DILLON CONSULTING

WOCAWSON ENERGY LIMITED PARTNERSHIP

Acoustic Bat Survey Report (Final)

November 2018 – 18-6975

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1.0 Introduction

Dillon Consulting Limited (Dillon) was retained by the Wocawson Energy Limited Partnership (WLP) to complete natural environment surveys in support of a future provincial registration for an Environmental Impact Assessment (EIA) for the Wocawson Energy Project (herein referred to as "the Project"). WLP is a partnership between Tobique First Nation (51%) and Natural Forces NB Inc. (49%).

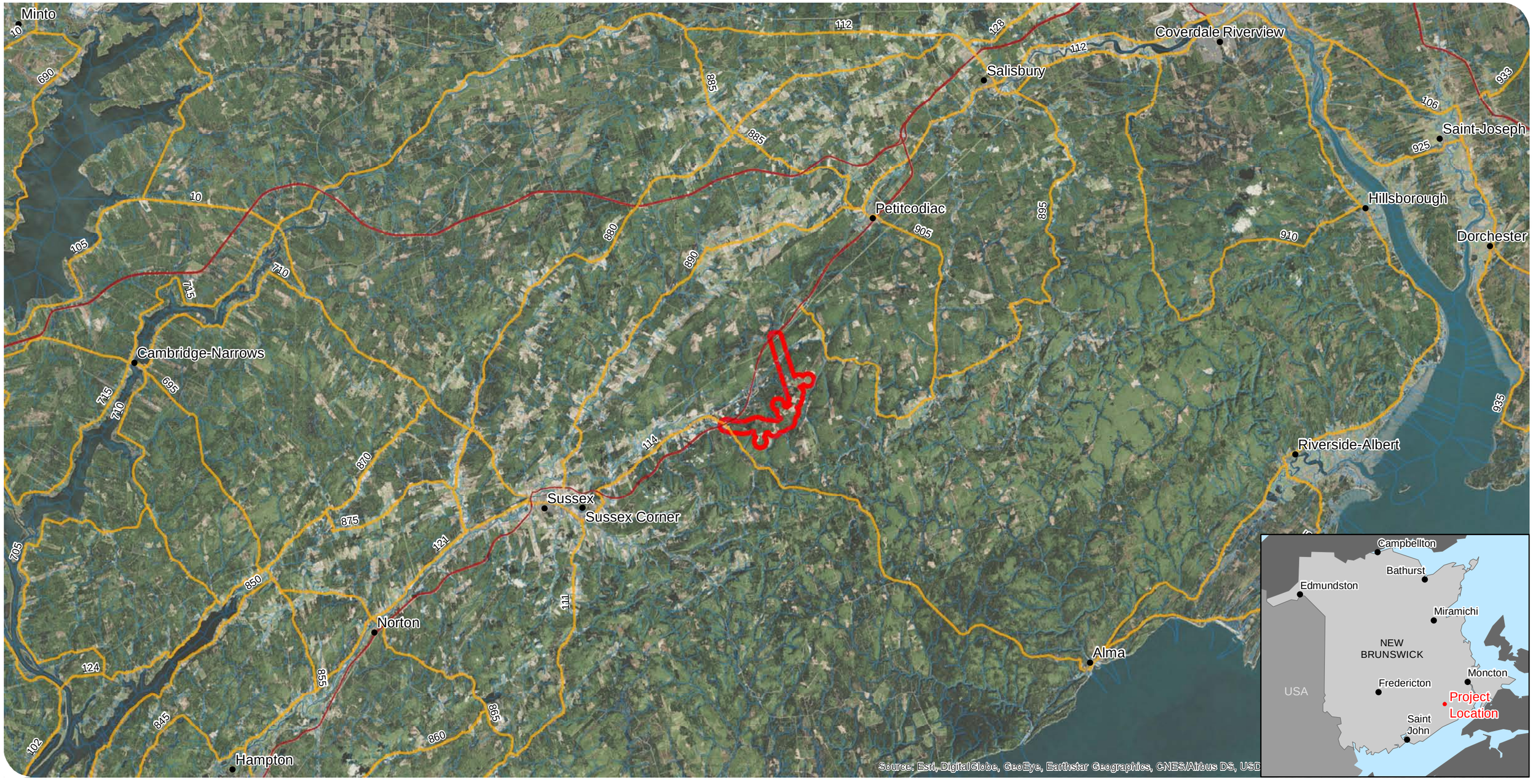
The proposed project is located within an undeveloped area, though regular tree harvesting has occurred. It is anticipated that the Project area may provide suitable habitat for bats, resulting in bats and bat habitat being considered an important feature and a valued component (VC) related to the proposed project. Natural environment surveys for the proposed project were conducted for VCs of the environment based on an understanding of the environmental features associated with the proposed project area, feedback from New Brunswick Department of Energy and Natural Resources (NBDERD) biologists, the nature of the proposed project, and the potential interactions that may occur between the proposed project and the environment/VCs.

This report provides a summary of the pre-construction bat acoustic monitoring program conducted in support of the Wocawson Energy Project EIA registration, and includes a brief description of the proposed project, a description of the approved scope and methodology used for the survey, a summary of the approved approach used to evaluate the bat acoustic data, and proposed mitigation based on industry best practices.

Though the bat acoustic surveys were completed over similar time frames as other focused environmental surveys (i.e. birds and bird habitat, vegetation, wetlands and watercourses, wildlife, and wildlife habitat), the focus of this report is on the bat acoustic monitoring results in the Project Assessment area. Separate reports were provided for other components of the environment, specifically for birds and bird habitat, wildlife and wildlife habitat, vegetation, and wetlands and watercourses.

1.1 Project Description

The 20-40 megawatt (MW) Project is expected to provide electricity to approximately 3,600 – 7,200 New Brunswick homes. The turbines for the proposed project are sited on approximately 1,150 hectares (ha) of Crown land located approximately 20 kilometres (km) east of the Town of Sussex, in Kings County, New Brunswick (**Figure 1**). The transmission line associated with the Project will extend across Crown land as well as private land to connect to the existing power grid.



NATURAL FORCES TECHNOLOGIES
Wocawson Energy Project

Wocawson Energy Project Location
FIGURE 1

Project Location
Watercourses

Road Network
Expressway / Highway
Freeway
Local / Street

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MAP DRAWING INFORMATION:
DATA PROVIDED BY NBDERD

MAP CREATED BY: JNH
MAP CHECKED BY: AS
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

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SCALE 1:300,000

FILE LOCATION: G:\CAD\GIS\186975_SUSSEX EAST\SUSSEX EAST WIND PROJECT\MAPS FOR REPORT\PROJECT LOCATION JULY 4 2018_JNH

PROJECT: 18-6975 STATUS: DRAFT DATE: 2018-07-18

Although the proposed project is anticipated to only include 6 turbines at this time, locations for 12 turbines were assessed to allow WLP the opportunity to refine the project footprint based on environmental constraints and to plan for potential future growth. A Wind Resource Assessment was completed and seven additional alternative locations for potential turbine sites were identified for maximum power production (Figure 2).

