flycatcher (*Contopus cooperi*, ranked S3B, S3M, SARA and NBSARA Threatened) was observed at point count #6 on June 30th, and one Eastern Wood Pewee (*Contopus virens*, ranked S4B, S4M, SARA and NBSARA Threatened) was observed at point count #4 on June 13th, 2017. While the Eastern Wood Pewee was detected from point count #4, the call was coming from approximately 90-100m south. Both species were documented as possible breeders, using guidance from the Maritime Breeding Bird Atlas. No other priority species were observed.

Passerines comprised 86% of all individuals observed, which is expected based on the forested habitat present within the Project study area and adjacent lands. Other land birds (such as Woodpeckers, grouse, etc) were the next most abundant bird group representing 9% of individuals observed, followed by waterfowl (3% of individuals). The most abundant species observed were Black-and-white Warbler (*Mniotilta varia*), Common Yellowthroat (*Geothlypis trichas*) and Northern Parula (*Parula Americana*), with 9 individuals observed each.

All observations were of single birds or groups of two. No obvious concentration of ducks or shorebirds were observed. Of the 39 species observed, 70% were identified as possible breeders based on the species being observed in suitable habitat during breeding season, or the observation of singing males or breeding calls heard. Evidence of probable breeding was observed in 25% of species. Agitated behavior and establishment of a territory (observing the same species in the same location on two consecutive surveys)

were documented as evidence of probable breeding. Breeding was confirmed in two species (5% of species). A Ruffed Grouse (*Bonasa umbellus*) was observed performing a distraction display (broken wing routine) near point count #5 on June 30th. A Hermit Thrush was observed on a nest in the same location on the same date. No other breeding evidence was observed during the breeding surveys.

Common Nighthawk

During breeding season surveys, an additional 2 locations were established for the purpose of specialized Common Nighthawk Surveys (Saskatchewan Ministry of Environment, 2015). No Common Nighthawks were observed during either specialized survey. A summary of incidental observations of other species documented during the Nighthawk surveys are provided in Appendix D along with all other detailed survey results.

Fall Migration

The seven spring migration and breeding season point count locations were surveyed during fall migration. During the fall point count surveys, 201 individuals representing 34 species were observed. One Killdeer (S3M, S3M) was observed at point count #6 on August 29th, 2017. No other priority species were observed.

Consistent with spring and breeding survey results, passerines comprised 81% of all individuals observed, which is expected based on the forested habitat present within the Project study area and adjacent lands. All other bird groups comprised less than 6% each of individuals observed. The Red-breasted Nuthatch (*Sitta canadensis*) was the most abundant species observed (n=31), followed by Black-capped Chickadee (n=29), Yellow-rumped Warbler (*Dendroica coronata*, n=17) and Blue Jay (*Cyanocitta cristata,* n=17).

Suitable habitat for all species identified is present in the Project study area and surrounding landscape. The majority of observations (92%) were of one or two individuals, and the largest group of birds observed was five Canada Geese observed at point count #5 on August 29th.

Waterfowl Surveys

Waterfowl surveys were completed at rising and falling tide at two watch count locations between mid-October and early November 2017 following recommendations made by the TRC. During these surveys, 181 individuals representing 21 species were observed. Of these 21 species, 3 priority species were observed. One Peregrine Falcon was observed 40m east of the “Lake S” survey location on November 1st. Two immature Bald Eagles were observed 200m west of the “Lake N” survey location on October 17th, and one Rusty Blackbird was observed 70m north of the same location on the same date. No other priority species were observed. A summary of results of point count surveys conducted in the fall waterfowl surveys are included in Appendix D.

Raptor Surveys

No evidence of raptors nesting in the area was observed in the spring or fall after leaves had fallen. One barred owl was observed close to Enterprise street flying away from the site. Two or three hawks were observed flying over the site during fall migration and six ospreys were observed flying very high over the site during fall migration.

Incidental observations of raptors have been provided and included Bald Eagles, peregrine falcon and a merlin.

Avian Species at Risk

Six avian priority species have been documented within the vicinity of the Project study area during bird surveys completed in 2017.

Bald Eagle

Two immature Bald Eagles were observed 200m west of the "Lake N" survey location on October 17th and were observed to be flying west to east across the middle of the larger pond to the northeast of the Project study area, slightly above the tree line.

The Bald Eagle is adaptable to a wide range of habitats, including agricultural landscapes but generally requires relatively large areas of suitable habitat in mixed or deciduous forest for breeding. Nests are often associated with large rivers or lakes and frequently located in prominent old growth trees (NSDNR, 2012).

Suitable habitat is not present for roosting (breeding) within the Project study area as it does not comprise old growth trees or larger areas of open water. Weldon Creek offers potential adjacent habitat for roosting, however large old growth trees are not present within the Project study area. In addition, no raptor nests were identified during all field surveys completed within the Project study area and surrounding habitats during bird surveys. As described above, diurnal movement of two eagles across the Project study area was observed once during the October 17th waterfowl survey, however no other evidence of eagles was noted during all other surveys completed during 2017.

Within New Brunswick Bald Eagles are considered endangered, however, throughout Canada they are not at risk. Though the population in New Brunswick is endangered, as mentioned, suitable habitat for breeding is not present within the Project study area and observed location and flight paths do not put bald eagles at an elevated risk of colliding with the turbine.

Peregrine Falcon

One Peregrine Falcon was observed 40m east of the "Lake S" survey location on November 1st, 2017.

Preferred Peregrine Falcon nesting habitat on shoreline cliff faces where an abundance of migrating shorebirds as a ready prey source during brooding and fledging is present. They breed in open landscapes with cliffs (or skyscrapers) for nest sites, as well as along rivers and coastlines or in cities, where the local Rock Pigeon populations offer a reliable food supply. In migration and winter, you can find Peregrine Falcons in nearly any open habitat, but with a greater likelihood along barrier islands, mudflats, coastlines, lake edges, and mountain chains (Cornell Lab of Ornithology, 2015).

The Project study area and surrounding landscape do not provide preferred nesting habitat due to the lack of elevation provided by trees, cliffs or buildings, however the open areas of the abandoned quarry may offer some potential for food supply. With this being said, the low numbers of birds observed at this location during fall surveys in combination with a lack of migrating shorebirds suggests that that the habitat within and surrounding the Project study area are not ideal habitat to support this species.

Rusty Blackbird

One Rusty Blackbird was observed on October 17th, 70m north of "Lake N" during waterfowl surveys. This location falls alongside habitat adjacent to Weldon Creek as it adjoins the abandoned quarries. This habitat conforms to the Rusty Blackbird's preferred habitat which includes forest wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps, beaver ponds and pasture edges. In winter, it occurs primarily in damp woodlands and cultivated fields (COSEWIC, 2006). Appropriate habitat for the Rusty Blackbird is therefore present along Weldon Creek which extends to the north of the proposed turbine. With that being said, only one Rusty Blackbird was observed during 2017 bird surveys, and the fen wetland providing the suited habitat will be avoided during construction activities. Therefore, limited suitable habitat is provided within the majority of the Project study area, and as such potential nesting habitat for this species will not be impacted.

The Rusty Blackbird is generally absent from wetlands in regions above the tree line (i.e. they prefer to remain within, or below the canopy) (COSEWIC, 2006), therefore interaction with the turbine rotor swept area is not expected.

Olive-sided Flycatcher

One Olive-sided Flycatcher (*Contopus cooperi*, ranked S3B, S3M, SARA and NBSARA Threatened) was observed during a breeding season survey at PC6, north of the Project study area on June 30th, 2017. It was observed singing, which is evidence of possible breeding. Olive-sided Flycatchers build their nest in conifer trees with twigs and rootlets. They nest within the forest edge near forest clearings (natural or man-made). There are forest clearings within the Project study area that provide suitable breeding habitat for the Olive-sided Flycatcher.

Construction of the access road and turbine pad may disrupt breeding birds such as the Olive-sided Flycatcher. While this species was not observed within the Project study area, and it is identified as a possible breeder only, it is reasonable to expect this species may use the Project study area to breed from time to time.

Clearing and grubbing in preparation of ground disturbance will be conducted outside of the breeding season to avoid direct or indirect impact to nesting birds in the vicinity of the Project study area. The Olive-sided Flycatcher does not have specific behaviours (foraging strategies, mating displays, etc) which place it at an elevated risk of interaction with the turbine.

Eastern Wood Pewee

A single Eastern Wood Pewee (*Contopus virens*, ranked S4B, S4M, COSEWIC and NBSARA SC) was observed at PC4 on June 13th, 2017. PC4 Is located adjacent to the proposed turbine location, however, the bird was heard calling from approximately 100m to the north (two faint calls). This is evidence of possible breeding within proximity to the proposed turbine. The Eastern Wood Pewee is found in older, predominantly deciduous forests, often mixed with mature hemlock or pine. It also shows some preference for riparian forests, especially in NB, and avoids young coniferous and managed forests as well as human-occupied areas. Suitable breeding habitat is available within the Project study area for this species.

The Eastern Wood Pewee was documented as a possible breeder in an area north of the proposed turbine location. Similar to the Olive-sided Flycatcher, the Eastern Wood Pewee may be disturbed, either directly or indirectly through on-site construction of the access road and the turbine pad. This species does not have specific behaviours (foraging strategies, mating displays, etc) which place it at an elevated risk of interaction with the turbine. Limiting clearing activities to outside the accepted breeding bird season will reduce potential impacts to this species.

Killdeer

One Killdeer (*Charadrius vociferous*, ranked S3M, S3M) was observed at PC7, east of the Project study area on May 13th and PC6 (north of the Project study area within the scrubby fen habitat) on August 29th, 2017. The Killdeer is associated primarily with open habitats dominated by cultivated grasslands or, especially in NB, coastal marshes and mudflats. The Killdeer is most often detected in the lowlands of NB and NS, regions characterized by open landscapes, especially farmlands. Suitable breeding habitat for this species is provided in the nearby quarry and roadsides within the Project study area. Where Killdeer are attracted to bare ground for nesting, the Project has the potential to increase habitat availability for this species through construction of a road.

Summary of Avian Use

Overall, species abundance and diversity were consistent with expectations, based on regional context and habitat available within the Project study area. On average, 79 individuals were observed per survey in the spring migration season, compared with 60 individuals per survey in the breeding season, and 67 individuals per survey in the fall migration (excluding focused surveys for Common Nighthawk and waterfowl). This suggests that bird usage of the Project study area is slightly higher in the Spring.

Diversity of species observed declined from spring through fall, and within standard seasonal surveys as well. During standard surveys (excluding CONI and waterfowl focused surveys), a total of 68 species were observed. Seventy percent of all species observed were recorded in the spring, while 55% of all observations were recorded in the breeding season, and only 50% were recorded in the fall migration. Of these 68 species, 20% were observed in all standard seasonal surveys. This common assemblage of species includes species such as American Robin, Blue Jay, Golden-crowned Kinglet, Common Loon, Common Raven, Hermit Thrush and Northern Parula. These species are expected to use the Project study area and surrounding
landscape for migration, foraging, resting, breeding and potentially overwintering as well.

Species which rely on habitat provided in the nearby IBA were not frequently observed within the Project study area The Kouchibouguac National Park IBA supports important coastal island habitat for a variety of nesting shorebirds and other water birds, such as the Piping Plover and Common Tern. In the Spring, Waterfowl, Shorebirds and Other Water birds accounted for 9.1% of all individuals observed, and the majority of these were Canada Geese, observed in groups of 1-5 individuals. During fall migration surveys, these groups accounted for 10.9% of individuals observed. Similar to the spring migration, the majority of these observations were of Canada Geese and Common Loons. The Project study area does not appear to be a migratory flyway for shorebirds to move into, or out of the Kouchibouguac IBA.

Based on surveys completed in 2017, the Project study area supports very few avifauna SAR or SOCI. A total of 8 individuals representing 6 priority species were documented. This accounts for less than 1% of all individual birds observed, and only 8% of species observed within the Project study area during all seasonal surveys.

Habitat within the Project study area is generally fragmented and immature, supporting birds which prefer this habitat type. As such the construction of a road and turbine pad is not likely to affect how birds use the local or regional area. Based on targeted bird surveys, as well as all other field surveys completed as part of the Study, general qualitative observations indicate that bird activity within and directly adjacent to the Project study area was low (i.e. limited evidence of breeding activities as well as evidence of migration pathways). The point count methodology employed provides us with an accurate indication of bird use within the habitats surveyed.

In addition, efforts to record incidental fly overs during and in-between point counts, as well as the completion of watch counts during Fall 2017 have enabled a quantitative determination of avian flyover activity to be made. Based on these surveys, it has been established that during the spring surveys, 25 of the 318 individuals observed were identified to be fly-overs. During the breeding bird surveys, 5 of the 120 individuals were fly-overs and during the fall surveys, 19 of the 201 individuals were fly-overs. During the waterfowl watch count surveys, some migration activity was encountered, however this was limited to small flocks of passerines and three raptors (two Bald Eagles and one Peregrine Falcon).

Peninsulas can concentrate migrating birds as they follow the land and then pause before launching over water (Cornell Lab of Ornithology, 2007). As has been previously discussed, the topography of the land surrounding the Project study area, and extending inland (westward) is predominantly flat, with a gradual rise in topography to the west of the proposed Project. There is a lack of abrupt topography which promotes funneling of bird movement across this land area, including the location of the Project study area.

It is possible due to the Project study area's relative proximity to tidal waters present in the Richibucto Estuary, and the coastline barrier beaches to the north, that shorebirds utilize the inland habitats present in, and near Project study area for feeding and diurnal activity. However, bird surveys completed in 2017 do not support this theory in the localized area surrounding the Project study area due to the low numbers of waterfowl and shorebirds identified.

4.2.2 Bats

According to the ACCDC report, no known bat hibernacula is present within 5km of the Project study area. And as reported in the NB Mine Openings database, no open mines are identified within Kent County. As well, there are no known critical habitats within 50km of the Project study area according to the Recovery Strategy for Little brown myotis, Northern myotis, and Tri-coloured bats (ECCC, 2015). Lastly, no observations of potential bat hibernacula were identified in the Project study area during site visits and field surveys.

Observations recorded during habitat surveys indicated that habitat within the Project study area was classified into two main upland components and one treed wetland component. As a result of this review, it has been determined that a closed canopy, mixed-wood forest habitat dominates the landscape, including the habitat present at the proposed turbine location. A full canopy cover was observed throughout, and apart from small variances in dominant species, general vegetative composition was similar. Bat detectors were installed to cover all habitat types field observed within the Project study area.

Data from the SM4Bat detectors was analysed from all three bat monitors and the results are provided in Table 4-11. Summaries of bat passes per detector night; average bat passes per detector night and total presence for each species across the three monitoring locations is provided. A bat pass is defined as a

sequence of 2 or more echolocation calls recorded as a bat flies within range of a bat detector (Thomas and West 1989; Vonhof 2006). A detector-night is the activity recorded by 1 detector from sunset to sunrise and was used to standardize measures of activity.

Where distinction between two species was not possible, the two undistinguishable species groups are grouped together as indicated Table 4-7 (i.e. Eastern red bat / Tricolored bat – (LABO/PESU) refers to either of these species).

