Alternative
RESOURCE ENERGY AUTHORITY

# ELLERSHOUSE WIND FARM EXPANSION

## Environmental Assessment Registration

**November 2016**

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# ELLERSHOUSE WIND FARM EXPANSION- Environmental Assessment Registration Document

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November 2016

## EXECUTIVE SUMMARY

Minas Energy, on behalf of the Alternative Resource Energy Authority, has proposed to construct and operate a 16.4 megawatt (MW) expansion of the existing 16.4 MW wind project in the community of Ellershouse, Nova Scotia. The expansion will consist of seven (7) 2.35 MW turbines, access roads, interconnecting cables and a connection to the Nova Scotia Power Inc. grid. The owner of the Project, the Alternative Resource Energy Authority, is a partnership between the municipal authorities of the towns of Berwick, Mahone Bay and Antigonish. The proposed Project site is located on vacant lands south of the existing Ellershouse Wind Farm which is situated approximately 11 km southeast of Windsor, Nova Scotia in the Municipality of the District of West Hants (44°55'16.28"N, 64° 1'7.25"W).

The existing Ellershouse Wind Farm is a seven-turbine, 16.4 megawatt (MW) project which received Environmental Assessment (EA) approval from the Minister of Environment on February 17, 2014. Four turbines (Turbines 2, 3, 4 and 5) were constructed in the spring / summer of 2015 (Phase 1). Three additional turbines (Turbines 1, 6 and 7) were constructed in the spring 2016 (Phase 2). The proposed Ellershouse Wind Farm Expansion (the Project) is considered a Class 1 undertaking under the Nova Scotia Environmental Assessment Regulations and as such, requires a registered Environmental Assessment as identified under Schedule A of the Regulations. The Environmental Assessment and the registration document have been completed according to the methodologies and requirements outlined in the document “A Proponent’s Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment Registration Document”, as well as accepted best practices for conducting environmental assessments. As the Project consists of adding seven turbines, it is considered a medium project. Based on the known occurrence of a bird species ranked ‘At Risk’ by the Nova Scotia Department of Natural Resources, and the presence of a bat hibernacula less than 25 km from the Project site, the Project is classified as having a ‘Very High’ potential sensitivity. As such, the Project is determined to be a Category 4.

A number of environmental components were evaluated for this assessment. Based on field data and associated research, mitigation strategies and best management practices were identified to avoid or mitigate potential effects of the Project for the majority of the components. Following the preliminary assessment, the components identified for further assessment were: avifauna, bats, and species of conservation interest. The effects assessment for these components determined that residual effects are expected to be not significant. Cumulative effects were also considered to be not significant.

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**LIST OF ACRONYMS**

| | |
|---|---|
| ACCDC | Atlantic Canada Conservation Data Centre |
| ARD | Acid Rock Drainage |
| AREA | Alternative Resource Energy Authority |
| ARIA | Archaeological Resource Impact Assessment |
| ATV | All-terrain Vehicle |
| AQHI | Air Quality Health Index |
| BEC | Berwick Utility Commission |
| BMPs | Best Management Practices |
| CanWEA | Canadian Wind Energy Association |
| CEAA | *Canadian Environmental Assessment Act* |
| CLC | Community Liaison Committee |
| COMFIT | Community Feed-In-Tariff |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CWS | Canadian Wildlife Service |
| dBA | Decibel |
| DFO | Fisheries and Oceans Canada |
| DND | Department of National Defense |
| EA | Environmental Assessment |
| EC | Environment Canada |
| EMI | Electromagnetic Interference |
| EMF | Electromagnetic Field |
| EPP | Environmental Protection Plan |
| ESCP | Erosion and Sediment Control Plan |
| FIT | Feed-In-Tariff |
| GHG | Greenhouse Gas |
| GIS | Geographical Information System |
| IBAs | Important Bird Areas |
| IBoF | Inner Bay of Fundy |
| KMKNO | Kwilmu'kw Maw-klusuaqn Negotiation Office |