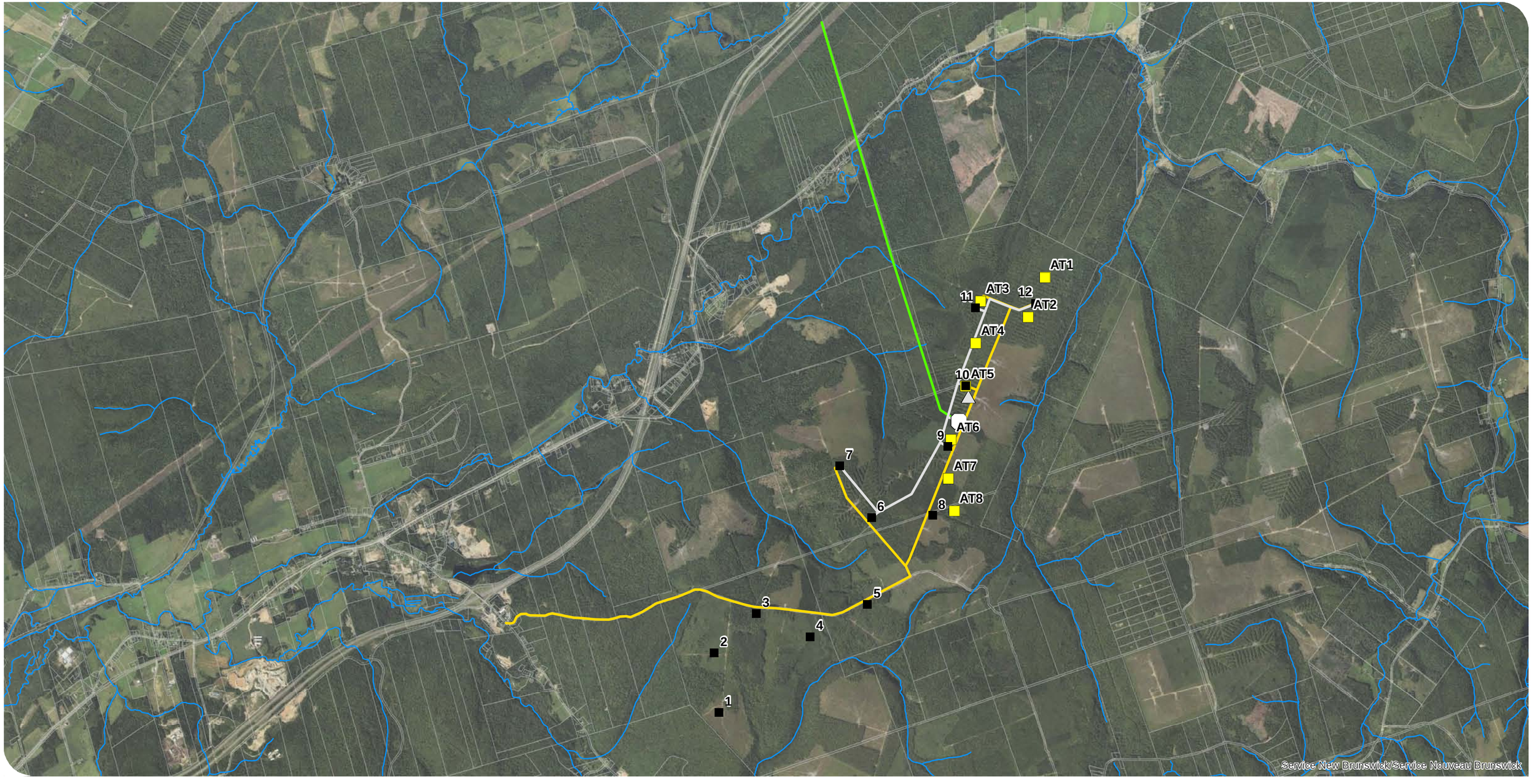
The proposed project includes a maximum of 12 turbines, connector lines, a substation and transmission line, as well as upgrades to pre-existing road infrastructure (Mitton Road) (Figure 2). Mitton Road (located off NB Route 114) is the main access to the proposed project area.

The proposed turbine layout includes sites for up to 12 turbines located along an elevated area running approximately northeast-southwest between elevations 225 metres (m) and 275 m above mean sea level (amsl). The general project area is recognized to have an energetic wind regime due to its high elevation (Natural Forces, 2018). Local topography is undulating, with several low ridges also following a northeast-southwest orientation.

The majority of the proposed project site is characterized as being predominantly in an early stage of forest regeneration due to historic and recent commercial forestry operations. Many of the turbine locations have been selected in areas of recent cut over (i.e., clear-cut and select-cut areas) to minimize potential adverse effects on the natural environment. No mapped watercourses or wetlands were observed within the footprint of the proposed turbine locations. One small unmapped ephemeral drainage channel was observed along Mitton Road (i.e. the proposed road upgrade).

The proposed transmission line runs approximately north-south and crosses a variety of land uses such as rural residential property, recent clear cuts, and areas of immature to mature coniferous and deciduous forests in various stages of regeneration. The northern portion of the proposed transmission line crosses three mapped and one unmapped watercourse, respectively. Although the proposed transmission line does not cross any mapped (regulated) wetlands, it does cross three unregulated wetlands. One of the three unregulated wetlands is located in low lying floodplain (riparian) habitat associated with the Kennebecasis River, and has been identified on the Service New Brunswick [SNB] draft beta wetland mapping currently being proposed by the New Brunswick Department of Environment and Local Government (NBDELG).

To facilitate the existing forestry operations, several logging roads have been constructed and maintained across the area. WLP has selected the proposed project site to use existing roads reducing the need for new road construction. Additionally, several groomed snowmobile trails pass through the proposed project area and are frequently used during the winter months. WLP recognizes that the local snowmobile club is a concerned stakeholder and thus WLP has selected the proposed locations for project infrastructure to minimize the possibility that snowmobile trails would be affected, or that construction of new trails may be required as a result of the Project.



NATURAL FORCES INC
Wocawson Energy Project

Wocawson Energy Project Site Plan
FIGURE 2

- Potential Alternative Turbine Locations
- Proposed Turbine Locations
- Proposed Substation
- Met Tower
- Proposed Road Upgrade
- Proposed Transmission Line
- Watercourses
- Proposed Collector
- PID

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MAP DRAWING INFORMATION:
DATA PROVIDED BY NBDERD

MAP CREATED BY: JNH
MAP CHECKED BY: ACS
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

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PROJECT: 18-6975 STATUS: DRAFT DATE: 2018-11-23

1.1.1 Siting Considerations

WLP has extensive knowledge with respect to the development of wind farms on lands with favourable characteristics to provide efficient renewable energy. Many considerations are taken into account during site selection that focus on efficiently delivering renewable energy to the local community in a way that minimizes the effects on the community and the environment (Natural Forces, 2018).

Specifically, the proposed project area is favourable due to the following characteristics (in no particular order): the available wind resource, the project distance from residential dwellings and environmentally sensitive features, proximity to the New Brunswick Power (NB Power) transmission system, and the existing land use and disturbed nature of the area due to extensive forestry activities (Natural Forces, 2018). The following is a list of factors that have been considered during the site selection and design process:

Technical Considerations:

- Sufficient wind resource;
- Regional topography;
- Proximity to transmission system; and
- Turbine technology.

Environmental Considerations:

- Proximity to provincially regulated wetlands;
- Proximity to residential dwellings or other sensitive buildings;
- Sensitivity of flora and fauna;
- Proximity to provincial or national parks and nature reserves; and
- Risk of archaeological resource disturbance.

Land use considerations:

- Known culturally significant areas;
- Current land use;
- Historical land use;
- Future land use;
- Available access to the land; and
- Proximity to residential properties, communities and towns.

1.1.2 Physical Components of the Project

The proposed project will consist of 6-12 Enercon wind energy generators, and turbine height is not expected to exceed approximately 135 m in total hub height with a blade length of 72 m (exact model not yet determined). Refer to **Figure 3** for a conceptual rendering of the proposed turbine design.

The transmission line will extend approximately 5.6 km across privately owned lands, within a cleared corridor approximately 75 m wide, and will connect with existing New Brunswick Power infrastructure along the New Brunswick Department of Transportation and Infrastructure (NBDTI) right-of-way for Route 1. The proposed project's output at the point of interconnection to the electrical grid will be 20 - 40 MW.

The project's lifespan ('design life') is expected to be 30-years; which is unique to Enercon wind turbines (Natural Forces, 2018). The 30-year design life allows the Project to align itself with a 30-year Power Purchase Agreement (PPA) with NB Power, and allows for a longer, stable energy production. Natural Forces has used Enercon machines exclusively for all its community wind projects currently under operation and has a long-standing relationship with the company.

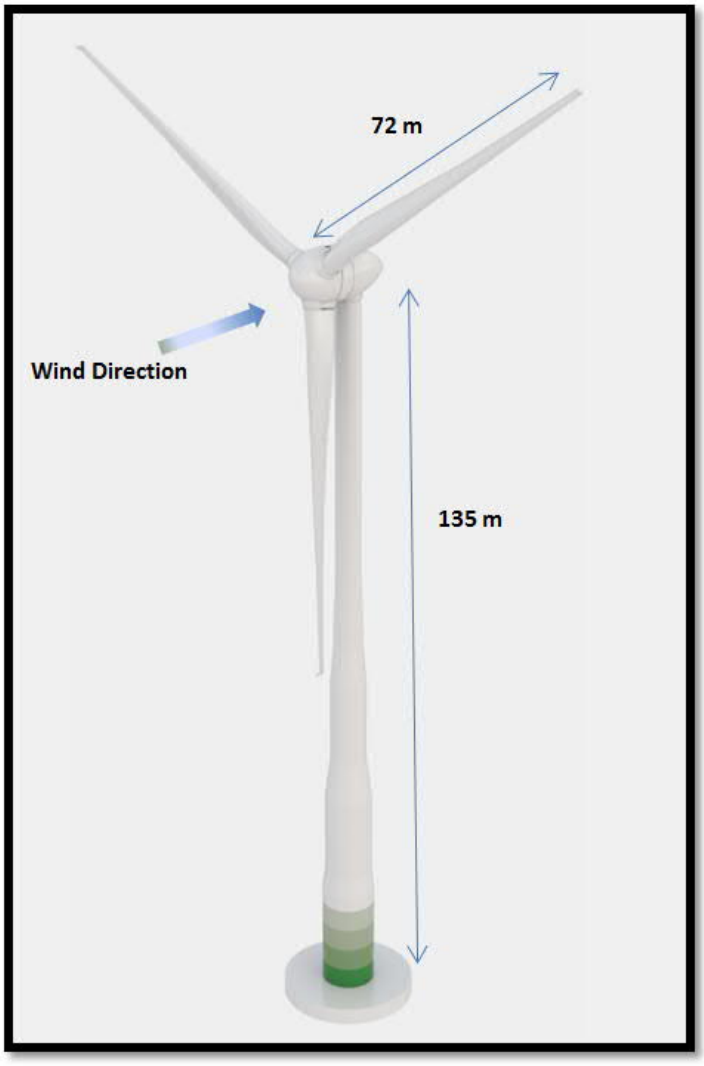


Figure 3: Anticipated Turbine Hub and Blade Lengths
Base photo reference: Enercon https://www.enercon.de/en/products/ep-4/e-141-ep4/