Table 4-7: Bat detector results

Species	Bat Detector			Total all sites
	BM1	BM2	BM3	
High Frequency	12	5	0	**17**
Little brown bat – (MYLU)	1	0	0	**1**
Little brown bat/Northern long-eared myotis – (Myotis)	3	8	0	**11**
Eastern red bat – (LABO)	42	3	0	**45**
Tricolored bat – (PESU)	15	1	0	**16**
Eastern red bat / Tricolored bat – (LABO/PESU)	60	3	0	**63**
Low Frequency	22	7	0	**29**
Hoary bat - (LACI)	135	30	0	**165**
Big brown bat - (EPFU)	2	1	0	**3**
Silver-haired bat - LANO	8	2	0	**10**
Silver-haired bat/Big brown bat - (EPFU/LANO)	3	4	0	**7**
Total passes all species	**303**	**64**	**0**	**367**
Detector Nights	117	112	19	**248**
Average passes per detector night	2.59	0.57	0	**1.48**

During the 2017 sampling period, there were a total of 367 bat passes recorded by three detectors. Activity at the detectors sites was variable, ranging from zero total passes at BM3 (albeit only over 19 nights during late September – mid October), to 303 total passes at BM1. The highest bat activity was at BM1, with 2.59 passes per night. The average passes per detector night for all detectors over the entire season was 1.48.

The most common species recorded during all detector surveys was the *Lasiurus cinereus* (Hoary bat) at 44.96%, followed by the *Lasiurus borealis* (Eastern Red) / *Perimyotis subflavus* (Tricolored) group (33.79%), Eastern red bat (12.26%), *Eptesicus fuscus* (Big brown) and *Lasionyceteris noctivagans* (Silver-haired) group (5.45%) and Myotis group (3.27%). The remaining consisted of unidentified high and low frequency bats.

Seasonal and Nightly Activity

During the 2017 monitoring season (June 13th to October 13th), bat activity was first recorded on June 16th during an isolated peak event. As is shown on Figure 4-10, activity levels increased throughout July and again peaked in August prior to decreasing sharply in early September. Only a single bat pass was recorded across the Project study area between September 14th and October 13th, 2017. No activity was recorded at BM2 and BM3 during late September and early October.

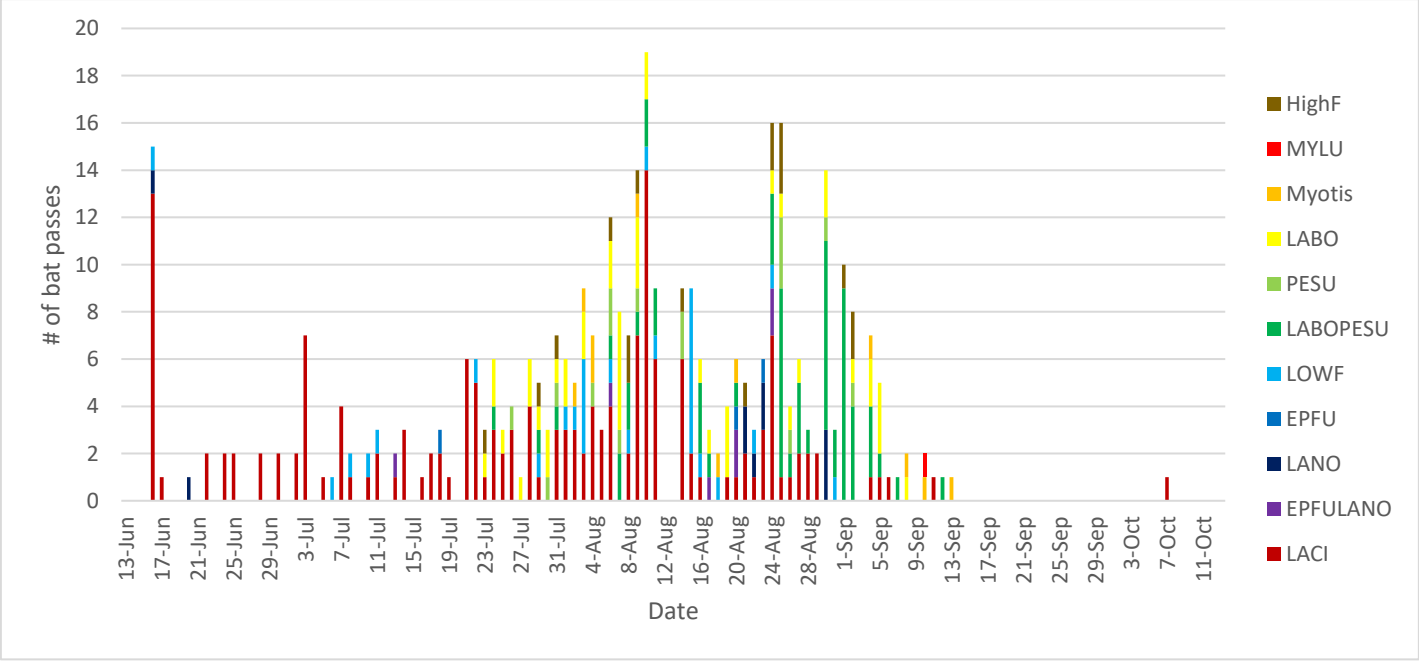


Figure 4-10: Total Bat Passes per Night

Activity was relatively even throughout the night, beginning near twilight (8pm) and increasing sharply through the first few hours after sunset, with highest levels of activity occurring at 10pm. A smaller peak in activity was observed at 1am, after which activity tapered off and ceased just before sunrise (6am) as shown in Figure 4-11.

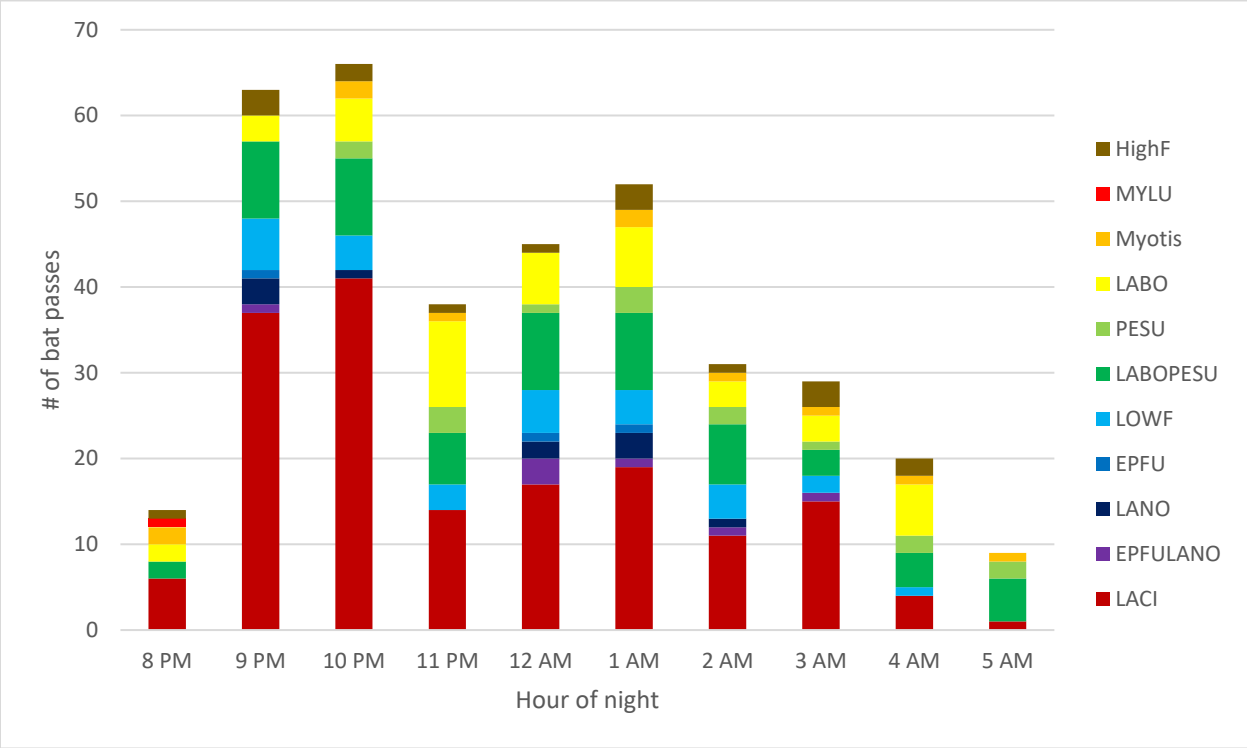


Figure 4-11: 2017 Nightly Timing of Recorded Passes

4.2.3 Wetlands and Watercourses

The Project study area is located within the Northumberland primary watershed, in the Richibucto River secondary watershed.

The DELG's Draft Wetlands Reference Map indicated the possible presence of multiple areas of wetland within, and adjacent to the Project study area. The Project study area extends entirely through an area of wetland habitat classified as "Other Wetlands" (which include freshwater marsh, aquatic bed, bog, fen, and shrub wetlands). As can also be noted, the Project study area abuts the eastern boundary of a provincially regulated wetland which extends northeast and drains into Weldon Creek. Weldon Creek drains into Loggie Pond prior to discharging into the Richibucto River approximately 2.2km northeast of the proposed turbine location.

Apart from the watercourse associated with the regulated fen wetland, no other watercourses are identified within the Project study area by the New Brunswick Hydrographic Network.

During field surveys, one large mixed-wood treed swamp wetland was also identified within the Project study area. In addition, the provincially regulated wetland was also confirmed to the west of the proposed turbine location. Apart from the watercourse which drains through the regulated wetland, no additional watercourses were identified within the Project study area, although, two ATV trails which act as a drainage route bisect the treed swamp.

Through consultation with DELG the Proponent has applied a minimum 30m buffer from provincially regulated wetlands and watercourses identified through field studies. The WTG location and proposed works have been optimized such that the turbine base is set back 60m from all regulated and unmapped (unregulated) wetlands as per the DELG recommendations and following the 30m setback required in the *Wetland Conservation Policy*. As well, the works associated with the RWP as located outside of the 30m buffered zone for the regulated wetland located to the west of the turbine. This was accomplished by locating the turbine on an elevated portion of the Project study area which is a dry region as shown in Figure 4-16. The access road is estimated to cover approximately 0.79 ha of unmapped and unregulated wetland and will be designed and constructed to ensure flow between wetland habitat is maintained making use of geotextiles, large aggregate, culverts or other materials or means as deemed appropriate. The access road will be designed by a professional engineer with appropriate experience in building roads in wet areas.

Figure 4-16 and Figure 4-17 outline the dry upland habitat to be used for the WTG and part of the access road. The Proponent does not expect to require a Wetland and Watercourse Alteration (WAWA) permit for the access road as they cross unregulated wetlands, however, should the construction activities for the turbine foundation and pad occur within 30m of a regulated wetland a WAWA permit will be obtained. Figure 4-16 demonstrates all regulated wetlands and watercourses onsite. In Figure 4-16 upland habitat is also delineated, it has been determined that all areas outside of the upland habitat and regulated wetland habitat are areas of unmapped wetlands. Additional details on the wetland and watercourse assessment are provided in Appendix D.

Surface Water

The land within and adjacent to the Project study area is relatively level and as such, surface water within the Project study area is influenced by water supplied from the upper reaches of Weldon Creek and its catchment area. Water is primarily supplied to the creek and associated fen wetland from the commercial peat producing facility located approximately 500 m southwest from the Project study area boundary. Water management techniques are currently in place at the facility in the form of surface drains, ditches, and water retention ponds. The peat facility is located on former wetland habitat, and as such, due to the expedited nature of water outflow from this area via the ditches, water level and water flow characteristics in the downstream fen, and the mixed-wood treed swamp within the Project study area are affected. The predominant flow of water is via the upper reaches of Weldon Creek, northeastward toward an abandoned quarry which contains areas of ponded water. However, due to the level land, the

forested community present within the Project study area intercepts some of the water, which has resulted in the presence of unmapped forested wetland habitat.

The presence of two ATV trails which bisect the Project study area, were observed to be flooded in April 2017 and act as temporary shallow surface channels during spring and periods of high flow. During drier summer months, the ATV trails lacked surface water, further suggesting that land within the Project study area acts as an overflow floodplain for Weldon Creek and the fen during spring melt and high flow conditions.

Wetlands

As previously discussed, one mixed-wood treed swamp was identified during field surveys across the Project study area in addition to the provincially regulated wetland (graminoid fen) located to the west of the proposed turbine.

Mixed-Wood Treed Swamp

The unmapped wetland within the Project study area is located in a throughflow position as it receives water from the floodplain of Weldon Creek, and drains water from southwest to northeast toward its outflow location at an abandoned quarry located north of the Project study area. The wetland extends to the north and south of the Project study area boundary. Water primarily moves sub-surface through the wetland (especially during the summer months), however the two ATV trails extend through the Project study area also collect and temporarily store water. Observations recorded in April 2017 indicated very wet conditions throughout the unmapped wetland, where standing water at depths of 10cm were consistently encountered (i.e. >70% of the wetland within the Project study area). This is largely a result of accelerated timing of water discharge especially post snow melt, from the adjacent commercial peat facility to the west of the Project study area. However, observations made during the June 2017 wetland evaluation (as well as during other biophysical evaluations) indicated drier conditions within the wetland prevailed throughout other times of the year. Although intermittent areas of standing water (1-5cm) were observed, they were restricted to small depressions/pits amounting to approximately 30% of the wetland surface within the Project study area. Elsewhere, saturated wetland surfaces were observed. Hydric soil present within the mixed-wood treed swamp is indicated by a thin layer of decomposed organic soil, underlaid with sandy mineral soils with redox features (Sandy Redox S5).

Graminoid Fen

As previously discussed, the graminoid fen to the west of the proposed turbine is identified as a regulated wetland on the GeoNB wetland database. The regulated wetland drains in contiguity with Weldon Creek and exists as a lotic throughflow graminoid fen. The portion of the wetland that extends into the Project study area was observed to comprise intermittent areas of standing water across approximately 10% of the wetland during the summer months (~15cm), and other areas where surfaces were saturated (i.e.

especially toward the edge of the fen where it transitions to treed swamp). The majority of surface water is confined to the main channel of Weldon Creek and some small minor side channels (Figure 4-12).

Figure 4-12: Weldon Creek in Fen (June 2017)

As the fen extends northeastward, toward the abandoned quarry located to the northeast of the Project study area, the wetland transitions into a modified landscape incorporating scrub, shrub fen habitat. The landscape in this area appears to have been altered by historical aggregate extraction, and standing water (~30-50cm in April) was observed upon a rocky hard pan substrate.

The fen comprises organic histosols in excess of 1 meter deep, although soil depths are much thinner in the scrub/shrub fen due to shallow rock. This is typical of a soil which experiences excessive standing water, and permanent high-water tables throughout the year, which creates anaerobic decomposition conditions.

Functional Wetland Assessment

The following section outlines the results of the functional assessment completed on the mixed-wood treed swamp and the graminoid fen. The functional assessment considers hydrology, water quality support, aquatic habitat, aquatic support, transitional habitat, wetland condition, and wetland risk. Details of each functional group and the score pages are discussed in Appendix D. Each functional group has been scored out of 10 and each function score has been weighted for that particular function/benefit. Additional informational on the wetland functional assessment can be located in the *Wetland Ecosytem Services Protocol* (Adamus, 2016).

Table 4-8: Functional Wetland Assessment Scores.

Functional Group	Graminoid Fen Score	Treed Swamp Score
Hydrologic: *Ability to store water*	2.82	4.92
Water Quality Support: *Ability to retain and remove nitrate, sediment, phosphorus, and sequester carbon*	3.02	1.49
Aquatic Habitat: *Ability to support amphibians, turtles, fish, and waterbirds*	8.27	6.47
Aquatic Support: *Ability to support species requirements*	7.05	3.31
Transitional Habitat: *Ability to support other wildlife*	7.38	5.38
Overall Wetland Condition	6.32	5.86
Wetland Risk to Stressors	8.78	10.0

Watercourses

No watercourses (lakes, streams or areas of open water) were identified within the Project study area. However, Weldon Creek drains from southwest to northeast approximately 80 meters from the proposed turbine, and discharges into an abandoned quarry. The abandoned quarry comprises multiple large pits, which has led to the development of small lakes and open water features. Water drains into, and out of the features northward, where it reintegrates with Weldon Creek and drains northeast into Loggies Pond and ultimately into the Richibucto River (Figure 4-13).