1.1.3 Project Schedule

The proposed project schedule and activities are currently arranged as four distinct phases, as described in **Table 1**, below:

Table 1: Anticipated Project Schedule

Phase	Phase Details	Anticipated Schedule
1. Development Phase	This phase includes the post power purchase agreement development activities (including the EIA and related work).	Q4-2017 to Q1-2019
2. Pre-Construction Phase	This phase includes pre-construction activities, including: financing arrangement for debt and equity, wind turbine supply negotiation, site design, execution of the Facilities Study Agreement, tendering for construction contracts, and final construction-related permitting.	Q4-2018 to Q2-2019
3. Construction Phase	This phase includes construction and commissioning related activities, including: tree clearing and grubbing, road building, electrical works, foundation pour, turbine delivery, turbine assembly, and final Project commissioning.	Q1-2019 to Q4-2019 Commercial Operation Date (COD) is anticipated in Q4-2019
4. Operation Phase	This phase includes activities that occur during the operation of the wind project, including: post-construction monitoring, annual monitoring reports, remote monitoring of turbine performance, and maintenance.	Q4-2019 to decommissioning of the turbines (30-year lifespan)

The decommissioning phase of the Project will include activities required to decommission the project at the end of its service life, including the removal of the turbine materials and associated infrastructure to an appropriate underground depth and restoration of the site. The precise timing of the decommissioning of the proposed project is currently unknown. If possible, the lifespan of the wind turbines may be extended by replacing parts or otherwise refurbishing them to produce additional energy after their original 30-year lifespan. Therefore, the decommissioning phase of the project is not considered within the scope of this assessment. Once the proposed project is approaching the end of its useful life, a decommissioning plan will be submitted to the NBDELG prior to undertaking decommissioning activities, which reflects the guidelines and regulations in place at that time.

2.0 Bat Acoustic Survey Scope and Methodology

Seven bat species are known to occur in New Brunswick and have the potential to occur within the assessment area. Of the seven bat species, three are listed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the federal Species at Risk Act (SARA), and the NB Endangered Species Act: little brown myotis (*Myotis lucifugus*), Northern myotis (*Myotis septentrionalis*), and tri-colored bat (*Perimyotis subflavus*). The aforementioned species are resident species and are known to hibernate in caves or abandoned mines in New Brunswick (Dilworth 1984, Environment Canada 2015) and have been reported within 100 km of the assessment area (AC CDC 2018). The big brown bat (*Eptesicus fucus*), is believed to over-winter primarily in anthropogenic structures in New Brunswick (McAlpine et al. 2002). The remaining three species known to occur in New Brunswick: Eastern red bat (*Lasiurus borealis*), Hoary bat (*Lasiurus cinereus*), and Silver-haired bat (*Lasionycteris noctvagans*), are considered migratory species (Dilworth 1984) as they fly south in the fall to over-winter.

This section details the scope of the pre-construction bat acoustic monitoring program conducted for the proposed project, and the methods that were used to conduct the desktop and field assessments.

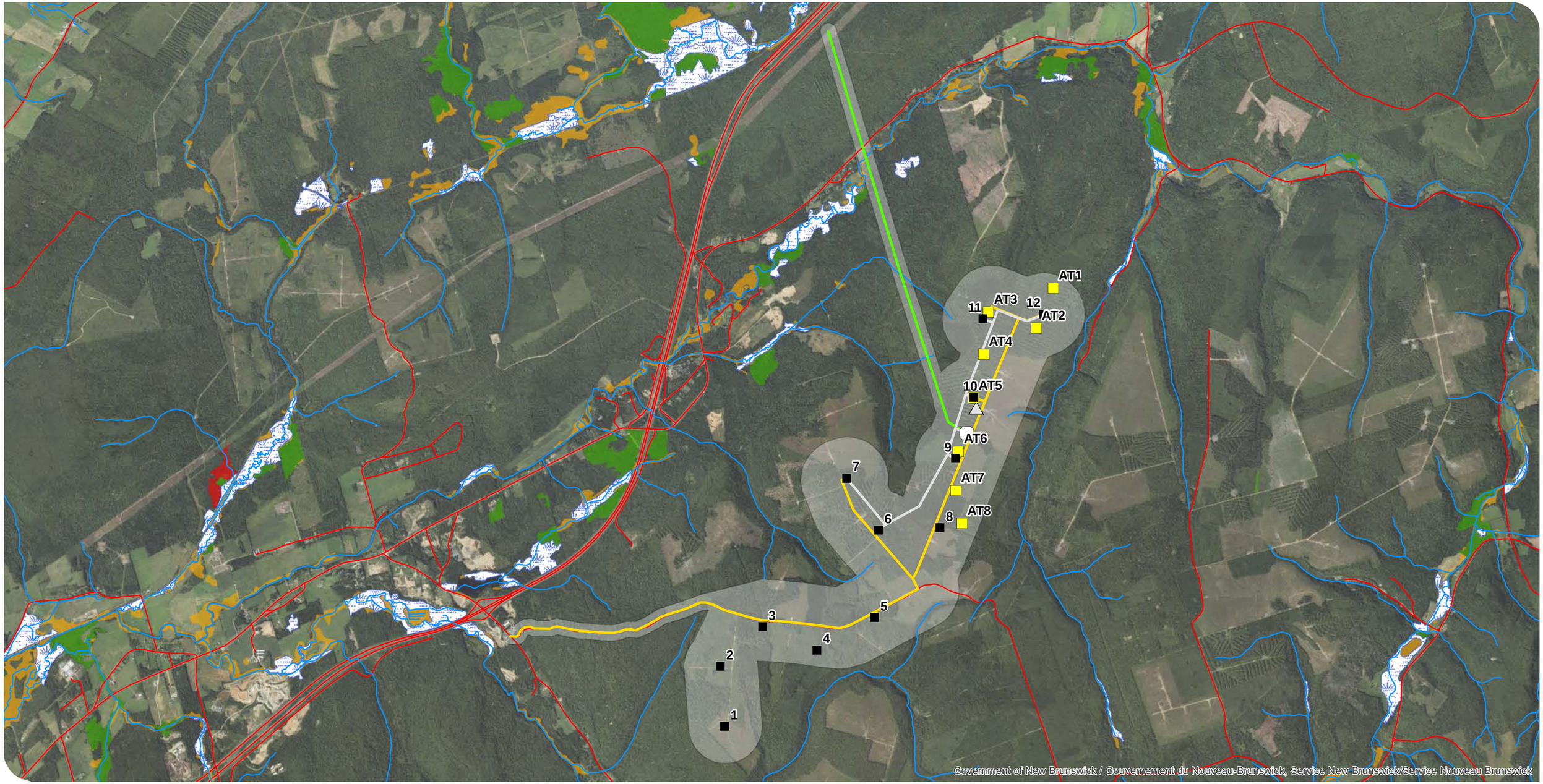
2.1 Survey Protocols and Scope of Work

2.1.1 Spatial Boundaries

For the purpose of this assessment, the spatial boundaries (i.e., the assessment area) were identified as the area encompassed in the study area as shown on **Figure 4** and included the access roads, turbine locations (plus a 500 m radius surrounding each turbine), and the transmission/connection lines (consisting of a 150 m-wide corridor), extending between the proposed project location to the existing power infrastructure. Refer to **Figure 4** for an illustration of the Project assessment area.

2.1.2 Temporal Boundaries

The temporal boundaries for the assessment define the time periods for which likely environmental effects of the Project are considered. The temporal boundaries of this assessment include the duration of the construction phase (approximately 1-year in duration during 2019) and subsequent operation phase (approximately 30-years following construction) of the Project. In the construction phase, specific construction-related effects are anticipated to be short term and limited to either the duration of the activities that produce the effects or the duration of the construction phase. Effects associated with the operation phase are longer term, as the proposed Project is intended to be operational for at least 30-years; although the lifespan may be extended with routine maintenance or refurbishment as appropriate.



NATURAL FORCES INC
Wocawson Energy Project

Wocawson Energy
Project Assessment Area
FIGURE 4

- Potential Alternative Turbine Locations
- Proposed Turbine Locations
- Proposed Substation
- Met Tower
- Proposed Collector
- Proposed Road Upgrade
- Proposed Transmission Line
- Roads
- Watercourses
- Regulated Wetlands
- Assessment Area

NBDELG Draft Beta Wetland Mapping (unregulated)

- Provincially Significant Wetlands
- Intermediate Wetlands
- Forested Wetlands

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MAP DRAWING INFORMATION:
DATA PROVIDED BY NBDERD

MAP CREATED BY: SCN
MAP CHECKED BY: ACS
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

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SCALE 1:45,000

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SUSSEX EAST WIND PROJECT\MAPS FOR REPORT\STUDY AREA
JULY 9 2018_JNH

PROJECT: 18-6975 STATUS: DRAFT DATE: 2018-11-23

2.1.3 Scope of Work

Bats and bat habitat were selected as a valued component (VC) related to the proposed project with potential interactions due to the possible environmental effects of:

- A potential change or alteration of habitat as a result of the proposed project activities;
- Effects to individuals due to collisions with turbine towers and turbine blades (i.e. direct mortality); and
- Modifications of movement patterns or flight paths.

Based on the Pre-Construction Bat Survey Guidelines (NBDNR, 2009), a background and desktop analysis followed by acoustic bat surveys for a minimum of 1-year prior to construction during both the early-breeding season (June 1 to June 30) and the late-summer and early-fall migratory period (August 15 to September 15) is required. A minimum of 40 hours of survey distributed over a minimum of 10 nights with a minimum of 4 hours per night starting 30 minutes after sunset is required for each the early breeding and late-summer early-fall migration periods, respectively. The guidelines require additional pre-construction bat acoustic survey effort during the late-breeding season (July 1 to July 31) and late-fall migration period (September 15 to October 15) if the proposed wind facility and surrounding areas contain high risk habitat features (i.e., within 5 km of a known hibernacula, or potential cave or abandoned mine; within 500 m from a coast line or other major water bodies; or located on or near forested ridge habitats) with 40 hours of survey over a minimum of 5 nights.

Although the site is not considered as a high risk area, surveys were designed to capture the entirety of the breeding season and migration period (June 1 to October 31; inclusive) from dusk to sunrise. This approach well exceeds the minimum survey requirements identified in the 2009 guidelines, reduces data biases, and eliminates data gaps during the vulnerable bat periods. Methodologies used for the scope of the desktop analysis and field surveys listed above are outlined within the following sections.

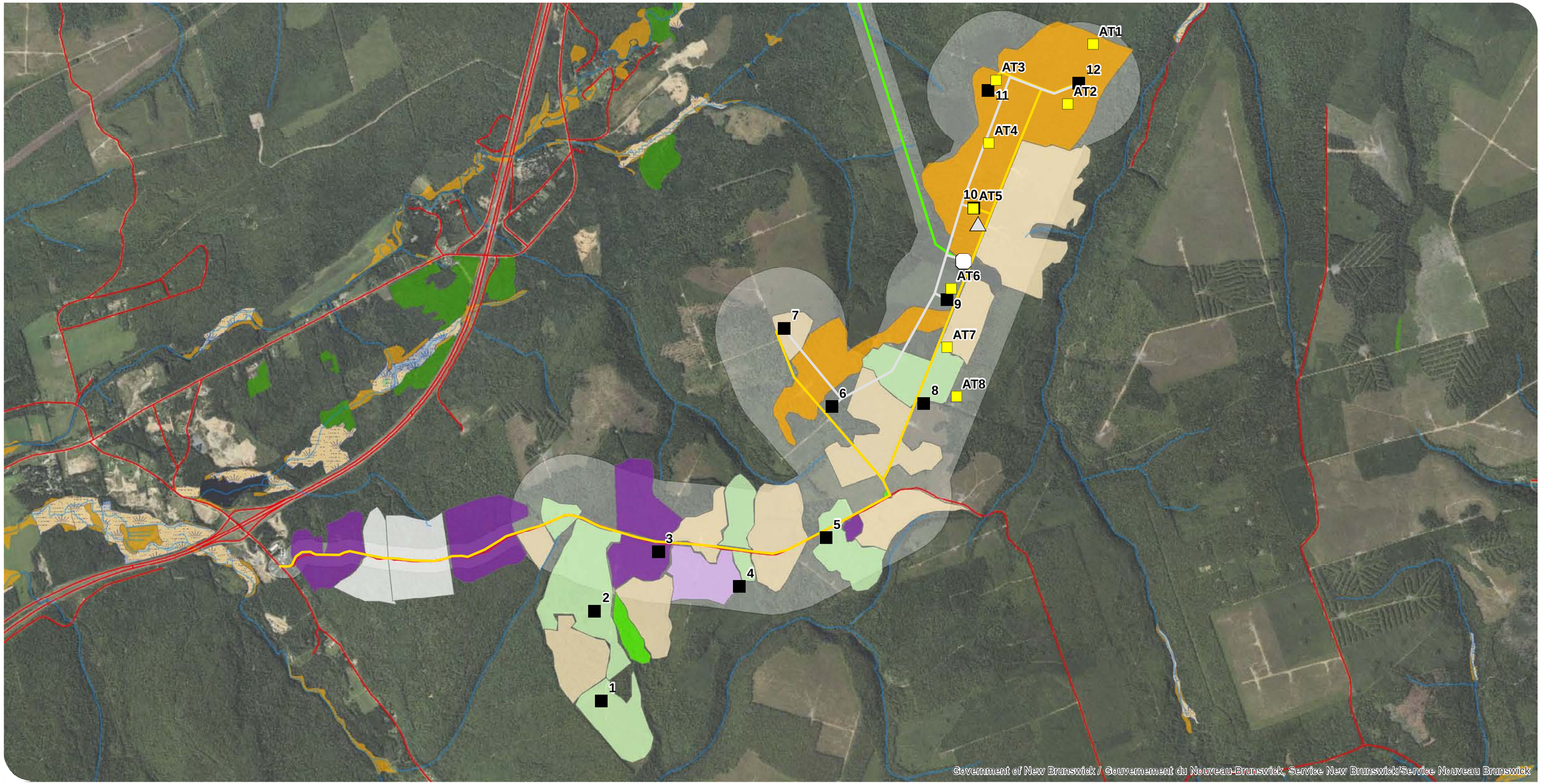
WLP understands that one of the key environmental concerns associated with wind projects is the potential for direct effects to bats. As such, WLP undertook consultation with NBDERD regarding the level of effort for the acoustic survey program. In email correspondence dated May 17, 2018, the NBDELG EIA project manager indicated that NBDERD was satisfied with the level of effort for the acoustic survey program; however, it was recommended that one of the four proposed acoustic stations be relocated. As a result, an acoustic station was relocated to the location suggested by NBDERD prior to mobilization of the bat acoustic program.

2.2 Desktop Assessment Methodology

Prior to completing the acoustic surveys, Dillon reviewed readily available information from reputable sources. The information was reviewed to evaluate the potential for high risk habitat features or other available information that could be used to refine the survey program. Dillon completed a review of the following sources, data lists, and publications prior to completing the field surveys:

- Atlantic Canada Conservation Data Centre (AC CDC);
- Environment and Climate Change Canada (ECCC) Species at Risk Reports;
- New Brunswick Department of Natural Resources (NBDNR) Species at Risk Reports;
- The federal Species at Risk Registry;
- The COSEWIC;
- Publicly available GIS map layers (e.g., ecological land classification, forest and non-forest inventory, wetland inventory, Protected Natural Areas, Wildlife Management Zones);
- Environmentally Significant Areas Database;
- Ecological Reserves in the Maritimes;
- Province of New Brunswick's Mine Opening Inventory Map;
- The General Status of Wildlife in New Brunswick publication; and
- Available aerial photography.

Approximate extents of different habitat types in the assessment area are presented on **Figures 5A and 5B,** respectively.