Figure 4-14: Brown Water and Algae within Weldon Creek

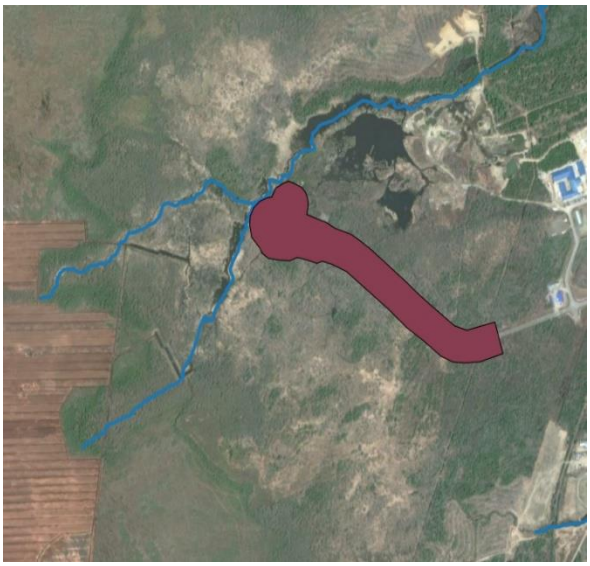


Figure 4-13: Weldon Creek (Blue) shown in proximity to the Project Study Area (red)

As indicated by New Brunswick Hydrographic Network database, Weldon Creek is sourced water from higher land to the southwest of the Project study area, at the location of the commercial peat facility. Water flow sourced from this area has been significantly modified (i.e. ditched, re-routed and detained in linear ponds) prior to it draining into Weldon Creek. Observations recorded during the characterisation of Weldon Creek indicated very brown water and presence of algae as shown in Figure 4-14, which is anticipated to be a result of the up-stream peat harvesting activities. Detailed characteristics of Weldon Creek are provided in Appendix D.

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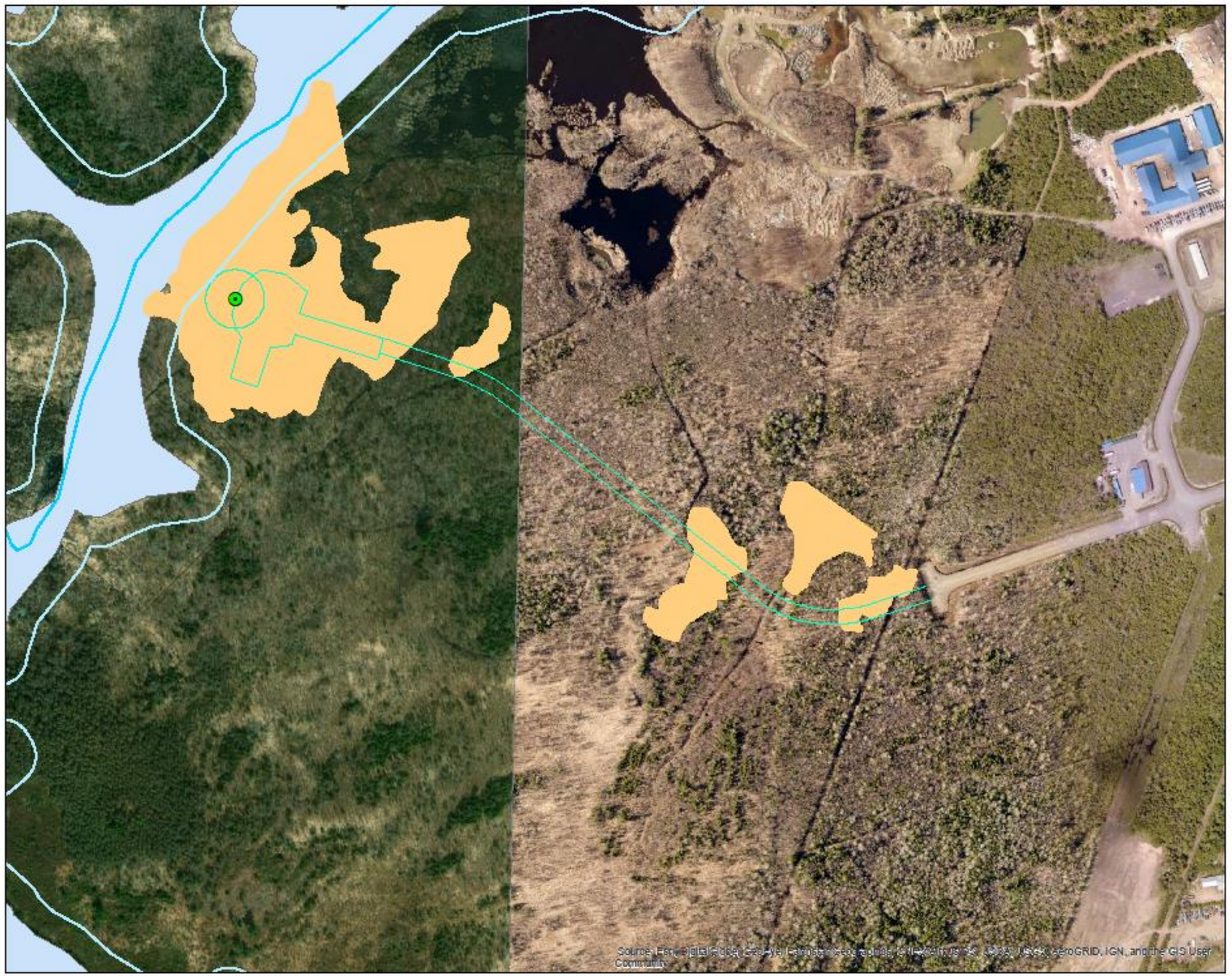

Richibucto Wind Project

Wetlands and Watercourses

Legend

- Proposed Turbine
- Access Road and Crane Pad
- 30m Regulated Wetland Buffer
- Upland Habitats
- Regulated Wetlands
- Weldon Creek

Notes

1. Upland Habitat as shown was ground truthed in the field by McCallum Environmental Ltd.
2. Regulated wetlands as shown were part of the NB Regulated Wetland Map obtained from GeoNB

N

1:5,500

0 120 240 360

Metres

WGS 1984 Web Mercator Auxiliary Sphere

Production Date: Nov 23, 2017

naturalforces

Figure 4-15: Regulated and Upland Habitat in Proximity to the Richibucto Wind Project

Figure 4-16: The top photo shows a close-up of the non-regulated wetland area. The second photo demonstrating the delineation between the dry upland habitat with a red line in which the WTG is

proposed and the surrounding habitat. The bottom photo shows the dry forest floor in the upland habitat where the turbine is proposed

4.2.4 Fish and Fish Habitat

Desktop and field surveys have identified two wetlands in the Project Study Area: the mixed-wood treed swamp and the regulated fen wetland habitat located west of the proposed turbine. One watercourse has also been identified in the Project study area and flows out of the fen (Weldon Creek). Surface water connection between the creek and mixed-wood treed swamp only persists during the spring months after snow melt. Although these conditions allow for potential fish passage during these conditions, fish habitat quality within the wetland itself is considered low with only temporary areas of standing water. There are no direct surface water connections between the wetland present in the Project study area and the ponded features existing in the abandoned quarry to the north. Due to its floodplain characteristics in the regulated wetland, fish access is possible within the fen, especially during spring and periods of high flow. Small off-shoot channels and standing water provide opportunity for fish to access various parts of the wetland and utilize it for feeding and refuge, however, the overall habitat for fish within the wetland is not considered critical (i.e. spawning habitat).

No barriers to fish passage were observed within the Project study area of Weldon Creek, although significant beaver dams and a beaver lodge are present within it. Up-stream fish habitat is not regarded as high quality due to the anthropogenic features discussed in Section 4.2.3. The document entitled Ecosystem Overview of the Richibucto Watershed (DFO, 2008), states that the results of a water quality analysis within the Richibucto esturine have shown that there is a threat of eutrophication in the estuarine part of the watershed due to accumulation of nutrients. This is particularly the case for the small streams that empty into the Richibucto River: Mooney's, Child's, Beattie's and Weldon Creeks. These conditions are a result of draining a peat bog for harvesting purposes which induces the decomposition of organic matter and hence lead to an increase in the nutrient load in the drainage water, which flows into nearby streams such as Weldon Creek. These conditions promte a eutrofied body of water (including presence of algae), which is depleted in oxygen and can result in the asphyxiation of fish and other aquatic insects inhabiting it.

According to DFO (2008) the following are also noted:

- The Richibucto River, and a number of its tributaries were stocked with brook trout around the period 1994-1997;
- Between 1974 and 2002, the Richibucto River and the Coal Branch were the only rivers found to be harbouring stable populations of juvenile Atlantic salmon;
- Between 1974 and 2002, there were more slimy sculpins and trout in the St. Nicholas River than in other streams, probably owing to the cold water in that river;
- An Atlantic salmon stocking project began with the collection of broodstock in 2004;
- In 2005, the Coal Branch, the Richibucto, the West Branch of the St. Nicholas, the Bass, the Molus and the St. Charles Rivers were stocked with parr.

Weldon Creek was evaluated for habitat characterizations based on parameters identified in the *Standard Methods Guide for Freshwater Fish and Fish Habitat Survey in Newfoundland and Labrador* (NL Guide; Sooley et al., 1998). As described in the guide, water quality and quantity tolerances of the Atlantic Salmon (*Salmo* salar) were used as an index of the relative health of the river for fish populations. The Atlantic Salmon were used as the indicator species for several reasons (Sooley et al., 1998);

- Salmon inhabited the Richibucto River between 1974 and 2002 and Weldon Creek is contiguous with it;
- Salmon are sensitive to acidification;
- Salmon are a predatory species at the top of the food chain; and
- Data exists that defines preferred habitat conditions for this species.

Based on Sooley et al., 1998, a Type I watercourse consists of:

- good salmonid spawning and rearing habitat,
- provides feeding pools for larger age classes of fish.
- contains moderate riffles and is relatively shallow.
- Substrate is gravel to small cobble size rock, some larger rocks or boulders and;
- general habitat types consist of primarily riffles and pools.

Weldon Creek exhibits characteristics that describe Type IV fish habitat which consists of:

- poor juvenile salmonid rearing habitat with no spawning capability,
- provides shelter and feeding habitat for larger, older salmonid (especially Brook Trout),
- water flows usually are sluggish and varies in depth
- substrate is soft sediment or sand, occasionally large boulders or bedrock and;
- general habitat types consist of flats, pools and glides.

However, expected elevated nutrient levels and poor water quality as a result of up-stream peat harvesting reduces fish habitat quality within this system

4.2.5 Wildlife

Habitat within the Project study area is relatively intact, albeit with some selective tree harvesting present within the mixed wood treed swamps. Therefore, the extent of habitat fragmentation within the Project study area is limited to small scale skidder tracks and a woods access road. Land surrounding the Project study area however comprises larger scale fragmentation in the form of commercial industrial development adjacent east, a large commercial peat facility approximately 530m west. In addition, an abandoned quarry exists approximately 100m northeast outside of the Project study area and comprises sided banks, areas of open water and a limited vegetative component. Habitat within the Project study area is suitable for those wild species that thrive in fragmented, diverse landscapes, such as Moose, White-tailed Deer, Coyote, and Snowshoe Hare. This fragmented, diverse landscape provides edge habitat for

foraging, and patches of full canopy coverage for refuge and cover through all seasons. Wildlife habitat observed was neither unique nor rare in the local or regional landscape context.

Herpetofauna

The only herptofaunal species identified during field surveys was a Spring peeper (*Pseudacris crucifer*) which is not a Species of Conservation Concern (SOCI) or a Species at Risk (SAR).

A limitation for many turtle and amphibian species presence is the lack of open water habitats, particularly associated with wetlands within the Project study area. A large area of mixed-wood treed swamp habitat exists within the Project study area which is hydrologically connected at surface to the fen habitat to the west of the proposed turbine during periods of high flow. However, the Project study area only provides access for herpetofaunal species into the mixed-wood treed swamp during spring melt and/or during other high flow events, at which point standing water is present within the treed swamp wetland. The mixed-wood treed swamp does not comprise vernal pool habitat and no open channels are present. Soil conditions during the summer months are saturated, but standing water within the mixed-wood treed swamp is absent.

Herpetofaunal habitat is present in the fen wetland (regulated wetland) due to its contiguity with the main watercourse channel, and its vegetative and hydrological characteristics (i.e. floodplain landform and graminoid dominated vegetation). Turtles and amphibians are more likely to find adequate habitat within this wetland; however, none were identified during all biophysical field evaluations.

Terrestrial Mammals

Table 4-9 lists those species that were confirmed within the Project study area either visually or by sign (scat, footprints, etc.).

Table 4-9: Incidental Mammal Observations During 2017 Field Surveys.

Scientific Name	Common Name	ACCDC Prov. Rank
Ursus americanus	Black Bear	S5
Tamiasciursus hudsonicus	American Red Squirrel	S5
Alces alces	Moose	S5
Castor canadensis	Beaver	S5
Lepus americanus	Snowshoe Hare	S5
Microtus pennsylvanicus	Meadow Vole	S5

Scientific Name	Common Name	ACCDC Prov. Rank
Erethizon dorsatum	North American Porcupine	S5

Ungulate species expected to inhabit the vicinity of the Project study area were established by examination of distribution maps, comparison of preferred habitat with that in the vicinity of the proposed location and field assessments. Mammal species observed within the Project study area include the white-tailed deer (*Odocoileus virginianus)* and Eastern Moose (*Alces alces*).

Common carnivore/omnivore species such as Raccoon (*Procyon lotor*), Coyote (*Canis latrans*), American Porcupine (*Erithizon dorsatum*), Red Fox *(Vulpes vulpes),* Bobcat (*Lynx rufus),* American Mink (*Mustela vision),* Striped Skunk (*Mephitis mephitis)*, and Short-tailed Weasel (*Mustela erminea)* may inhabit the Project study area or surrounding areas, at least periodically.

4.2.6 Vegetation and Habitat

The Project study area lies in the Eastern Lowlands Ecoregion in the Kouchibouguac Ecodistrict. Topography in this ecodistrict is level and low (less than 60m near the coast) rising gently westward (Department of Natural Resources, 2007). The Project study area typifies these conditions as it encompasses flat land with minor elevation changes where small upland habitats are present and a range of 7-12m in elevation across the extent of the Project study area. The Project study area and surrounding lands do not contain major islands, peninsulas, or ridgelines. A wetland complex which is located westward of the Project study area comprises an extensive area currently utilized for commercial peat farming.

The Kouchibouguac Ecodistrict encompasses the eastern coastline of New Brunswick from Miramichi Bay to Cape Tormentine. The Ecodistrict is dominated by river estuaries, sand dunes, and peat bogs. The Kouchibouguac Ecodistrict is mostly natural, with approximately 75% forest cover. The forest cover consists primarily of coniferous stands and mixed forests. Black spruce *(Picea mariana)* stands dominate poorly drained areas whereas mixed wood stands incorporating tolerant hardwoods such as red maple *(Acer rubrum)* together with balsam fir *(Abies balsamea)* dominate the better drained sites (Department of Natural Resources, 2007).

The DERD Forest Cover database presents the variations in habitat types across the Project study area. The database indicates that the proposed turbine location exists within a mapped area of hardwood cover type with balsam fir mixed-wood (BFMX). The proposed access road extends through softwood cover type (red spruce balsam fir) (RSBF), mixed-wood cover type with spruce as a dominant species (SPMX) and soft wood cover type with spruce balsam fir (BFSP).

The field habitat assessment was completed within the Project study area in June 2017. The Project study area contains a mosaic of natural and anthropogenic disturbed habitat.

Observations recorded during the field survey indicate that habitat was generally classified into two main upland components and one treed wetland component. Although not within the Project footprint, a second wetland component (a graminoid fen) that was identified as a regulated wetland was also identified to the west of the proposed turbine, and was also evaluated.

Figure 4-18: Canopy of RM/BFMW Habitat.

Figure 4-17: RM/RSMW Habitat.

The upland components consisted of;

i) Mixed-Wood, Red Maple Balsam Fir Forest (MW-RM/BF) and
ii) Mixed-Wood, Red Maple Red Spruce White Pine Forest (MW-RM/RS/WP)

The MW-RM/BF upland habitat type (Figure 4-17), exists in eastern portions of the Project study area. This area is identified by the DERD Forest Database as mixed-wood cover type with spruce as a dominant species (SPMX) and soft wood cover type with spruce balsam fir (BFSP). During field surveys, this area was observed to be dominated by red maple *(Acer rubrum)* and balsam fir *(Abies balsamea)* trees, red maple, wild raisin *(Viburnum nudum)* and mountain holly *(Ilex mucronatus)* shrubs, and wild sarsaparilla *(Aralia nudicaulis)* and Canada mayflower *(Maianthemum canadense)* herbs. For the most part, this upland habitat comprises a closed canopy and is mature in its stand age. Some anthropogenic disturbances in the form of a skidder trail and an electrical transmission line has occurred in this upland habitat in close proximity to the western extent of Enterprise Street. However, tree harvesting activities are relatively absent as they are concentrated to thinning activities in the treed swamp wetland habitat, as well as land extending off site to the south.

The second upland habitat component (Figure 4-18) is identified by the DERD Forest Database as hardwood cover type, with balsam fir mixed (BFMX). The field survey confirmed that this area was dominated by equal amounts of red maple, red spruce *(Picea rubens)* and white pine *(Pinus strobus)*. An understory of shrubs dominated by balsam fir and red maple, and an herb layer of wild sarsaparilla, velvet-leaf blueberry *(Vaccinium myrtilloides)* and starflower *(Trientalis borealis)*. This upland habitat comprises a closed canopy and is mature in its stand age. Apart from an ATV trail bisecting it, no other anthropogenic disturbances exist within the habitat.

Remaining portions of the Project study area, in-between the upland habitats discussed above exist as mix-wood treed swamp wetland habitat (Figure 4-19). The wetland is dominated by gray birch *(Betula populifolia)*, eastern larch *(Larix laricina)* and balsam fir trees, with a shrub stratum comprised of red maple, eastern larch, speckled alder *(Alnus incana)* and red spruce. The wetland has been subject to small scale anthropogenic disturbances including an ATV trail, skidder trails, and historical selective tree thinning. This wetland, as well as the area of fen habitat located to the west of the proposed turbine, is described in Section 4.2.3.

Figure 4-19: Mixedwood Treed Swamp

Vegetative composition was evaluated during the habitat surveys completed within the Project study area in June and August 2017. In general, vegetative diversity is relatively limited across the Project study area. The few upland areas present across the Project study area share very similar vegetative characteristics (i.e. mixed-wood forest dominated by coniferous species intermixed with red maple). The eastern upland areas tend to comprise a denser shrub understory than the western upland community, however neither possess a diverse nor extensive shrub congregations at either location. Herbaceous species are limited in

both upland communities identified. In general, limited ground cover is present in uplands, likely as a result of the closed canopy conditions present.

Conversely, the areas of wetland across the Project study area comprise a dense ground cover of herbs including Bluejoint *(Calamagrostis canadensis)* in the fen west of the proposed turbine location, and tussock sedge *(Carex stricta),* rhodora, and sheep laurel throughout the mixed wood treed swamp elsewhere throughout the Project study area.

A total of 72 species were identified within the RWP Study Area. No priority species were observed. A list of all species identified within the Project study area is provided in Table 4-10 below.

Table 4-10: List of flora species identified in the field.

Latin Name	Common Name	Srank
Abies balsamea	Balsam Fir	S5
Acer rubrum	Red Maple	S5
Alnus incana	Speckled Alder	S5
Amelandchier bartramiana	Bartram's Serviceberry	S5
Aralia nudicaulis	Wild Sarsaparilla	S5
Betula alleghaniensis	Yellow Birch	S5
Betula papyrifera	Paper Birch	S5
Betula populifolia	Gray Birch	S5
Calamagrostis canadensis	Bluejoint Reed Grass	S5
Carex cumulata	Dense Sedge	S4S5
Carex debilis	White-edged Sledge	S5
Carex folliculata	Northern Long Sedge	S4
Carex intumescens	Bladder Sedge	S5
Carex lurida	Sallow Sedge	S5
Carex projecta	Necklace Sedge	S5
Carex stricta	Tussock Sedge	S5
Carex trisperma	Three-seeded Sedge	S5

Latin Name	Common Name	Srank
Clintonia borealis	Yellow Bluebead Lily	S5
Comptonia peregrina	Sweet-fern	S5
Coptis trifolia	Goldthread	S5
Cornus canadensis	Bunchberry	S5
Cypripedium acaule	Pink Lady's-Slippers	S5
Drosera rotundifolia	Round-leaved Sundew	S5
Dryopteris cristata	Crested Wood Fern	S5
Equisetum arvense	Field Horse Tail	S5
Equisetum sylvaticum	Woodland Horsetail	S5
Fragxinus nigra	Northern Beech Ferm	S5
Galium palustre	Common Marsh Bedstraw	S5
Glyceria canadensis	Canada Manna Grass	S5
Glyceria grandis	Common Tall Manna Grass	S5
Ilex mucronatus	Mountain Holly	S5
Iris versicolor	Harlequin Blue Flag	S5
Juncus effusus	Soft Rush	S5
Kalmia angustifolia	Sheep Laurel	S5
Larix laricina	Larch	S5
Lonicera canadensis	Canada Fly Honeysuckle	S5
Lycopodium complanatum	Northern Clubmoss	S4S5
Maianthemum canadense	False Lily-of-the-valley	S5
Maianthemum trifolium	Three-leaved False Solomon's Seal	S5
Oclemena nemoralis	Bog Aster	S5
Onoclea sensibilis	Sensitive Fern	S5
Osmunda cinnamomea	Cinnamon Fern	S5

Latin Name	Common Name	Srank
Osmunda regalis	Royal Fern	S5
Phegopteris connectilis	Northern Beech Fern	S5
Picea mariana	Black Spruce	S5
Picea rubens	Red Spruce	S5
Pinus strobus	Eastern White Pine	S5
Pteridium aquilinum	Bracken Fern	S5
Quercus rubra	Northern Red Oak	S5
Rhododendron canadensis	Rhodora	S5
Rhododendron groenlandicum	Common Labrador Tea	S5
Rosa nitida	Shining Rose	S5
Rubus allegheniensis	Alleghaney Blackberry	S5
Rubus hispidus	Bristly Dewberry	S5
Rubus pubescens	Dwarf Red Raspberry	S5
Salix discolor	Pussy Willow	S5
Solidago canadensis	Canada Goldenrod	S5
Sorbus americana	American Mountain Ash	S5
Spiraea alba	White Meadowsweet	S5
Spiraea tomentosa	Steeplebush	S5
Thalictrum pubescens	Tall Meadow Rue	S5
Thelypteris noveboracensis	New York Fer	S5
Triadenum fraseri	Fraser’s Marsh St. John’s-wort	S5
Trientalis borealis	Northern Starflower	S5
Trillium undulatum	Painted Trillium	S5
Typha latifolia	Broad-leaved Cat-tail	S5
Vaccinium myrtilloides	Velvet-leaved Blueberry	S5

Latin Name	Common Name	Srank
Vaccinium oxycoccus	Small Cranberry	S5
Viburnum lantanoides	Hobblebush	S5
Viburnum nudum	Northern Wild Raisin	S5
Viola macloskeyi	Small White Violet	S5

4.2.7 Significant and Sensitive Habitat

There are no ESA's within 500m of the WTG or Project footprint. The closest ESA's are York Point Island and the Richibucto Estuary located approximately 4 and 5 km northeast of the project site, respectfully. Additionally, the Kouchibouguac Sand Island IBA and National Park is located 4.7 km north of the project site and the Bouctouche Bar IBA is located 20 km southeast of the project land. No sensitive habitat such as bat hibernacula or wood turtle habitat has been identified near the project as demonstrated in the ACCDC results located in Appendix D and further verified during field surveys. Wetland habitat has been identified onsite as described in Section 4.2.3 and no disturbance will occur within 30m of the regulated wetland.

4.3 Existing Socio-economic VECs

4.3.1 Archaeological Resources

The New Brunswick's Archaeological Spatial Database and Archaeological Services were consulted during a desktop review for possible archaeological resources. It was determined that the Project footprint lies within a 5km buffer zone of a plane crash demonstrated in Figure 4-20. The estimated location of the crash was provided by the Department of National Defense and can be found at 46° 38' 27.37" N and 64° 56' 3.90" W. A full archaeological field survey was not required and no archaeological artifacts were observed during 2017 field surveys.

Through consultation with the Department of Tourism, Heritage and Culture, the Proponent recognizes that areas within 80m of a waterbody and 100m of a confluence contain elevated archaeological potential.

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Richibucto Wind Project

Archaeological Buffer

Legend

- Proposed Turbine
- 5 km Plane Crash Buffer
- Plane Crash Location

Notes

N

1:57,000

0 1,200 2,400 3,600

Metres

WGS 1984 Web Mercator Auxiliary Sphere

Production Date: Nov 23, 2017

naturalforces

Figure 4-20: Archaeological 5 km Buffer Around a Plane Crash

4.3.2 Electromagnetic Interference

The results of the Electromagnetic Interference Study have identified 43 possible communication towers within a 35km Project footprint, one of which is used for broadcasting, 27 for land mobiles, and 15 for fixed point to point communication. The closest tower to the proposed WTG is a fixed point-point tower located 1.2 km to the northeast among the industrial park. This is a sufficient setback according to the RABC where a one km buffer from all land mobiles and point-to-point systems is required. There is one point to point link or communication corridor between two communication towers. The WTG is located 940m away from this link which is sufficient when calculating the Fresnel Zone (the transmitting corridor between two towers) using the RABC guidelines which is only 335m wide. Depending on the type of Broadcasting transmitter (AM, FM, TV) a buffer of 2 – 15 km is required. The broadcasting transmitter is located in Bouctouche, New Brunswick, over 20 km from the proposed WTG which is a sufficient setback to reduce any interference.

Transport Canada and Navigation Canada have been consulted. Aeronautical Obstruction Evaluations and Land Use Proposal Forms have been submitted for evaluation of the proposed location. Previous iteration of the turbine location as presented in Section 2.5.5, were approved by both regulatory bodies and therefore no issues are anticipated with the proposed turbine location in this EIA.

Department of National Defence has also been notified about the proposed project and location and no objections have been received.

4.3.3 Land Uses and Property Value

The land in which the WTG will be located is privately-owned and is being leased to the Project's Limited Partnership for the development of this project. Two additional privately-owned parcels will be crossed for the construction of the access road. Adjacent land to the WTG includes PID 25358094to the north, Crown land leased by Malpec Peat Moss Ltd to the west (PID 25358086), PID 25280843 to the south, and four parcels to the east including PID 25371634, PID 25371626, PID 25396045, and The Town of Richibucto (PID 25403502). Specific landowner names have been withheld from this document for confidentiality.

The project site is located just west of the Richibucto-Rexton Industrial Park and the area is zoned industrial. The land was once used as a gravel quarry. Since then, the land remains vacant consisting of wetland, peatland, forest, and barren grounds. There is peatland harvesting to the west of the site, but no contamination is suspected on the project lands or adjacent lands.

According to Statistic Canada (2011) the average value of a property within the Town of Richibucto upon selling is $109,884. For surrounding areas including Rexton and the Richibucto Parish, on average, homeowners receive $120,721, and $124,992 respectfully.

4.3.4 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 WTG;
- 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 WTGs 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. The main access to the site will be from Enterprise Street and will likely also use parts of Main Street.

4.3.5 Public Health and Safety

Many of the assessments that have been completed are to mitigate any potential impact to public health and safety. The few predominant 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.

4.3.6 Community and Local Economy

The RWP is situated in the Town of Richibucto which is made up of 1245 residents according to the Statistic Canada 2011 Census data. Out of the 1245 residents, 1070 are above 15 years old and eligible to be in the labour force. There are 660 of the 1070 classed as in the labour force with 520 actively employed and 140 unemployed. The prominent industries for employment in the area, from most employed to least include manufacturing, public administration, wholesale and retail trade, accommodation and food services, construction, agriculture, forestry, fishing and hunting, administrative and support, transportation and warehousing, finance and insurance, and education services.

The Project is also located in proximity to the Village of Rexton where the access road will cross parcels in this municipality. The Village of Rexton has a population of 780 and of these, 680 are above 15 years old and eligible to be part of the labour force. There are 405 of the 680 classed as in the labour force with 320 actively employed and 85 unemployed. The prominent industries for employment in the area, from most employed to least include public administration, health care, construction, manufacturing, retail trade, educational services, transportation and warehousing, finance and insurance, professional, science and technical services, and wholesale trade.

Within the communities there are also small businesses, community buildings, and tourist attractions. All federal, provincial, and local recreational sites, tourism features, cultural features, and provincial parks within a 5 km radius of the project site are provided below in Table 4-11.

Table 4-11: Recreational, tourism, and cultural features near the project site.

Feature	Distance to Project Land
Jardine's Inn Inc.	1.92 km
Auberge O'leary Inn	3.26 km
Chapiteau Atlas Gazebo	3.87 km
Rexton Catholic Church	2.82 km
Rexton Elementary School	2.94 km
Hall of Jehovah's Witness	3.10 km
Bonar Law Memorial School	3.26 km
Arena	3.55 km
Eleanor W. Graham Middle School	3.47 km
Rexton Curling Club	3.46 km
Richibucto River Resort Ltd.	3.76 km
Public Library	2.99 km
Sea Land Sports (Kite, Paddle, Surf, Skate)	2.78 km
Jardine Municipal Park	2.16 km

Feature	Distance to Project Land
Chalets Du Havre Inc	4.10 km
Visitor Information Centre	2.03 km

5.0 Predicted Environmental Impacts and Mitigation

The construction, operation, and decommissioning phases of the RWP have the potential to affect 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 including accidents and malfunctions, 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	Power Pole and Line & U/G Electrical	Crane Pad Construction	Turbine Installation	Commissioning	Accidents and Malfunctions	Turbine Operation	Inspection and Maintenance	Accidents and Malfunctions	Infrastructure Demolition	Site Reclamation	Accidents and Malfunctions
Physical VECs														
Ground Water	•	•	•	•				•			•	•	•	•
Geophysical		•	•	•	•	•		•			•	•	•	•
Atmospheric	•	•			•			•				•		•

	Site Preparation and Construction								Operation and Maintenance			Decommissioning		
	Clearing and Grubbing	Access Road and Laydown Area	Turbine Foundation	Power Pole and Line & U/G Electrical	Crane Pad Construction	Turbine Installation	Commissioning	Accidents and Malfunctions	Turbine Operation	Inspection and Maintenance	Accidents and Malfunctions	Infrastructure Demolition	Site Reclamation	Accidents and Malfunctions
Wind Resource									•					
Noise	•	•	•	•	•		•		•			•	•	
Shadow Flicker & Visual						•			•					
Biophysical VECs														
Avian	•	•			•	•			•				•	
Bats									•					
Wetlands & Watercourses	•	•			•			•	•					•
Fish and Fish Habitat	•	•						•			•			•
Wildlife	•												•	
Vegetation	•	•			•								•	
Significant & Sensitive Habitat	•	•									•			•
Socio-economic VECs														
Archaeological Resources	•	•	•	•									•	
Electromagnetic Interference									•					
Land use & Property Value	•	•				•			•		•			
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 – Ground water is present approximately one meter below the surface. The sulfur content in the water does not present construction issues for the proposed project and the Proponent will ensure mitigation measures are applied to protect ground water resources from contaminants.