NATURAL FORCES INC
Wocawson Energy Wind Project

Wocawson Energy Project
Terrestrial Habitat Types
FIGURE 5A

Potential Alternative Turbine Locations
Proposed Turbine Locations
Proposed Substation
Met Tower

Proposed Road Upgrade
Proposed Collector
Proposed Transmission Line
Watercourses

Roads
Regulated Wetlands
Assessment Area

Terrestrial Habitats
Pre-Commercial Thinning
Clear Cut
Strip Cut
Select Cut Mixedwood
Immature Mixedwood
Semi-Mature to Mature Mixedwood
Softwood Plantation
Semi-Mature to Mature Softwood
Semi-Mature to Mature Hardwood
Pine Retention
Potential Wetland

NBDELG Draft Beta Wetland Mapping (unregulated)
Provincially Significant Wetlands
Intermediate Wetlands
Forested Wetlands

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MAP DRAWING INFORMATION:
DATA PROVIDED BY NBDERD

MAP CREATED BY: JNH
MAP CHECKED BY: ACS
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

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PROJECT: 18-6975 STATUS: DRAFT DATE: 2018-11-23

NATURAL FORCES INC
Wocawson Energy Wind Project

Wocawson Energy Project
Terrestrial Habitat Types
FIGURE 5B

Potential Alternative Turbine Locations
Proposed Turbine Locations
Proposed Substation
Met Tower
Proposed Road Upgrade
Proposed Collector
Proposed Transmission Line
Watercourses
Roads
Regulated Wetlands
Assessment Area

Terrestrial Habitats
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Semi-Mature to Mature Hardwood
Pine Retention
Potential Wetland

NBDELG Draft Beta Wetland Mapping (unregulated)
Provincially Significant Wetlands
Intermediate Wetlands
Forested Wetlands

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MAP DRAWING INFORMATION:
DATA PROVIDED BY NBDERD

MAP CREATED BY: JNH
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PROJECT: 18-6975 STATUS: DRAFT DATE: 2018-11-23

2.3 Field Survey and Data Analysis Methodology

Five acoustic stations were installed to collect data from representative habitat types located in the assessment area (**Figure 6** and **Table 2**). Each station was equipped with a Wildlife Acoustics SM3BAT or SM4BAT full-spectrum ultrasonic bat detector and condenser microphone(s) (i.e., SMM-U1), with an effective recording range of approximately 25 – 30 m in open environments (Photo 1 and Photo 2). The microphones were equipped with a foam wind screen to reduce interference from wind and were aimed away from the prevailing wind direction and tilted slightly downward to protect from precipitation. Prior to deployment, each microphone was calibrated to the manufacturer's specification. Each detector was powered by a 12 volt battery charged by a solar panel. For each the SM3BAT and SM4BAT, the following settings were programmed for the duration of the acoustic program:

- Trigger Frequency Minimum: 16 kHz;
- Trigger Frequency Maximum: 192 kHz;
- Trigger Level: Automatic (12dB);
- Trigger Window Setting (recording continues until no trigger is detected): 3 seconds, or when the maximum file duration (i.e., 15 seconds) was reached;
- Sample Night: from dusk (30 minutes before sunset) to sunrise; and
- Gain Level: Automatic (12dB).

Photo 1: Wildlife Acoustics SM3BAT detector used at Station 3.

Photo 2: Wildlife Acoustics SM4BAT ultrasonic bat detector and condenser microphone used at station 1.

Following the completion of the bat acoustic program, the data was analyzed using the automated software Kaleidoscope Pro (Wildlife Acoustics, vers. 5.0.0) with the following settings:

- Minimum number of pulses = 2;
- Division Ratio = 8;
- Time Expansion Factor = 1;
- Duration = 2 – 500 ms; and
- Frequency Range = 16 – 120 kHz.

Using the automated bat species classifier for North America for the New Brunswick region provided by Kaleidoscope Pro, each acoustic file was first identified to species (where possible) and/or identified as either NoID (i.e., no identification - pulses recorded but unable to identify species) or NOISE (i.e., no pulse recorded). All files from the auto-analysis were manually reviewed in Kaleidoscope viewer by a biologist trained in bat acoustic identification.

Bat species produce unique call characteristics; however, there is overlap in certain call patterns in species, some of which call within the same frequency range. Additionally, call recordings may lack sufficient detail to allow species level identification due to factors such as; background noise, distance from the detector, weather and other environmental factors. As such, species and/or species groups were identified based on maximum frequency, minimum frequency, call duration and shape (Jones and Siemers, 2010) during the manual data review process and classified as follows (van Zyll de Jong 1985):

- **EPFU/LANO/LABO** – [Big brown bat/Silver-haired bat/Eastern red bat]: Both Silver-haired bats and big brown bats produce calls with a constant frequency (CF) tail around 22 – 25 kHz. Although eastern red bats are the only species to produce calls with a minimum frequency between 30 – 35 KHz, they also produce calls with lower minimum frequencies within the range of big brown and silver-haired bats. As such, Eastern red bats were included in this species group.
- **LACI** –Hoary bat: Noticeably lower in frequency, with calls ranging from 25 to 18 kHz (maximum to minimum frequency). Calls are also noticeably longer in duration, with a longer CF tail compared to other bat species known to occur within the assessment area. Hoary bats can, therefore, be reliably differentiated from all other species.
- **MYOTID SP + PESU** – [Little brown Myotis, Northern Myotis, and Tri-colored bat]: unlike the species outlined above, the species in this group produce shorter duration calls with a minimum frequency between 40 – 45 kHz, and maximum frequencies ranging between 120 kHz and 80 kHz. Occasionally myotis calls can, however, have a minimum call frequency of 35 kHz; though their maximum call frequencies distinguish them from potential Eastern red bat calls.

Ecologically, these classification make sense as Hoary bats are typically confined to more open habitats, the EPFU/LANO/LABO group typically forage in open and along woodland edges, and the MYOTID SP + PESU group are the most agile and therefore may be found in more cluttered environments (van Zyll de Jong 1985).

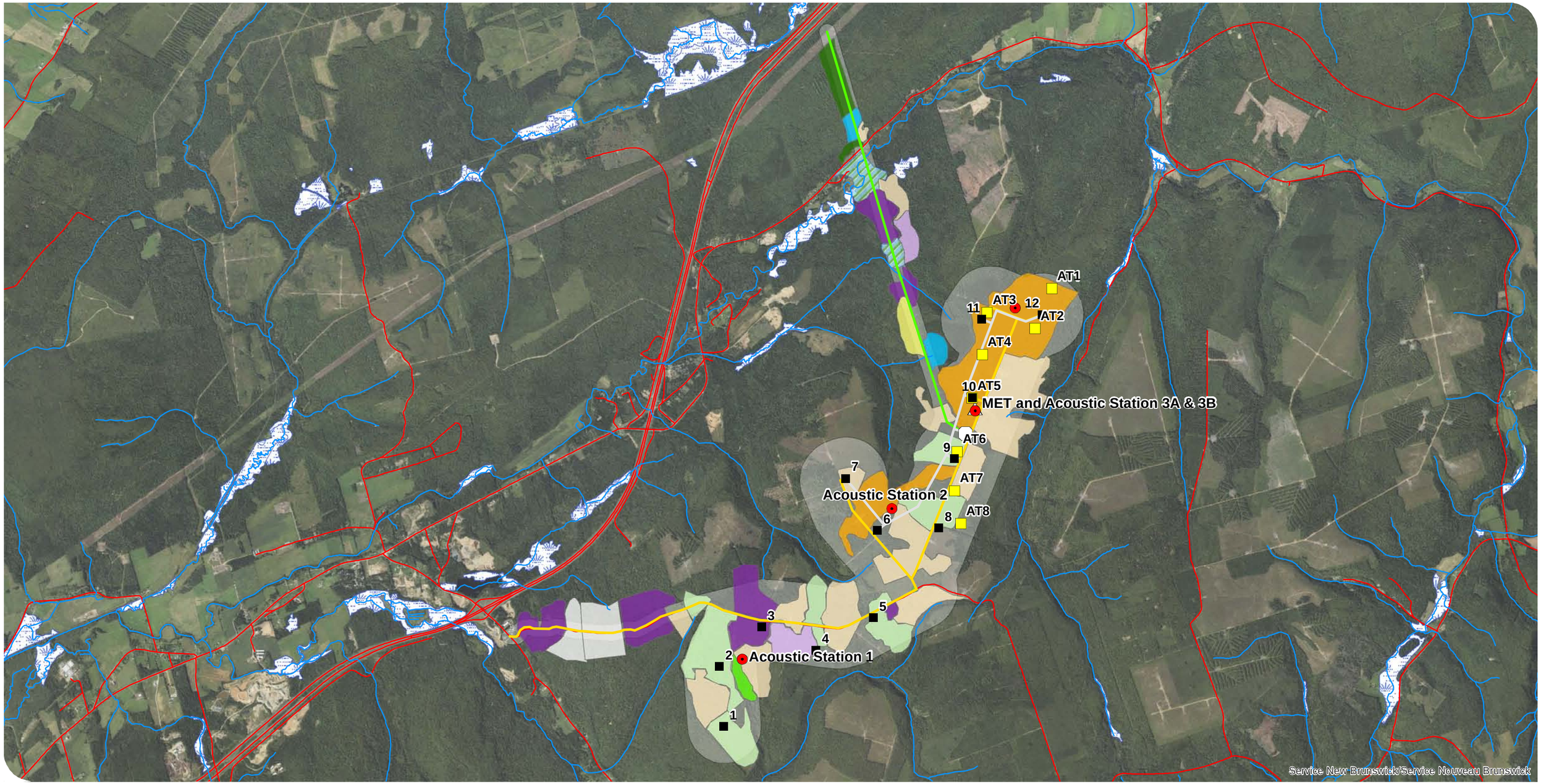
The acoustic monitoring stations were deployed on May 31 through to October 31, 2018.