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 pad and access road might induce a change in hydrology or sediment input into ground water.	• A minimum setback distance will be adhered to of 30m between the site works and wetlands; • Efforts will be made to design the access road such that it does not interfere with a watercourse, water body or drainage channel; • Where possible, clearing shall take place in the winter months on frozen ground; • Erosion control strategies (ie. Straw bales and geo-textiles) will be outlined in the Erosion and Sedimentation Control Plan in the Environmental Protection Plan (EPP); • Baseline water quality conditions in the watercourses and wetlands at the site will be maintained; 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.

Potential Impacts on Ground Water	Proposed Mitigative Measures
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 If a spill occurs, corrective measures will be implemented immediately and reported to the DELG's Moncton Regional Office at (506) 856-2374 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 road does not interfere with a watercourse, water body or drainage channel; • Erosion control strategies (ie. Straw bales and geo-textiles) will be outlined in the Erosion and Sedimentation Control Plan in the EPP in order to maintain baseline water quality conditions in the watercourses and wetlands at the site; 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 10km 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 ground water would be a negative effect, it will be of small magnitude, of short duration and local. The significance of residual effects on ground and surface 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 RWP will require the excavation of materials to order to support the WTG foundation, and grading and filling for the crane pad and access road. The geophysical conditions will be disturbed for the construction and installation of the RWP. 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 has determined to ground conditions and found no limitations to construction; and • Stantec Consulting has provided recommendations for design and construction of the RWP based on the geotechnical survey results.
Excavation and transportation of material will be required for the turbine foundation, crane pad and access road.	• 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.)

Potential Impacts on Geophysical Conditions	Proposed Mitigative Measures
	• Soil compaction will be limited to the project footprint and the access road will be designed as a floating road likely using geotextile, large aggregate, and culverts to maintain flow between wetlands and to minimize soil and aggregate mixing.

Cumulative Effects – There are no other operating or proposed wind farms within a 10km 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 disturbance to the immediate geophysical conditions. However, the significance of residual effects on geophysical conditions after applied mitigation measures is to be considered 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 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 goals of producing 40% of electricity from renewables by the year 2020. By reaching 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 900 homes with clean	• Reducing reliance on fossil fuels is a positive impact: no mitigation is proposed

Potential Impacts on Atmospheric Conditions	Proposed Mitigative Measures
renewable energy, reducing fossil fuel requirements.	
The RWP is one step towards achieving 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 10km radius from the project site. No cumulative effects are expected to occur with respect to atmospheric conditions.

Significance of Residual Effects – The RWP will help global 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 RWP 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 RWP will have over 12 months of wind resource monitoring data to determine the wind resource onsite prior to erection of the turbine. 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.	• A minimum of one year of data collected from the installed meteorological mast will measure the wind to test for sufficient wind resource.
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 10km radius from the project site. No cumulative effects are expected to occur with respect to the wind resource.

Significance of Residual Effects – The RWP will use the wind resource in the local area over the lifetime of the project. As the RWP 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 to be considered beneficial.

5.1.5 Noise

Noise is defined as a sound, especially one that is loud, unpleasant or that causes disturbance. The Project poses two issues with noise pollution which could affect local residents. Noise from the construction and decommissioning phase, and noise from the WTG operation is to be expected. 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 2,500 m radius from the WTG 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 2.5 km area surrounding the proposed turbine location. This assessment includes parts of the Town of Richibucto and the Village of Rexton for a total of 262 residential houses and 43 buildings (large garages, warehouses and businesses). Prior to this assessment careful siting of the turbine 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 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 the noise prediction model at the top 20 receptors are summarized in Table 5-6, while all receptor noise levels are provided in Appendix F. All 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. The table below demonstrates the loudest noise levels for any wind speed modelled between and including 4 to 12 m/s. The loudest sound noticed at any of the receptors at these wind speeds is 35.8 dB[A].

Table 5-6: Wind Turbine Noise Impact Assessment Summary of the Top 20 Loudest Receptors

Point of Reception ID	Max Sound Level from WTG [dB(A)]	Compliance with New Brunswick's Requirements
DI	31.3	Yes
DJ	31.6	Yes
DK	32.3	Yes
DL	32.4	Yes
DM	32.9	Yes
DN	32.9	Yes
DP	33.1	Yes
DW	31.3	Yes
DX	31.6	Yes
DY	31.6	Yes
JC	34.2	Yes
JD	34.1	Yes
JE	**35.8**	Yes
JF	35.5	Yes
JG	33.9	Yes
JH	31.8	Yes
JV	32.8	Yes
JW	33.4	Yes
JX	32.9	Yes
JY	31.6	Yes

Based on the parameters used to run the WindPRO noise prediction model, it has been shown that the predicted SPL's emitted by the proposed WTG are less than 40 dB(A), thus demonstrating exceeding compliance with the *Additional Information Requirements for Wind Turbines* document created to support the New Brunswick *Environmental Impact Assessment Regulation*.

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, foundation, 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 4-8 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 4-8, noise levels from the construction site reach ~40dB[A] at 1 km from the site. With the nearest dwelling located ~1.2 km from the turbine, construction noise is not expected to impact dwellings in the area. Further, the construction noise is not expected to be annoyingly high beyond 61m.

Additionally, this site has been chosen due to it's excellent wind resource and industrial setting. Wind generally increases ambient sound levels in an area and in combination with the dense forest cover and industrial environment 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). Wind is estimated to reduce noise levels by as much as 20-30 dB at long distances (USDOT, 1995) and lastly, industrial activity is expected to increase ambient noise levels of the area.

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). • At 250m from the construction site, construction noise levels are estimated at 56 dB[A].
Elevated SPLs will be observed during operation from the nacelle, which will be a maximum 135 m above ground level.	• A noise impact assessment has been conducted to predict a 'worst case scenario' SPL that can be expected at the surrounding dwellings and is well below 40 dB[A] at the nearest building; • 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 comply with Provincial wind turbine noise guidelines • The wind turbine chosen for the project incorporate advanced noise reduction technologies in order to mitigate noise generated by the moving blades. • 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.
Infrasound from wind turbines.	• Infrasound from wind turbines is not a concern given the distance the wind turbine is located in relation to homes and dwellings.

Cumulative Effects – There are no other operating or proposed wind farms within a 10km 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 night time construction activities, WTG lighting, and shadow flicker during WTG operation are expected to contribute to the visual aesthetics. The proposed WTG is located outside of the Town of Richibucto and Village of Rexton among forested land; turbine pad elevations are approximate, 8m above sea level. 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 noise impact study was conducted; this being a 2,500 m radius from the WTG location. The temporal boundary is focused on the operation phase of the WTG but also includes the turbine installation phase of construction.

Discussion

Shadow Flicker

A shadow flicker impact assessment for the proposed RWP 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 G.

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 no effective. Prior to conducting an assessment, careful site design and applying 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 2.5 km area surrounding the proposed turbine location. This area includes most of the dwellings just outside of the Richibucto Town

Centre and the Village of Rexton. A total of 262 residential houses and 43 buildings (large garages or businesses) have been included in this assessment.

The desired results of the shadow flicker prediction model at each receptor is 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.

The study of this particular turbine location demonstrates that 303 of the 305 receptors located within 2.5 km of the wind turbine are subject to less than 30hrs/year or 30mins/day.

Table 5-10 shows the results of the receptors that are predicted to experience shadow hours exceeding the requirements for this assessment. The detailed results of the shadow assessment study are included in Appendix G.

Table 5-10: Predicted preliminary worst case shadow flicker for E-126 3.5 MW @ 135m hub height for receptors receiving more than 30 minutes per day without mitigation.

Receptor ID	Shadow hours per year (h/year)	Max shadow hours per day (h/day)	House or Business
C	21:17	0:33	B
D	15:40	0:31	B

Receptors "C" and "D" include two buildings in the Industrial Park. Photos of these receptors can be found in Appendix G and demonstrate that many of the industrial buildings have small windows that do not face the turbine location and therefore, the windows will likely be shaded by the building during times of shadow flicker occurrences limiting the amount of flicker noticed.

This study was conducted using a worst-case scenario for the RWP and does not consider the existing vegetation or local weather conditions. 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 7.1.2. Based on the worst-case scenario and proposed mitigation measures the shadow flicker predictions using WindPRO are expected to pass New Brunswick's shadow flicker requirements. Additionally, the Proponent will work closely with the local businesses to determine real-case shadow flicker impact and apply effective mitigation.

Photomontage

ReSoft Ltd WindFarm software was used to create three photomontages of the RWP from Main Street on the bridge just before Mooney Street in Richibucto (5.1 km north), Bonar Law Avenue in Rexton (1.8 km south), and Centennial Avenue in Jardineville (3.1 km southeast). Determining suitable locations for photomontages required and 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. For example, the turbine visibility near Jardine Municipal Park and the section of Highway 11 running parallel to Cartier Boulevard is expected to be limited by the trees in close proximity to roads and recreational features. Figure 5-1 through Figure 5-3 demonstrate how the WTG is predicted to look on the landscape.

Figure 5-1: Predicted visibility of the turbine on Bonar Law Avenue.

Figure 5-2: Predicted visibility of the turbine on Main Street by Mooney's Street.

Figure 5-3: Predicted visibility of the turbine on Centennial Avenue in Jardineville.

Richibucto Wind Project

Photomontage

Legend

- Photomontage Locations
- Proposed Turbine

Notes

N

1:35,000

0 600 1,200 1,800

Metres

WGS 1984 Web Mercator Auxiliary Sphere

Production Date: Nov 7, 2017

naturalforces

Figure 5-4: Photomontage Locations

Zone of Visual Influence

A ZVI model was conducted to determine the visual impact the turbine may have on the surrounding landscape. The maximum hub height of 135m and rotor diameter of 127m was used to calculate the worst-case impact. Given the size of the turbine, the flat local landscape, and increasing elevation moving north, south, and westward, it is expected the turbine will be visible at several locations throughout Kent County. Figure 5-5 shows the WindPRO ZVI model output showing a 48km visual radius recommended for visual analyses by Sullivan et al. in *Wind Turbine Visibility and Visual Impact Threshold Distances in Western Landscapes*. Though the turbine proposed is larger than included in the western study, it is noted that blade movements become less noticeable to the naked eye at closer distances. Further, Figure 5-6 demonstrates the subtended vertical angle (SVA) in which the WTG is visible at all distances. The SVA analysis helps to incorporate distance. The basic ZVI model only uses digital elevation to determine if any part of the turbine is visible whereas the SVA analysis will help determine how dominant the turbine appears on the landscape.

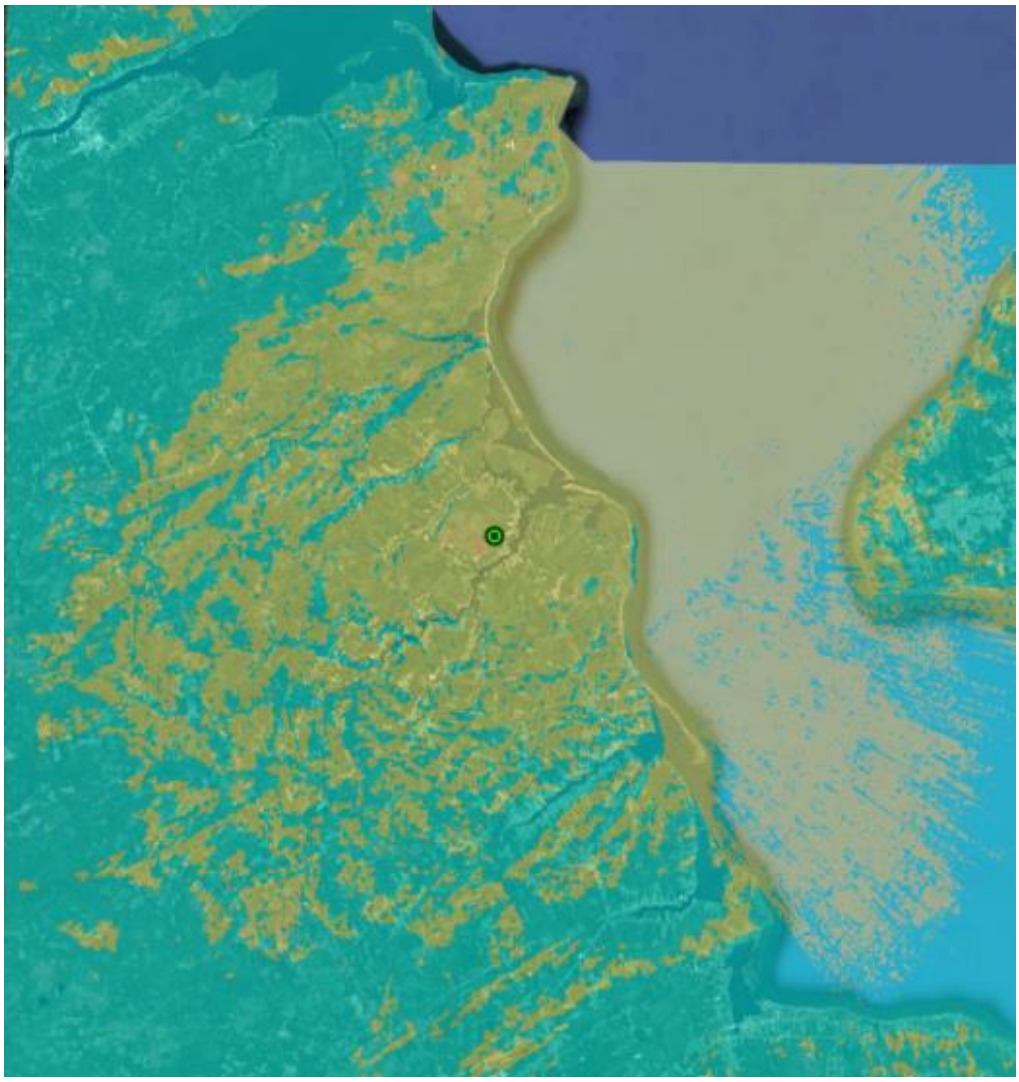

Figure 5-5: Zone of Visual Influence over a 48km visual analysis radius. Yellow color demonstrates some portion of the turbine may be visible.

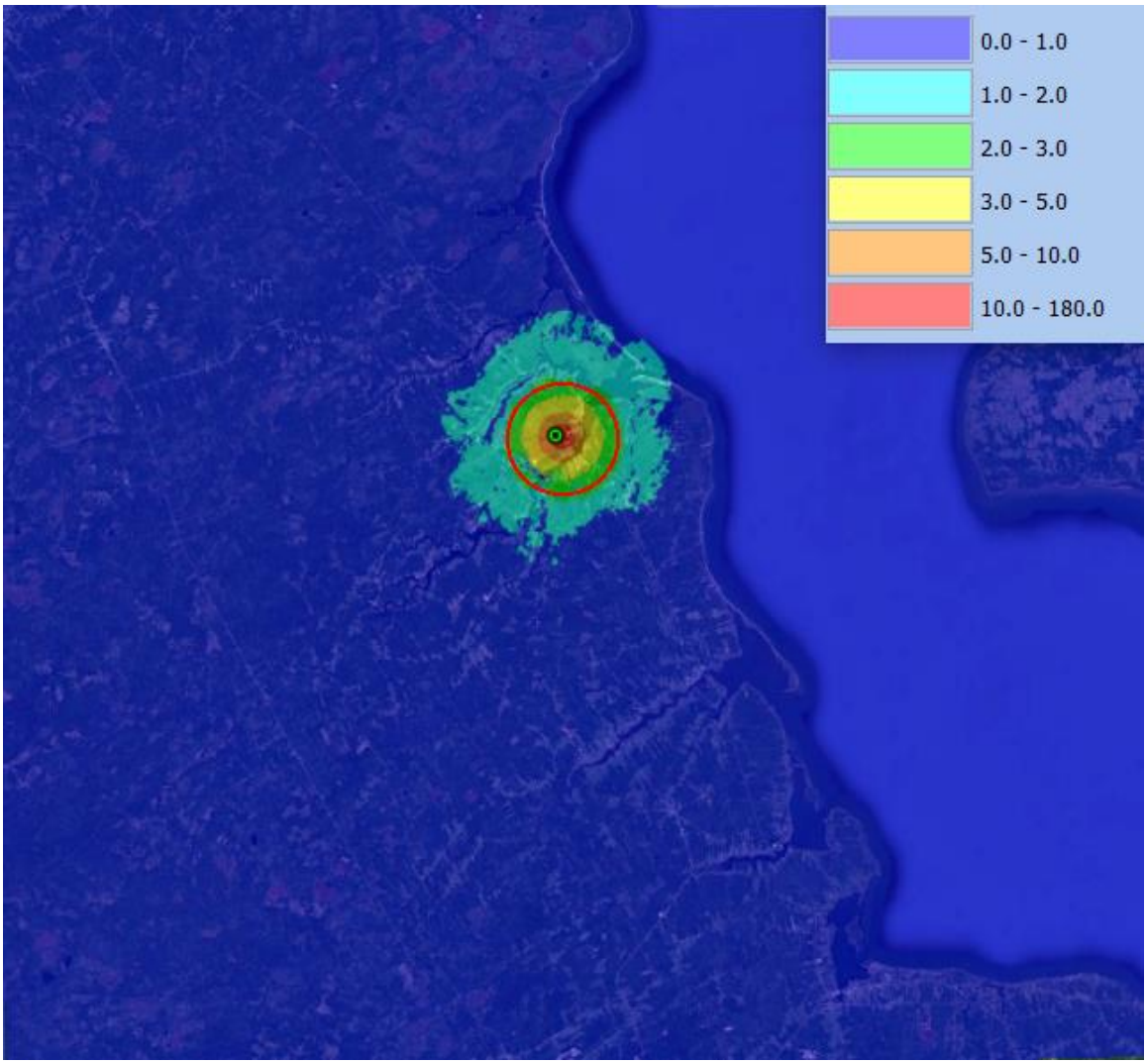

Figure 5-6: Subtended Vertical Angle

The SVA demonstrates that ~11 km from the WTG location the angle of view is less than one degree meaning the turbine appears very small upon the landscape and will no longer have a dominant impact on the landscape. At distances just 5 km (thin red ring) from the WTG location the turbine already looks small and begins to blur with background lighting as seen in Figure 5-2 of the photomontages. The photomontages would have been taken at locations predicted to be in 5-10 degrees for Figure 5-1, and 3-5 degrees for Figure 5-2 and 5-3.

Table 5-11: Potential impacts and proposed mitigative measures for shadow flicker and 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; and • 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.

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 dwellings and public areas within 2.5km of the proposed WTG; • Compliance with industry standard guidelines on shadow flicker has been adhered to. All dwellings will experience less than 30 hours of shadow flicker per year and 30 minutes of shadow flicker on the worst day after feasible mitigation has been applied; and • If shadow flicker occurrences during operation are found to be annoying to surrounding houses and buildings, programmed shutdown may be iconsidered during the time of day when shadow flicker would occur to bring all occurrences well below the allowable limits. • 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 night time 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 is less than 4 m/s. These conditions are commonly seen in the early evening.

Potential Impacts on Shadow Flicker and Aesthetics	Proposed Mitigative Measures
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 WTG; • The paint on the WTG has been selected so that it does not contrast sharply with the environment; and • By-Laws regarding responsible siting of WTG were followed to minimize the potential impact on the landscape aesthetics during WTG siting

Cumulative Effects – There are no other operating or proposed wind farms within a 10km radius from 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 were employed during site design and further mitigation can be implemented during operation. The perception of landscape aesthetics is a subjective matter. The Proponent recognizes the development of the proposed WTG 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.

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

Discussion

Comments provided by CWS to the proponent regarding the proposed Project, indicated that there is potential for bird passage migration from inland areas to the coast, and that this could lead to interaction with the proposed turbine. Although quantitative methods of predicting possible interaction between birds and the proposed turbine have not been completed as part of this Study, it is relevant to recognize the physical obstruction the proposed turbine would pose to bird movement at this location compared to the region as a whole.

As a Category 2 risk wind project and from concerns raised by CWS about the size and height of the rotor swept area, the rotor diameter of the proposed turbine has been reduced since the Draft EIA was submitted. The change in turbine model as described in the draft EIA and the current final EIA has changed the rotor swept area from 15,614.5 m^2 to 12,688 m^2 as shown in Section 2.5. The maximum height of the proposed WTG is 198.5m. The height of the proposed turbine occupies ~10% of the migration heights as per CWS's comments which stated that it is believed 75% of migratory birds migrate between 500-2000 ft (150-600m). Therefore, the proposed WTG may pose higher risk to only 7.5% of most migrating birds. However, during field surveys none of the species observed experience an elevated risk of turbine strikes based on behaviour and aerial flight displays.

Additionally, the approximate air space taken up by the proposed turbine as determined by the total rotor diameter is approximately 2.04 million cubic meters. This accounts for approximately 0.0002% of the air space across the entire peninsular that falls within the zone of the rotor swept area. Based on this example, it is appropriate to suggest that the proposed turbine presents a very low potential to impact avian population on a regional scale. This does not presuppose that mortality will not occur, only that mortality would probably be expected to fall within regional norms for wind projects in New Brunswick. Further, the WTG will be equipped with only flashing lights for aviation safety at the minimum flashes per minute to reduce the risk of birds becoming attracted to the lights during foul weather conditions.

Table 5-12: 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 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 migratory birds would possibly be in the area. • To minimize potential interaction with ground nesting species, it is recommended that bare ground is minimized, by re-vegetating lay-down yards and as much of the turbine pad area as is possible following construction of the Turbine.
During operation there is a possibility that migrating birds could collide with the WTG.	• 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; and • A WTG with a smaller rotor diameter has been proposed compared to the Draft WTG to reduce impact on migratory birds. This technology has reduced the rotor swept area from 15,614.5 m^2 to 12,688 m^2
Birds may alter their migration flyways and/or local flight paths to avoid WTG.	• 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.

Potential Impacts on Migratory and Breeding Birds	Proposed Mitigative Measures
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 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 DNRE 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 WTG.	• ECCC climate database has been consulted to predict the rate of fog occurrence; • An annual average of 1.1% - 2.2% % 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 to clearing. This is considered to have no negative impact on migratory and breeding birds.
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.

Potential Impacts on Migratory and Breeding Birds	Proposed Mitigative Measures
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 10km 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 during construction will be unlikely to occur 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. Monitoring for bird mortality during operation will verify the effect the Project has on migratory and breeding birds. While not all phases of the Project are negative, construction, and operation phases pose potential for negative impact. With the proposed mitigation measures employed, the significance of residual effects on migratory and breeding birds is predicted to be minor.

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 cause by the project activities.

Boundaries – The spatial boundaries include the area where the WTG 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 Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the Canadian Species at Risk Act (SARA) and the NB Endangered Species Act (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. On an individual basis, the Hoary bat appears to be the most commonly recorded and most dominant bat species present across the Project study area.

There is a lack of readily available data in New Brunswick to which the data collected for this Study can be compared to. Therefore, the Alberta model has been adopted for the purposes of analysing potential impacts to bats as a result of the RWP. 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). In Alberta, during the fall migration (July 15 to September 30), bat fatalities consist mainly of hoary and silver-haired bats (Government of Alberta, 2013)

The Government of Alberta (2013) adopts a Precautionary Principle whereby the following bat passes per night for migratory species is considered when determining project risk:

- Less than 1 migratory-bat pass per detector night = potentially acceptable risk
- 1-2 migratory bat passes per detector night = potentially moderate risk
- Greater than 2 bat passes per detector night = potentially high risk of bat fatalities

<u>Analysis using collected data from all 3 detectors</u>

Based on this model, the migratory species identified during the survey period at the RWP have been listed in Table 5-13, and their respective average passes per detector night have been calculated.

Table 5-13: Migratory Species Passes per Detector Night

Migratory Species	Detector			Total Passes	Average passes per detector night
	BM1	BM2	BM3		
Low Frequency	22	7	0	**29**	**0.12**
Hoary bat - (LACI)	135	30	0	**165**	**0.66**
Big brown bat - (EPFU)	2	1	0	**3**	**0.01**
Silver-haired bat - LANO	8	2	0	**10**	**0.04**
Eastern red bat - LABO	42	3	0	**45**	**0.18**

Migratory Species	Detector			Total Passes	Average passes per detector night
	BM1	BM2	BM3		
Silver-haired bat/Big brown bat - (EPFU/LANO)	3	4	0	**7**	**0.03**
Total Migratory Passes				**259**	
Average passes per detector night				**1.04**	

The average passes per detector night for all migratory species has been determined to be 1.04 which falls within the *potentially moderate risk category* as outlined by the Alberta government.

It should be noted that the information provided in Table 5-13 provides the reader a comprehensive account of bat passes and relative bat abundance across the three monitoring stations during the period studied. The following important items should be considered:

1) Bat passes refer to a sequence of 2 or more echolocation calls recorded as a bat flies within range of a bat detector (Thomas and West 1989), in comparison to relative bat abundance. Relative bat abundance is an estimate of the number of individuals in a population. Absolute abundance is expressed as a number present per area. Absolute abundance can not be reliably assessed for bats. Relative abundance can be compared between localities or over time, but reliable comparisons of relative abundance can not be made between different species of bat (MELPRIB, 1998).
2) Average migratory bat passes per detector night provided in Table 5-13 have been determined based on the individual bat passes at each monitor, across the total detector days for all monitoring stations. As discussed, BM3 was only monitored for 19 days during mid-September-early October 2017, in comparison to BM1 (117 days) and BM2 (112 days). According to results collected at BM1 and BM2, it appears that highest bat activity occurs during the period end July to the beginning of September and such, the time period monitored at BM3 does not account for this period. In order to account for the lack of data during this period, the following sections outline two methods by which i) potential migratory bat activity at BM3 has been accounted for and ii) the study period and data recorded for BM3 has been removed from the analysis in order to give a more conservative bat pass result for BM1 and BM2.

Analysis using BM1 bat pass data for BM3

BM1 was positioned at the edge of the mixed-wood forest in close proximity to open water. These features are contiguous with the graminoid fen wetland located west of the proposed turbine location.

Table 5-14 repeats the same information as that within Table 5-13 although bat pass data from BM1 has been included in the BM3 column as a "worst case" scenario. The actual bat passes at BM3 during the period end July to the beginning of September is unknown; however due to it's relative proximity to BM1 (i.e. 550m west), and its location along a contiguous wetland comprising open water habitat, bat activity is predicted to be similar. In addition to utilizing the BM1 bat pass data for the BM3 location, the results in Table 5-14 take into consideration the bat detector nights recorded at BM1 (i.e. 117 instead of 19).

Table 5-14: Migratory Species Bat Passes: Predicted BM3 data using BM1 Data to determine the Highest predicted bat activity.

Migratory Species	Detector			Total Passes	Average passes per detector night
	BM1	BM2	BM3[1]		
Low Frequency	22	7	22	**51**	**0.15**
Hoary bat - (LACI)	135	30	135	**300**	**0.87**
Big brown bat - (EPFU)	2	1	2	**5**	**0.01**
Silver-haired bat - LANO	8	2	8	**18**	**0.05**
Eastern red bat - LABO	42	3	42	**87**	**0.25**
Silver-haired bat/Big brown bat - (EPFU/LANO)	3	4	3	**10**	**0.03**
Total Migratory Passes				**471**	
Average passes per detector night				**1.36**	

[1] *Data from BM1 was used as a worst-case scenario*

As is depicted in Table5-14, the average passes per detector night for all migratory species based on the approach discussed above, has been determined to be 1.36 passes/night which also falls within the *potentially moderate risk category* as outlined by Alberta government.

Analysis with removed nights between September 24 – October 13th

During the period September 24 – October 13th, only a single migratory bat pass was recorded at BM1 on October 7, 2017. Therefore, in order to evaluate the overall migratory bat passes per night across the active times of the study period, the data at BM3, and the time period of Sep 24-Oct 13 (19 days), has been removed from the analysis (Table 5-15). This produces a more conservative result of bat passes per night for BM1 and BM2 based on 229 total detector nights instead of 248 detector nights.

Table 5-15: Migratory Species Bat Passes at BM1 and BM2 During Reduced Study Period

Migratory Species	Detector		Total Passes	Average passes per detector night
	BM1	BM2		
Low Frequency	22	7	**29**	**0.13**
Hoary bat - (LACI)	134	30	**164**	**0.72**
Big brown bat - (EPFU)	2	1	**3**	**0.01**
Silver-haired bat - LANO	8	2	**10**	**0.04**
Eastern red bat - LABO	42	3	**45**	**0.20**
Silver-haired bat/Big brown bat - (EPFU/LANO)	3	4	**7**	**0.03**
Total Migratory Passes			**260**	
Average passes per detector night			**1.14**	

[1] *Includes removal of the single bat call recorded on Oct 7, 2017*

Table 5-15 depicts the average passes per detector night for all migratory species based on the reduced study period approach for BM1 and BM2. A value of 1.14 falls within the *potentially moderate risk category* outlined by the Alberta government.

In summary, Table 5-16 provides results of the options analysed to determine average migratory bat passes per night across the Project study area as outlined in the preceding sections.

Table 5-16: Summary of Average Bat Pass Results of Migratory Species Using Three Options

Analysis Option	Average Bat Passes Per Night
Bat passes per night based on: - Three detectors (BM1, BM2 and BM3) - Entire study period (248 detector nights)	**1.04**
Bat passes per night based on: - Three detectors (BM1, BM2 and BM3) - Entire study period (248 detector nights) - Using BM1 data as a prediction tool for BM3 data during period of June 13-September 24	**1.36**
Bat passes per night based on: - Two detectors (BM1 and BM2) - Reducing study period to active time (i.e. 229 detector nights between June 13-Septembber 24)	**1.14**

The average migratory bat passes per detector night for the options analysed above, fall between 1.04 and 1.36 migratory bat passes per detector night. As previously discussed, based on the Bat Mitigation Framework for Wind Power Development (Government of Alberta, 2013), this data falls within a potentially moderate risk.

It is widely understood that high levels of bat activity are typically documented in forested ridge habitats, forest canopy openings, and along the shores of large waterbodies. These areas may offer attractive migratory and feeding habitat for some species of bats, which may lead to increased bat activity and mortality risk (Ontario Ministry of Natural Resources 2011). Therefore, as part of the analysis for bat activity within the Project study area, it is important to note that the average bat passes per night stated in Table 5-16 are based on all three bat monitors, and that BM1 is elevating the average bat passes per night tally due to its location (i.e. ideal bat habitat, within open area adjacent to open water). In order to simplify this fact, Table 5-17 provides a breakdown of all bats and migratory bat passes per night for BM1 and BM2, during the active monitoring period (108 nights and 103 nights respectively) and provides the associated habitat of each monitor station.