Of the five acoustic stations, one station was located on the existing meteorological tower (MET) at approximately 30 m above ground level, to collect bat activity within the upper blade sweep area (**Figure 6**, Station 3B). An additional four acoustic survey stations were mobilized at ground level (~ 1.5 to 2 m above ground) to capture the site boundaries, turbine clusters, and representative habitat types within the study area. The ground level monitors were installed approximately 1.5 - 2 m above ground using microphone clips secured to polyvinyl chloride (PVC) pipe driven in to the ground. The MET included both a ground level as well as an elevated (i.e. 30 m) acoustic station. Refer to **Figure 6** for the acoustic station locations within the assessment area.

Table 2: Acoustic Station Characteristics

Acoustic Station ID	Representative Photo	Detector Height	Habitat Description
Acoustic Station 1		Ground Level	Acoustic station 1 was deployed at the southwestern end of the assessment area near the edge of a recent clear cut adjacent to a small mature mixed softwood stand (approx. 3.2 ha) with several large white pine retention trees.
Acoustic Station 2		Ground Level	Centrally located in the project assessment area near the edge of a clear cut adjacent to an area of hardwood dominant mixed forest that has been strip cut.
Acoustic Station 3a and 3b		30 m Above Ground Level and Ground Level.	At the on-site MET tower in a large clearing adjacent to semi-mature mixed forest and a large clear cut. One microphone was raised approximately 30 m above ground with an additional microphone at ground level (~ 2 m above ground).

Acoustic Station ID	Representative Photo	Detector Height	Habitat Description
Acoustic Station 4		Ground Level	At the northeastern end of the project assessment area at the edge of a hardwood dominant stand.



NATURAL FORCES INC
Wocawson Energy Project

Wocawson Energy
Acoustic Station Locations
FIGURE 6

Acoustic Station Locations
Potential Alternative Turbine Locations
Proposed Turbine Locations
Proposed Substation
Met Tower

Proposed Road Upgrade
Proposed Collector
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PROJECT: 18-6975 STATUS: DRAFT DATE: 2018-11-23

3.0 Acoustic Survey Results

According to the project specific AC CDC data report, there are no known bat hibernaculum within the assessment area (AC CDC 2018) and no observations of potential bat hibernacula were made during surveys in the Assessment area. Critical habitat as defined in the proposed recovery strategy (ECCC, 2015) does not overlap with the assessment area. A review of existing information indicates that there are no known hibernacula, caves, or abandoned mines (based on the Province of New Brunswick's Mine Opening Inventory Map) within 5 km of the Project assessment area, and it is not within 500 m of a coast line or major water body (ECCC, 2015).

A total of 354 bat passes were recorded over 591 detector nights between June 1 and October 31, 2018. Station 2 had a malfunction between July 27 and August 22 which was caused by low battery power resulting from the solar panel being disconnected from the unit after the microphone stand was knocked over; likely a result of wildlife interference. Station 2 was excluded from calculations of the number of bat passes/detector-night during this time as it was unable to record passes. The elevated station on the MET tower (Station 3a) recorded only 2 bat passes during the entire sampling period (June 1 to October 31) which were both recorded on the first night of the survey. The remaining sound files recorded at the elevation MET station (1,216 files) were identified as Noise which is suspected to have been caused by an electromagnetic frequency emitted from the MET and/or other electrical equipment installed on the MET. There is no way to determine if the extraneous noise recorded from the MET tower precluded recordings of bat passes at the elevated station. As such, as a conservative measure, the elevated MET station was excluded from calculations of the number of bat passes / detector night after the first night of data recording. The elevated monitor was functioning properly throughout the survey period, however, we believe the ability to capture bat passes at the elevated microphone may have been compromised due to the unknown sound interference.

The number of bat passes recorded throughout the entire monitoring period are presented in **Figures 7** and **8.** Average number of bat passes per detector per month were also calculated from the total of all bat passes and are provided in **Table 3.**

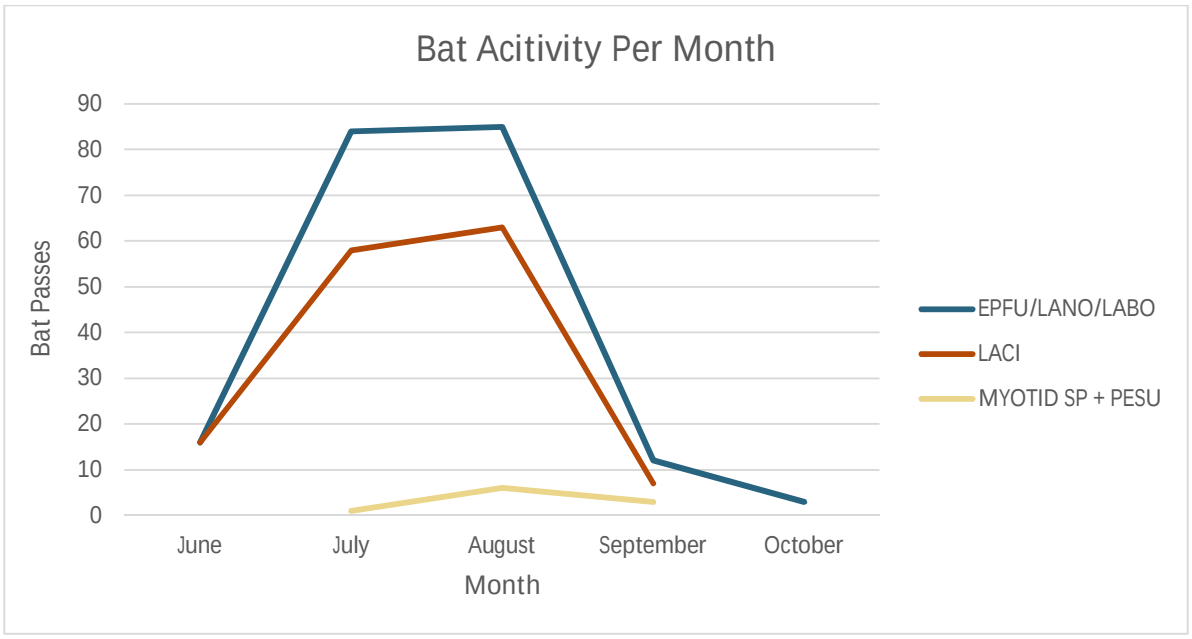

Figure 6: Total number of bat passes per month per species/species group during the 2018 monitoring period

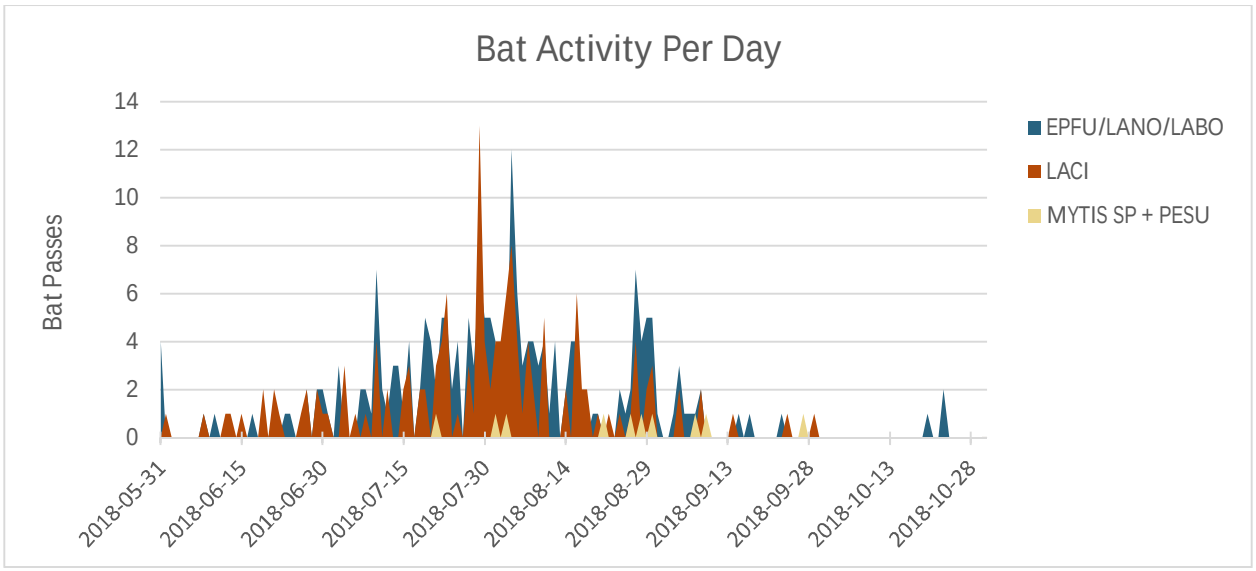

Figure 7: Total number of bat passes per day per species/species group during the 2018 monitoring period.