Table 5-17: Average Bat Passes Per Night Comparison (All Bats and Migratory) - Active Period.

Bat Monitor	Average Bat Passes Per Night – ALL Bats	Average Bat Passes Per Night – Migratory bats	Habitat Present
BM1	2.8	1.96	Open, adjacent to open water
BM2	0.62	0.46	Edge of mixed wood forest clearing

BM2 located in a clearing in similar forested habitat to that of the proposed turbine location, exhibits far less average bat passes per night than at BM1. As such, since the proposed turbine is to be located in forested habitat, bat activity levels are expected to resemble those at BM2 (<1 migratory and all bat passes per night), rather than the bat activity experienced at BM1 and is therefore, expected to pose a potentially acceptable risk as defined by the Alberta Government.

Table 5-18: 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 WTG commissioning and appropriate actions will be taken in consultation with DNRE and CWS should there be a significant negative impact to bats; and • A 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 10km 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. It is expected that the mortality rate of bats from collision or habitat loss during Project operation, if at all, will be low. Monitoring for bat mortality during operation will verify the effect the Project has on bats. The proposed curtailment scenario may be implemented if a significant amount of bat mortality is observed. While not all phases of the Project are negative, construction and operation phases pose potential for negative impact. With the proposed mitigation measures employed, the significance of residual effects on bats is predicted to be negligible.

5.2.3 Wetlands and Watercourses

Management of wetlands and watercourses is an important and integral aspect of maintaining a diverse ecosystem. The Projects 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 road and the WTG location. The temporal boundary focuses on Project construction but also includes operation and decommissioning for the unlikely event of an accident or malfunction.

Discussion – The Project study area is located within the Northumberland primary watershed, in the Richibucto River secondary watershed. The Draft Wetlands Reference Map indicated the possible presence of multiple areas of wetland within, and adjacent to the Project study area. The Project study area extends entirely through an area of wetland habitat classified as “Other Wetlands” (which include freshwater marsh, aquatic bed, bog, fen, and shrub wetlands). As can also be noted, the Project study area abuts the eastern boundary of a provincially regulated wetland which extends northeast and drains into Weldon Creek. Weldon Creek drains into Loggie Pond prior to discharging into the Richibucto River approximately 2.2km northeast of the proposed turbine location.

Apart from the watercourse associated with the regulated fen wetland, no other watercourses are identified within the Project study area by the New Brunswick Hydrographic Network. As per consultation with the DELG the Project Footprint has been setback a minimum of 30m from regulated wetlands and watercourses.

Table 5-19: 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 of the soil needed for constructing the access road. 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.	• Avoidance of all regulated wetlands and locating the turbine and site works a minimum of 30m from regulated wetlands; • Work within the 30m regulated wetland buffer will be prohibited; • Field surveys in the Spring and Summer of 2017 were completed to ensure unmapped wetlands were delineated; • Construction of the access road will be designed likely using geotextiles, large aggregate and culverts to maintain flow; • Appropriate sediment erosion and run-off control measures (e.g. silt fencing, haybales) will be implemented when needed; and • No stockpiling of materials will occur within 30m of a regulated 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 supplied to handle a worst-case scenario on ground or in surface and groundwater; and • Corrective measures will be implemented immediately and reported to the DELG's Moncton Regional Office at (506) 856-2374 or outside of business hours to the Canadian Coast Guard's environment emergencies reporting system at 1-800-565-1633Routine maintenance, refueling and inspection of machinery will be performed off-site whenever possible. • A spill contingency and emergency response plan has been developed and will

Potential Impacts on Wetlands and Watercourses	Proposed Mitigative Measures
	be implemented during construction (Appendix H)

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

Significance of Residual Effects –The access road design will be optimized in order to minimize direct alteration of wetlands and watercourses. The WTG has been located such that a 60m buffer exists between the WTG and any wetland. Direct alteration is expected in unmapped wetlands for the access road and will follow New Brunswick's *Wetlands Conservation Policy*. The significance of residual effects on wetlands and watercourses is predicted to be minor.

5.2.4 Fish and Fish Habitat

Alteration of freshwater environments may occur through the construction of the proposed access road. However, it is not expected to impede any fish habitat on the Project site. The wetlands and watercourse survey has verified all wetlands and watercourses onsite. The project impacts on fish and fish habitat are considered to have no impact.

Impacts to fish and fish habitat are not expected based on these assessments and the distance of fish habitat to proposed project work. If project plans should change in any way that may cause interference, or accidental interference has occurred, the Proponent will follow the Duty to Notify and update the DFO on any changes or incidences via http://www.dfo-mpo.gc.ca/pnw-ppe/violation-infraction/index-eng.html. The Proponent expects any changes or incidences to be unlikely due to the careful siting and proposed mitigation to ensure safe construction and operation

5.2.5 Wildlife

Information collected during field surveys has covered all habitat types and wildlife observations. Wildlife species including terrestrial mammals and herpetofauna have been identified in Section 4.2.5. In an effort to preserve wildlife habitat and ensure wildlife species remain unharmed, 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 road, WTG crane pad and foundation, as well as the decommissioning phase focusing on site reclamation.

Discussion – The project is not expected to impact herpetofauna species. The spring peeper was the only amphibian species observed onsite and is not of special conservation concern. Additionally, 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.

The Project will decrease some wildlife habitat from the access road and crane pad. 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 5-20: 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 road has 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 road will be optimized to reduce footprint and to avoid sensitive areas where feasible.
The Project footprint will cause loss of habitat for herpetofauna and terrestrial mammals.	• Desktop and field studies conducted suggest a minimal loss of habitat due to clearing. This is considered to have minimal on wildlife as the project site was previously disturbed.

Cumulative Effects – There are no other operating or proposed wind farms within a 10km 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 and small number of terrestrial mammals and herpetofauna observed onsite, 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 road, WTG crane pad and foundation, as well as the decommissioning phase focusing on site reclamation.

Discussion – There have been no plant species of concern identified in the Project Study Area. There will be some loss of vegetation for the construction of the access road 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 5-21: 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.	• There will be minimal land/habitat loss attributable to the construction phase as determined by desktop and field studies; • The access road has 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 road will be optimized to reduce footprint and to avoid sensitive areas where feasible.
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 no plant matter is attached to the machinery.

Cumulative Effects – There are no other operating or proposed wind farms within a 10km 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 road and crane pad. 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. 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. Provincially significant wetlands and ESA's have been identified near the project site. 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 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 road, WTG crane pad and foundation, as well as the decommissioning phase focusing on site reclamation.

Discussion – Alteration of aquatic environments such as the potential unmapped wetland alteration for the proposed access road may be required; however, it is not expected to impact the Provincially Significant Wetland to the northwest of the proposed WTG location as all disturbance from the construction of the WTG base will remain outside of the 30m wetland buffer. The wetlands and watercourse survey has verified all wetlands and watercourses onsite. Further, desktop surveys have identified two ESA's 4-5 km from the project location. The Project footprint does not interact with any ESA's or sensitive habitat.

Table 5-22: 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.	• There will be minimal land/habitat loss attributable to the construction phase as determined by desktop and field studies; • The WTG has been setback 60 m from all mapped and unmapped wetlands keeping all disturbance from the turbine base outside of the 30m wetland buffer; and • The WTG is setback a sufficient distance (4-5km) from all ESA's to prevent impacts.

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

Significance of Residual Effects –Due to the buffer applied and distance between the Project and identified siensitive areas, the project impacts on significant and sensitive habitat are to be considered negligible.

5.3 Assessment of Socio-economic VEC Impacts

5.3.1 Archaeological Resources

The results of the desktop archaeological resource potential assessment indicated the only archaeological resources predicted are that of a plane crash approximately 4 km southwest. 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.

Disscussion – The Project Footprint is not expected to interact with archaeological resources as a result of the archaeological predictive modeling and through consultation with the Department of Heritage, Culture, and Tourism. In the unlikely event that archaeological features are encountered during ground disturbance activities, all activities will cease and the Archaeological Branch will be contacted immediately.

Table 5-23: 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.	• The desktop archaeological resource impact study concludes the Project site is of low potential for significant archaeological resources; • 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 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 10km radius from the project site. No cumulative effects are expected to occur with respect to archaeological resources.

Significance of Residual Effects – The significance of residual effects on archaeological resources is expected to be negligible.

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 Proponent has consulted Navigation Canada, Department of National Defence, and Transport Canada to mitigate potential negative impacts on telecommunications and radar communications. A desktop study for electromagnetic interference was conducted to identify potential impact on microwave link communication. As a result, electromagnetic interference has been identified as a VEC.

A significant environmental effect would result if considerable interference was the result of project activities.

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

Discussion – An electromagnetic interference assessment has been completed to locate the communication towers in the area. Appropriate buffers have been applied to all towers found based on the RABC guidelines and the WTG is located 940m away from the nearest point-point communication link. This distance between the turbine and the communication link is sufficient based on the Fresnel Zone (the transmitting corridor between two towers) calculated for this link using the RABC guidelines which is only 335m wide.

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 the current will result in a 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 EMF's around wind turbines do not present a health concern to the public and that levels surrounding wind turbines are found to be lower than levels found around homes from use of common household electrical devices.

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

Table 5-24: Potential impacts and proposed mitigative measures for electromagnetic interference.

Potential Impacts on Electromagnetic Interference	Proposed Mitigative Measures
WTG operation may interfere with telecommunication and/or radar communication infrastructure	• Consultation was completed as recommended by CanWEA and RABC's guidance document – *Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines, on Radio Communications, Radar and Seismoacoustic Systems*; • A desktop EMI assessment was conducted by the proponent in line with the RABC guidelines. The results of the assessment showed that the turbine will not interfere with the telecommunication links of nearby towers; • Application process with Navigation Canada's Land Use Proposal Submission Form to ensure that the Project does not pose any hazard to the navigational systems; and • Transport Canada and Department of National Defence has also been consulted.

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

Significance of Residual Effects – Based on consultation with the appropriate authorities, no impedance on communication infrastructure is to be expected. As a result, the significance of residual effects on telecommunication and radar communication is expected to be negligible.

5.3.3 Land Use and Property Value

The proposed RWP makes use of three land parcel adjacent to the Town of Richibucto and Village of Rexton, in Kent County. The lands are privately owned and will be leased to the Proponent for the purpose of developing the proposed RWP or easements will be obtained for the construction of the road access. Lands surrounding the Project land parcels are zoned industrial. However, there are 305 dwellings within 2,500 m of the Project. 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 - 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 conclude 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 5-25: 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 a brownfield site supporting former quarry activities to a source of renewable energy	• The land use changes are predicted to be positive: no mitigation is proposed.
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 10km 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 Vehicular Traffic and Pollution

The Project will be accessed via Enterprise Street. During construction of the access road and WTG foundation, 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 tower, blades, nacelle, and the cranes required for erection. These deliveries are anticipated will 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 and the proposed site located within an industrial area, elevated noise levels due to construction will not be significant when compared to adjacent land activity and is not likely to impact surrounding communities.

Table 5-26: 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 will consult with NBDTI as early as possible regarding the permits and approvals required for the construction of

Potential Impacts on Vehicular Traffic and Pollution	Proposed Mitigative Measures
	the RWP 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 (WATCM) for delivery of materials on provincial roads; • A Transportation Plan will be developed with reference to these guidelines in consultation with Enercon, the turbine manufacturer, and New Brunswick Department of Transportation and Infrastructure. This plan will help familiarize workers with the correct routes to take minimizing wrong turns and excess fuel use. • The Transportation Plan will be reviewed by NBDTI 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.
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;

Potential Impacts on Vehicular Traffic and Pollution	Proposed Mitigative Measures
	• 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 • Corrective measures will be implemented immediately and reported to the DELG's Moncton Regional Office at (506) 856-2374 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 10km 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 RWP. During the construction, operation and decommissioning phase the protection of workers and the public's

health and safety is protected under the provincial OHS Act. 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 would 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 2, 500 m radius from the WTG. 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 reduced 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.

Table 5-27: 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; and • When ice is detected the blade has a heating mechanism that will effectively melt the ice to mitigate ice-throw; and • Personal Protection Equipment (ie. 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 Impacts on Public Health and Safety	Proposed Mitigative Measures
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.	• Every effort will be made to ensure that oversized loads are delivered during times of lowest traffic to mitigate road traffic.
Shadow flicker may affect human health.	• This potential impact has been addressed in the Shadow Flicker and Visual Aesthetics Section 5.1.6.
Noise impact may affect human health.	• This potential impact has been addressed in the Noise Section 5.1.5.
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 10km 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 the Town of Richibucto and Village of Rexton in Kent County, 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 from Statistics Canada. The

installation of the WTG may also provide tourism benefits for the area as people may come through to view the turbine.

Table 5-28: 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 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.	• Community economic development is a positive impact: no mitigation is required.

Cumulative Effects – There are no other operating or proposed wind farms within a 10km radius from the project site. The wind farm will provide clean, renewable energy to regions within Kent County.

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 municipal 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 WTG 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 Kent County, New Brunswick region are listed in Table 5-29.

Table 5-29: 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.
Heavy rain and flooding	• Flooding of road and project site	• Turbine has been moved to the largest area of upland habitat and the road has been designed

Weather Event	Effect	Mitigation
		to maintain water flow between sections to prevent flooding and wash-outs from current precipitation levels and to mitigate risks associated with predicted increases in precipitation from climate change.
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.

The initial turbine location proposed prior to the Draft EIA has been moved to the current location, as it was determined through field surveys, the original location was located in an unregulated wetland. The turbine location has been moved to a large swath of dry land delineated as upland habitat that is surrounded by lowland unregulated wetland and small areas of dry land.

The immediate surrounding dry land along with its slight increase in elevation provides the turbine protection from potential increasing precipitation amounts and flood waters as further described in Section 4.1.3. The increase in precipitation is expected to occur mostly during the summer months when the site is observed to be dry further allowing the large area of wetland to absorb and retain excess water. Additionally, as the road may cross sections of the unregulated wetlands, they will be designed to

incorporate large aggregate, geotextile and/or multiple culverts to allow flow between the sections that will aid in reducing the risk of the road becoming eroded and washed out.

Extreme weather events have also 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 ms;
- All wind directions are equally likely; and
- Ever-present individual between 50 m and 300 m (dounut 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 Enercon E-126 has 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 5-30: 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	+	small	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

	Nature	Magnitude	Reversibility	Timing	Extent	Residual Effect
Avian	-	small	REV	Long	Local	Minor
Bats	-	small	REV	Long	Local	Negligible
Wetlands & Watercourses	-	small	REV	Short	Local	Minor
Fish & Fish Habitat	No Impact	N/A	N/A	N/A	N/A	No Impact
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
Archaeological	-	small	IRR	Short	Local	Negligible
Electromagnetic Interference	-	small	REV	Short	Local	Negligible
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

6.0 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. These 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 30th of August 2017 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 of August 14th. A copy of this advertisement is available in Appendix J. Advertisements were also displayed in local newspapers in French and English. As well, invitations were sent to special interest groups and businesses within the Rexton-Richibucto Industrial Park. Open house attendance was tracked by a sign in sheet.

Questionnaires were distributed to attendees at the open houses to express any concerns regarding the RWP 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 will be displayed with Proponent representatives present to answer questions and discuss concerns the public may have.

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 included in the Public Consultation Plan 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 December 2017. 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.

6.1.2 Website

Websites have proven to be an excellent vehicle for making project information available for the general public to access and stay up to date on the progress of wind farm developments. The website 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.

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 2017, 2018 and 2019 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 (CLC)

A 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 the final 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 RWP development. The Complaint Resolution Plan is located in Appendix I.