Table 3: Average number of bat passes per detector night across the assessment area for each month of the 2018 assessment period.

Month	Average number of bat passes/Detector-night
June	0.25
July	1.28
August	1.54
September	0.18
October	0.02

The highest level of bat activity was recorded in August with an average of 1.54 bat passes/detector-night followed by 1.28 bat passes/detector night in July. Bat activity diminished substantially in September and October with only 0.18 and 0.02 bat pass/detector night, respectively. The EPFU/LANO/LABO species group accounted for 200 (or 56%) of all bat passes, while Hoary Bat (LACI) accounted for 144 (or 40%). The MYOTID SP + PESU group which includes the three Species at Risk, accounted for 10 (or 3%) of the bat passes recorded.

Summaries of bat activity during the breeding period (June 1 – July 31, 2018) and migration period are provided in **Table 4** and **Table 5**, respectively. Bat activity was higher during the breeding period than the migration period at all stations (**Table 4 and 5**).

During both the breeding and migration periods Station 4 had the highest level of bat activity recorded with a total of 126 (or 36%) passes, while Station 2 had the lowest level of activity with a total of 47 (or 13%) passes (**Figure 9**). EPFU/LANO/LABO were the most commonly recorded species/species group during the breeding and migration periods followed by hoary bats (LACI). The majority of MYOTID + PESU were recorded during the migration period (9 of 10 calls).

Table 4: Summary of Bat Activity at Each Monitoring Station during the Breeding Period (June 1 – July 31, 2018)

	Station 1	Station 2	Station 3A (ground)	Station 3B (elevated)	Station 4	Total*
Number of Survey Nights	61	56	61	61	61	239
Total Number of Recorded Bat Passes	44	23	42	2	64	173
Number of recorded EPFU/LANO/LABO passes	20	10	30	1	39	99
Number of LACI passes	23	13	12	1	25	73
Number of MYOTID SP + PESU	1	0	0	0	0	1
Total Bat passes per Detector-night	0.72	0.41	0.69	0.03	1.05	0.72

* Survey effort for the elevated station was excluded from calculation of total survey effort after the first night of survey due to equipment malfunction.

Table 5: Summary of Bat Activity at Each Monitoring Station during the Migration Period (August 1 – October 31, 2018).

	Station 1	Station 2	Station 3A (ground)	Station 3B (elevated)	Station 4	Total*
Number of Survey Nights	92	71	92	92	92	347
Total Number of Recorded Bat Passes	61	24	32	0	62	179
Number of recorded EPFU/LANO/LABO passes	24	10	20	0	46	100
Number of LACI passes	31	12	12	0	15	70
Number of MYOTID SP + PESU passes	6	2	0	0	1	9
Total Bat passes per Detector-night	0.66	0.34	0.35	0	0.67	0.52

* Survey effort for the elevated station was excluded from calculation of total survey effort after the first night of survey due to equipment malfunction.

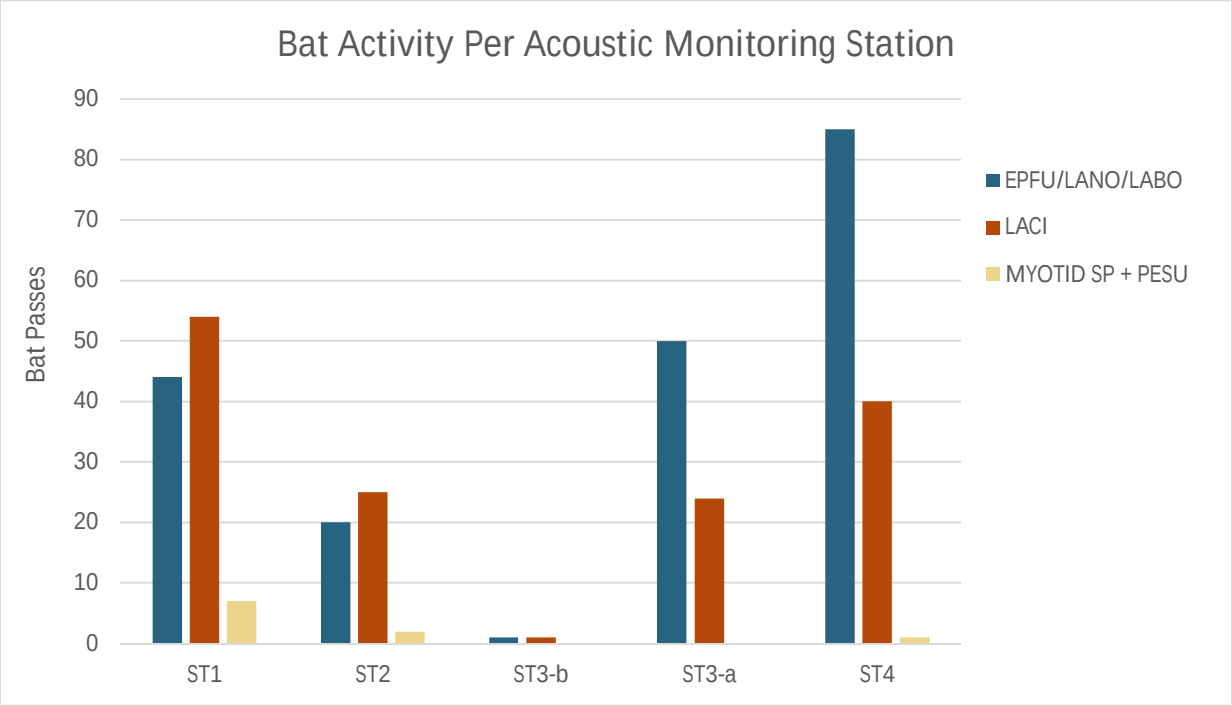

Figure 8: Total number of bat passes per monitoring station per species/species group during the 2018 monitoring period.

The highest levels of bat activity were recorded between 21:00 and 0:00 hours with notable peaks between 22:00 and 23:00 h (**Figure 10**). Of the 354 bat passes recorded during the monitoring period, nearly half (48 %) of the calls were recorded during these peak hours and 76% (or 268 calls) were recorded between 21:00 and 0:00 hrs.

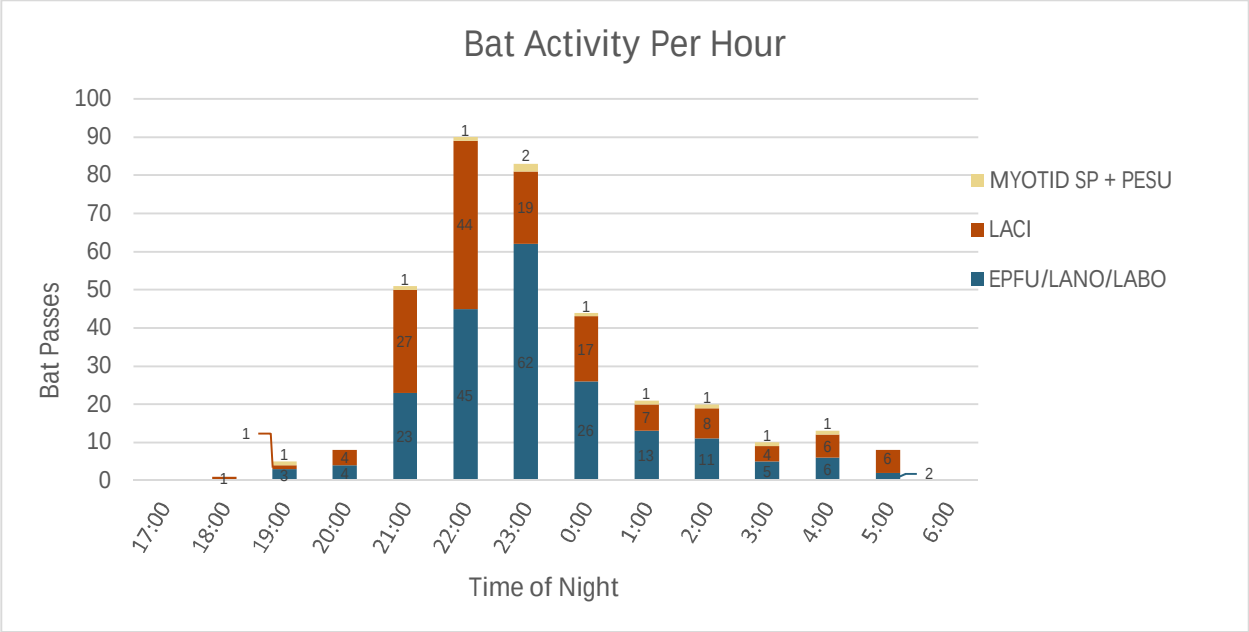

Figure 9: Distribution of hourly bat activity during the 2018 monitoring period.

Despite the equipment malfunctions which resulted in reduced sample size, sufficient data were collected for the assessment area as the level of effort exceeded the minimum requirements for pre-construction monitoring (Table 6).

Table 6: Pre-construction Monitoring Requirements based on the NBDNR guidelines (NBDNR 2009) Compared to the Number of Survey Nights Observed at Each Station

Inventory Dates	Minimum survey requirements	Number of survey nights per station					
		Station 1	Station 2	Station 3A (ground)	Station 3B (elevated)	Station 4	Total number of survey nights
June 1 - June 30	40 hours over a minimum of 10 nights.	30	30	30	1	30	121
July1 - July31	40 hours over a minimum of 5 nights.	31	26	31	0	31	119
August 1 - August 15	NA	15	0	15	0	15	45
August 15 - September 15	40 hours over a minimum of 10 nights.	30	23	30	0	30	113
September 15 - October 15	40 hours over 5 nights.	30	30	30	0	30	120
October 15 - October 31	NA	15	15	15	0	15	60

Although detection distance of ultrasonic microphones is difficult to predict (Agranat 2014), we consider that the ground level monitoring stations would have captured the lower range of the blade sweep area given that the ground level monitors were positioned in areas with clear paths to maximize detection ability.

In addition, continuous monitoring throughout the breeding season and migration periods from June 1 to October 31, inclusive, allowed for the detection of increased bat activity observed during the entirety of August. The data provides information on temporal and seasonal peaks in bat activity which can be used as a mechanism to minimize potential adverse effects on bats during the operation of the wind farm.

4.0 Environmental Effects Assessment

4.1 Identification of Project Interactions

Six of the seven bat species with the potential to occur in the assessment area were identified during the bat acoustic monitoring program, including; big brown bat, eastern red bat, hoary bat, silver-haired bat, little brown myotis, and tri-colored bat. The results of the acoustic surveys confirm the use of the assessment area by bats. The identification of anticipated potential interactions between the Project and bats or bat habitat is presented below.

4.1.1 Approach to Project Components

As presented in **Section 1.1.3**, this assessment recognizes four main distinct Project phases. The potential interactions with the surrounding environment have been considered in terms of each distinct phase. Additionally, accidents and malfunctions were considered.

The phases of the Project include:

1. *Development Phase;*
2. *Pre-Construction Phase;*
3. *Construction Phase; and*
4. *Operation Phase.*

This initial screening (i.e., project interaction matrix) assists in determining if an interaction between the activities being carried out in each phase of the proposed project and the valued component is possible. The matrix is presented below in **Table 7**.

Table 7: Project Interactions with Environmental Components

Valued Component	Project Phases				
	Development Phase	Pre-Construction Phase	Construction Phase	Operation Phase	Accidents and Malfunctions
Bats and Bat Habitat			✓	✓	✓

Legend: ✓ = Potential interaction identified

Those project phases for which a checkmark is provided indicates that the project may interact with the VC, and thus an environmental effects assessment is warranted in **Section 4.2** below.

Those project phases for which no interaction was noted with the VC (namely the development and pre-construction phases) are not carried forward or discussed further in this report. Bats and bat habitat will not interact with the development and pre-construction phases of the proposed project due to the conceptual, planning, administrative, and design nature of these phases. Since there are no "on the ground" activities associated with these phases, no environmental effects are expected to result and therefore no interaction is anticipated.

As described in **Section 1.1.3**, the decommissioning phase of the project is not considered within the scope of this assessment; a decommissioning plan will be completed prior to this phase of the project that reflects the guidance and regulations of the time.

4.2 Assessment of Residual Environmental Effects

4.2.1 Identification of Potential Environmental Effects

Without mitigation, the proposed project is anticipated to interact with bats and/or bat habitat and cause environmental effects in the following ways:

- Loss of habitat, or displacement from surrounding habitat, due to construction activities;
- Fatalities due to collisions with turbine towers or blades during operation; and
- Modifications to existing flight paths.

4.2.2 Standard Mitigation of Potential Environmental Effects

Standard mitigation has been identified for the anticipated interaction and/or effect in relation to bats and bat habitat in an attempt to prevent the interaction from occurring if possible, or to reduce the magnitude, geographic extent, frequency, duration, reversibility, or ecological/socioeconomic context of the interaction. Best management practices (based on industry guidelines and regulatory guidance documents) have been proposed as mitigative measures. In addition, several acts, codes, regulations, and guidelines may require appropriate actions be conducted as mitigative measures prior to or during the interaction.

The federal and provincial legislation and codes that could apply to the proposed project include (but may not be limited to):

- *Canadian Environmental Protection Act* and regulations;
- *Species at Risk Act*;
- *Transportation of Dangerous Goods Act*, and regulations;
- New Brunswick *Clean Environment Act*, and regulations;
- New Brunswick *Clean Water Act*, and regulations;
- New Brunswick *Clean Air Act*, and regulations;
- New Brunswick *Occupational Health and Safety Act*, and regulations; and
- New Brunswick *Species at Risk Act* and regulations.

The following standard mitigation measures have been identified to reduce the likelihood of occurrence, or minimize potential extent of effects of the Project on bats or bat habitat. Planned standard mitigation measures for the proposed project include the following:

- The area of disturbance associated with the development of the physical components of the Project (e.g., turbines, transmission line) will be minimized to the extent possible to limit the associated environmental effects associated with such disturbance;
- The area of disturbance shall be revegetated as soon as feasible;
- Existing access roads will be utilized where possible to reduce the loss of habitat;
- Post construction bat mortality surveys will be completed during the operation phase of the project to identify if additional mitigation is required, in consultation with NBDERD and CWS. Additional measures could potentially include:
    - Temporary shutdown of one or more turbines during high risk/high activity periods;
    - Temporary feathering of turbine blades during high risk periods; and
    - Completion of additional habitat studies to evaluate factors that may be contributing to the increased mortality rates;
- Non-operational towers shall be dismantled if not expected to be put back into operation; and
- Lighting installed on the turbines will follow, but not exceed, the Transport Canada requirements.

4.2.3 Characterization of Residual Environmental Effects

Based on the anticipated interactions with bats, residual effects that may occur as a result of the construction and operation phases of the Project are expected to be of low magnitude.

With the implementation of planned mitigation, and with the careful development and implementation of contingency and emergency response plans, it is anticipated that effects posed by accidents and unplanned events related to construction and operation of the Project will not be substantive.

5.0 Summary and Conclusion

This report has been prepared for the construction and operation of the Wocawson Energy Project. The Project is expected to provide renewable electricity to approximately 3,600 – 7,200 New Brunswick homes and support New Brunswick Power in attaining their future renewable energy targets.

The information provided in this document is based on the current available design/planning information, existing environment information and the information obtained during the 2018 bat acoustic monitoring program. Based on the anticipated effects on bats, residual effects that may occur as a result of the construction and operation phases of the Project are expected to be of low magnitude. With mitigation measures taken and post-construction mortality surveys, potential impacts to bats are expected to be negligible and may be avoidable with adaptive operating plans during high activity periods.

6.0 Closure

This report was prepared by Dillon Consulting Limited (Dillon) on behalf of the Wocawson Energy Limited Partnership, in support of the Wocawson Energy Project EIA. Dillon has used the degree of care and skill ordinarily exercised under similar circumstances at the time the work was performed by reputable members of the environmental consulting profession practicing in Canada. Dillon assumes no responsibility for conditions which were beyond its scope of work. There is no warranty expressed or implied by Dillon.
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Yours truly,

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