6.2 Aboriginal Peoples

The proposed RWP is being developed in partnership with Pabineau First Nation. Throughout the development process the New Brunswick First Nations community will be consulted through meetings, presentations, personal mailings, and phone calls. The Proponent has been in contact with the Aboriginal Affairs Secretariat and First Nations Chiefs have been informed on the Project. A letter informing all Mi'gmaq Chiefs about the Project and partnership along with Natural Forces' contact information has been distributed and a copy of this letter has been provided in Appendix J.

As Elsipogtog is the closets First Nation to the RWP, the Proponent has been communicating with Kopit Lodge regarding the Project. Discussions will continue for the remainder of the development, construction and operation phases of the project.

First Nations and Aboriginal Affairs correspondence will be documented and summarized in the Public Consultation Summary Report. Should any Project plans or predicted impacts change that may cause adverse impact to Aboriginal and Treaty Rights the Aboriginal Affairs Secretariat will be contacted.

6.3 Public and Aboriginal Concern

Comments and concerns that have been received from open house questionnaires, individual discussions, aboriginal 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 will be addressed directly at the open house, through telephone conversations, emails, letters and one on one meetings. Following the open house in December, one-on-one discussions and other community engagement events, all concerns raised will be identified and presented in the Public 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 and community members.

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 RWP, 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 with Municipal Councils in the Town of Richibucto and the Village of Rexton to discuss the proposed Project. Presentations were made informing the Richibucto Council and Rexton Council regarding the Proponent's background, the project activities, benefits of the project, and partnerships involved.

The Proponent will continue ongoing consultation with both the Town of Richibucto and the Village of Rexton as well as the Kent Regional Service Commission to ensure compliance with by-laws, to coordinate engagement events, and to provide project updates.

The correspondence between the Proponent and municipalities 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 RWP. The scoping of this EIA document was designed in consultation with the DLEG and DERD through informal discussion and through the TRC review process of the draft EIA submitted in August 2017. Consultation topics with the DELG and DERD included:

- Scoping and guidance of wildlife surveys and studies to conduct as part of the RWP EIA;
- Ideal dates to conduct effective bat monitoring surveys;
- Provide insight on proper course of action to take in effectively avoiding wetlands, mitigating impacts on wetlands and compensation that is required when direct wetland alteration is required; and
- Species at risk in general, and approach to assessment in 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 with various Federal Government entities regarding the construction of the RWP. ECCC, CWS, Navigation Canada, Transport Canada, and the Department of National Defence 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 RWP as appropriate.

7.0 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 and decommissioning phases of the Project.

7.1 Post-Construction Monitoring

7.1.1 Avian and Bats

A post-construction monitoring plan will be developed and implemented by a third-party consultant in consultation with DERD, 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 turbine becomes 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 the months which showed high hoary bat migration activity in the 2017 baseline surveys.

The Proponent may commit to active mitigation should the post construction carcass searches reveal higher than normal mortality levels of Hoary or other 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 DERD and other bat researchers that in fact the wind farm is producing higher than normal bat fatalities, the Proponent, in collaboration with DERD 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 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. These measures include, turbine relocation, screening of receptors using vegetation and awnings, and operational shutdowns during the expected shadow flicker times.

Relocation

The location of the RWP has been relocated from its original location twice in attempt to reduce impact to as many environmentally sensitive features as possible. The current proposed location is located as far away from houses and buildings as possible without also impacting the wetland habitat that surrounds the forested habitat in which the turbine is proposed. Relocating the turbine any farther west from houses and buildings in an attempt to reduce shadow flicker impact is not a feasible mitigation measure for this particular project due to wetland constraints. However, the Proponent has chosen a smaller turbine which has effectively reduced original shadow flicker levels. The rotor diameter is 16 m smaller that the turbine originally proposed in the draft EIA. This has reduced the number of impacted receptors in a worst-case scenario from six to two receptors.

Screening

Vegetation is a feasible, effective mitigation measure for reducing predicted shadow flicker impact. It can be further proposed that if businesses and landowners observe an annoyingly high amount of shadow flicker impact, the Proponent may propose vegetation efforts that will provide shade to buildings and windows effectively reducing shadow flicker annoyance. Similar results can also be obtained by installing awnings and window coverings.

Operational Controls

The Proponent feels confident that, as the model produces a worst-case scenario, that receptors will not receive exceeding amounts of shadow flicker as the model assumes cloudless skies all year. However, the Proponent will work closely with land and businesses owners to observe occurrences of real-case shadow flicker impact during operation and apply mitigation as mentioned.

If, during the operation of the WTG, receptors observe unacceptable limits of shadow flicker even after the above-mentioned mitigation is applied, operational shutdowns may be proposed and implemented. The WindPRO model outputs an additional document showing a calendar in which timeframes are produced where shadow flicker is expected. Upon reviewing the calendar outputs and observing real-case scenarios and timeframes where elevated shadow flicker is observed, the turbine can be effectively programmed to shutdown during high shadow flicker times when the sun is at the appropriate angle. Once the sun shifts enough to where shadow flicker is no longer occurring on sensitive receptors, the turbine can be programmed to restart. This mitigation measure can effectively reduce all exceeding and annoyingly high occurrences of shadow flicker on sensitive receptors.

8.0 Approval of the Undertaking

8.1 Federal

Federal environmental permits are not required for the proposed Project, however, approval from Navigation Canada, Transportation Canada, and the Department of National Defense will be required for aviation and military safety. The Project is not expected to require permitting through harmful alteration, disruption or destruction of fish habitat or have an impact to navigable waters.

Consultation with Federal authorities has been ongoing with Navigation Canada, Transport Canada, the Department of National Defence, and the CWS.

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 *Environment 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. It is anticipated that the rated capacity for the RWP is 3.5 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. Any applications or approvals provided or received from provincial or federal departments will be attached in Appendix K.

Table 8-1: Federal and provincial permitting requirements.

Permit Required	Permitting Authority	Status
Archaeology Field Research Permit	Provincial Tourism Heritage and Culture	Not Required
Special Move Permit	Provincial Transportation and Infrastructure	To be obtained

Permit Required	Permitting Authority	Status
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 obtained
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	Not Required
Aeronautical Obstruction Clearance Permit	Transport Canada	In Progress
Land Use permit	Navigation Canada	In Progress

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	Municipal County or Environment and Local Government	To be obtained

9.0 Signature

Table 9-1 below defines the concluding signature of this EIA for Natural Forces NB Inc.

Table 9-1: Signature Declaration

EIA TO BE CONDUCTED BY:	Natural Forces NB Inc.
PROPONENT:	Oinpegitjoig Wind Limited Partnership
PROPONENT SIGNATURE:	 Robert Apold, Director
DATE:	November 27, 2017

10.0 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 green house 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 RWP and other similar projects represents 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 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 this EIA, it can be concluded that there are no significant residual environmental effects predicted for the construction, operation, and decommissioning phases of the proposed RWP.

The following benefits would result due to the RWP 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 municipalities 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;
- Creation of supplementary income and income diversity for local landowners; and
- Creation of additional employment in the region during the entire Project life.

The RWP provides an excellent opportunity to transform and industrial brownfield site into a productive source of renewable energy providing source diversity while meeting increasing energy demands. The Proponent wishes to develop the proposed RWP 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 Environmental Impact Assessment to the Sustainable Development, Planning and Impact Evaluation Branch of the DELG and looks forward to working with provincial regulators to progress the RWP to a construction ready stage.

11.0 Works Cited

Adamus, P.R. (2016)Manual for the Wetland Ecosystem Services Protocol (Wesp). Accessed via http://people.oregonstate.edu/~adamusp/WESP/Manual_WESP1.3_13Oct2016_Adamus.pdf

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.

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.

Bird Studies Canada, 2012. Important Bird Areas of the Maritimes. http://www.ibacanada.org/maps/regions/Maritimes.pdf

Canadian Wildlife Service (2007). Recommended protocols for monitoring impacts of wind turbines on birds.

Canning, Simmons, AACI, FRI, CMR, PLE (February 2010). Wind Energy Study – Effect on Real Estate Values in the Municipality of Chatham-Kent, Ontario.

Clean Environment Act, R.S.N.B. 1973, c. C-6

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2006. Assessment and Status Report on the Rusty Blackbird Euphagus carolinus in Canada. Accessed from: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_rusty_blackbird_0806_e.pdf

Community Planning Act, R.S.N.B. 1973, c. C-12

Cornell Lab of Ornithology, 2015. All About Birds: Peregrine Falcon. Accessed from: https://www.allaboutbirds.org/guide/Peregrine_Falcon/lifehistory

Cornell Lab of Ornithology. 2007. All About Birds. The Basics Of Bird Migration: How, Why, And Where. Accessed from: https://www.allaboutbirds.org/the-basics-how-why-and-where-of-bird-migration/

Department of Environment and Local Government (2012) A Guide to Environmental Impact Assessment in New Brunswick. Retrieved from: http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/GuideEnvironmentalImpactAssessment.pdf

Department of Environment and Local Government (n.d.) 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 (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

Department of Fisheries and Oceans Canada (DFOC). Turcotte-lanteigne. A. Furguson. E. 2008. Ecosytem Overview of the Richibucto Watershed in New Brunswick.

Department of Natural Resources. 2007. Our Landscape Heritage: The story of ecological land classification in New Brunswick. Accessed online, October 10, 2017 via http://www2.gnb.ca/content/gnb/en/departments/erd/natural_resources/content/ForestsCrownLands/content/ProtectedNaturalAreas/OurLandscapeHeritage.html

Electricity from Renewable Resources Regulation (NB Reg. 2015-60) - Electricity Act

Enercon (2016) E-126/EP3 Overview of Technical Details. Retrieved From: https://www.enercon.de/en/products/ep-3/e-126-ep3/

Environmental Impact Assessment Regulation – Clean Environment Act

Environment Canada (2017). *Canadian climate normals 1971-2000*. Retrieved from website: http://climate.weather.gc.ca/climate_normals/results_e.html?searchType=stnProv&lstProvince=NB&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=6232&dispBack=0

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.

Environment Canada (2006). *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds.*

Environment Canada. Canadian Wildlife Service. 2007 Wind Turbines and Birds. A Guidance Document for Environmental Assessment. Accessed at: http://publications.gc.ca/site/eng/458437/publication.html

Froidevaux J. S. P., Zellweger, F., Bollmann, K. and Obrist, M. K. (2014) Optimizing passive acoustic sampling of bats in forests. Ecology and Evolution. 4(24) – 4690-4700.

Government of Alberta - Wildlife Management – Bat Mitigation Framework for Wind Power Development. 2013. http://aep.alberta.ca/fish-wildlife/wildlife-land-useguidelines/documents/WildlifeGuidelines-BatMitigationFramework-Jun19-2013.pdf

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

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

Kearney, J. (2012, November). Interview by Andy MacCallum [Personal Interview]. Lighting effects on migratory birds.

Kent District Planning Commission (2004) Town of Richibucto Zoning By law. [Retrieved from: http://www.richibucto.org/userfiles/file/04-11%20-%20Plan%20de%20zonage.pdf].

Lausen, C., Baerwald, E., Gruver, J., & Barclay, R. (2008). Bats and Wind Turbines. Pre-siting and preconstruction survey protocols. In M. Vonhof, *Handbook of Inventory Methods and Standard Protocols for Surveying Bats in Alberta.* Edmonton, Alberta: Alberta Sustainable Resource Development, Fish and Wildlife Division.

LeBlanc, Marc, Garrad Hassan. June 2007. Recommendations For Risk Assessments of Ice Throw and Rotor Blade Failure in Ontario; CanWEA Municipal issues and wind energy workshop.

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.

Ministry of Environment, Lands and Parks Resources Inventory Branch (MELPRIB) (1998) Terrestrial Ecosystems
Task Force Resources Inventory Committee Inventory Methods for Bats Standards for Components of British Columbia's Biodiversity No. 20
https://www.for.gov.bc.ca/hts/risc/pubs/tebiodiv/bats/index.htm

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

NOAA [National Oceanic and Atmospheric Administration], 1995: Surface weather observations and reports, Federal Meteorological Handbook No. 1, 94 p. [Available from Department of Commerce, NOAA, Office of the Federal Coordinator for Meteorological Services and Supporting Research, 8455 Colesville Road, Suite 1500, Silver Spring, MD, 20910.

Nova Scotia Department of Natural Resources (2012) Special Management Practices for Bald Eagle Nests. Accessed from: https://novascotia.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_Bald_Eagle_Nests.pdf

Ontario Ministry of Natural Resources. 2011. BATS AND BAT HABITATS Guidelines for Wind Power Projects. Second Edition.

Patriquin. K, Laureen K. Hogberg, Bryan J. Chruszcz, and Robert M. R. Barclay. 2003. Wildlife Society Bulletin 2003, 31(2):475–481. *"The influence of habitat structure on the ability to detect ultrasound using bat detectors".* Accessed from: https://kristapatriquin.files.wordpress.com/2015/06/patriquin-et al-2003.pdf

Patterson, J.W. (2012) Evaluation of New Obstruction Lighting Techniques to Reduce Avian Fatalities. Technical Report for the U.S. Department of Transportation.

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].

Roy, P. and Huard D. (2016). Future Climate Scenarios - Province of New-Brunswick. Montreal: Ouranos.

Saskatchewan Ministry of Environment (2015) Species Detection Survey Protocols - Common Nighthawk Surveys. [Retrieved from: http://www.environment.gov.sk.ca/adx/aspx/adxGetMedia.aspx?DocID=ae248a4a-8f91-46b4-8798-246827540829].

Seifert, H. Et al. April 9-11, 2003. Technical Requirements for Rotor Blades Operating in Cold Climate; BOREAS VI, Phya, Finland.

Smith, E.A. (2008) Bedrock geology of central New Brunswick (NTS 21 I and part of 11 L). New Brunswick Department of Natural Resources; Minerals, Policy and Planning Division. Plate NR-10. http://www2.gnb.ca/content/dam/gnb/Departments/en/pdf/Minerals-Minerales/NR10_2008.pdf

Sooley, D.R, E.A. Luiker and M.A Barnes. 1998. Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: River & Streams. Fisheries and Oceans, St. John's, NF. iii + 50 pp.

Statistics Canada (2011) National Household Survey Data for the Town of Richibucto, Village of Rexton, and Parish of Richibucto. [Retrieved from: http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/details/page.cfm?A1=All&B1=All&Code1=1308018&Data=Count&Geo1=CSD&Lang=E&SearchPR=01&SearchText=Richibucto&SearchType=Begins&TABID=1

Sullivan, R.G., Kirchler L. B., Lahti, T., et al (2012) Wind Turbine Visibility and Visual Impact Threshold Distances in Western Landscapes.

Thomas D. W. and West S. D.. (1989) Sampling methods for bats . United States Department of Agriculture, Forest Servive, Research Paper PNW-GTR-243:1–20

Toth, G., Gultepe, I., Milbrandt, J., Hansen, B., Pearson, G., Fogarty, C. and Burrows, W. (no date) The Environment Canada Handbook on Fog and Fog Forecasting. [Retrieved from: http://publications.gc.ca/collections/collection_2011/ec/En56-231-2010-eng.pdf].

Transportation and Infrastructure (2017) Spring Weight Restrictions. Retrieved from: http://www2.gnb.ca/content/gnb/en/departments/dti/trucking/content/spring_weight_restrictions.html

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.

Vonhof M. J. (2006) Handbook for inventory methods and standard protocols for surveying bats in Alberta . Alberta Fish and Wildlife Division, Edmonton, Alberta, Canada.

Vyn & McCullough, 2014. The effect of wind turbines on property values in Ontario: Does public perception match empirical evidence? *Canadian Journal of Agricultural Economics.* Volume 62, Issue 3, pages 365-392.

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

World Health Organization (2017) Electromagnetic Fields (EMF). Accessed via http://www.who.int/peh-emf/about/WhatisEMF/en/