| | |
|---|---|
| LWT | Large Scale Wind Turbine |
| MBBA | Maritime Breeding Bird Atlas |
| *MBCA* | *Migratory Birds Convention Act* |
| MW | Megawatt |
| NRC | National Research Council |
| NRCan | Natural Resources Canada |
| NSDE | Nova Scotia Department of Energy |
| NSE | Nova Scotia Environment |
| NSEA | *Nova Scotia Environment Act* |
| NS *ESA* | *Nova Scotia Endangered Species Act* |
| NSPI | Nova Scotia Power Inc. |
| NSTIR | Nova Scotia Department of Transportation and Infrastructure Renewal |
| PID | Property Identification Number |
| RABC | Radio Advisory Board of Canada |
| RCMP | Royal Canadian Mounted Police |
| *SARA* | *Species at Risk Act* |
| SOCI | Species of Conservation Interest |
| UTM | Universal Transverse Mercator |
| VEC | Valued Ecosystem Component |
| WAM | Wet Areas Mapping |
| WHMIS | Workplace Hazardous Materials Information System |

# 1.0 PROJECT INFORMATION

## 1.1 Project Introduction

Minas Energy (Minas), on behalf of the Alternative Resource Energy Authority (AREA), has proposed to construct and operate a 16.4 megawatt (MW) expansion of the existing 16.4 MW wind project in the community of Ellershouse, Nova Scotia. The expansion will consist of seven (7) 2.35 MW turbines, access roads, interconnecting cables and a connection to the Nova Scotia Power Inc. grid. The owner of the Project, AREA, is a partnership between the municipal authorities of the Towns of Berwick, Mahone Bay and Antigonish. The Ellershouse Wind Farm (the Project) has been proposed in support of Nova Scotia's "Renewable Electricity Plan: A Path to Good Jobs, Stable Prices and a Cleaner Environment" (Renewable Electricity Plan) (NSDE 2010), which is a strategic plan designed to decrease the province's dependence on carbon-based energy sources (*i.e.*, fossil fuels) and move towards greener, more affordable and more reliable sources of electricity. Nova Scotia recognizes the numerous benefits of supporting the development of renewable energy within the province, as currently 70% of the province's energy comes from non-renewable sources, mostly sourced from outside of the province (NSPI 2016). Dependence on fossil fuels increases the vulnerability of Nova Scotians to rising international energy prices, weakens energy security, and takes valuable revenue out of the province (NSDE 2010). Negative impacts to human health, particularly in developing countries, and the environment, mainly in the form of climate change, are among the widely cited problems associated with fossil fuel consumption around the world.

In its most recent assessment report, "Climate Change 2014 - Impacts, Adaptation and Vulnerability", the United Nations Intergovernmental Panel on Climate Change provides a detailed synopsis of the impacts associated with climate change on both global and regional scales. Evidence from all continents indicates that many biological systems and habitats are currently being affected by regional climate change. Ecological changes include: changes to the thermal dynamics and quality of aquatic habitats; shifts in migratory timing and ranges of fauna and flora; changes in fish abundance; and increased risk of extinction and loss of forest habitat (IPCC 2014).

Canadian climate experts acknowledge that the debate has largely evolved from questions about the reality and causes of climate change, to what actions can be taken to adapt to the realities of a changing climate. As the second most important and fastest growing (along with solar) renewable energy source in Canada (NRCan 2009), wind energy is a critical component of Canada's renewable energy strategy. Wind energy is emission-free; with every megawatt of wind energy generated reducing greenhouse gas emissions by as much as 2,500 tons per year, and improving air quality (NSDE 2009). Numerous benefits can be expected from the transition to renewable energy, and may include:

- Long term stability in energy prices;
- Long term security in locally-sourced energy supply, and decreased dependence on international markets;
- Creation of jobs and economic opportunities throughout the province;
- Community investment and economic return;
- Protection of human health and the environment;
- Retaining revenue within the province; and

- Educational opportunities for youth and the broader community about renewable energy technology, its benefits, and the role played in Nova Scotia's energy future.

As part of this overall strategy, the Project will contribute to meeting Nova Scotia's renewable energy goals by producing enough green energy to provide 4,500 NS homes with stable, locally-produced renewable energy.

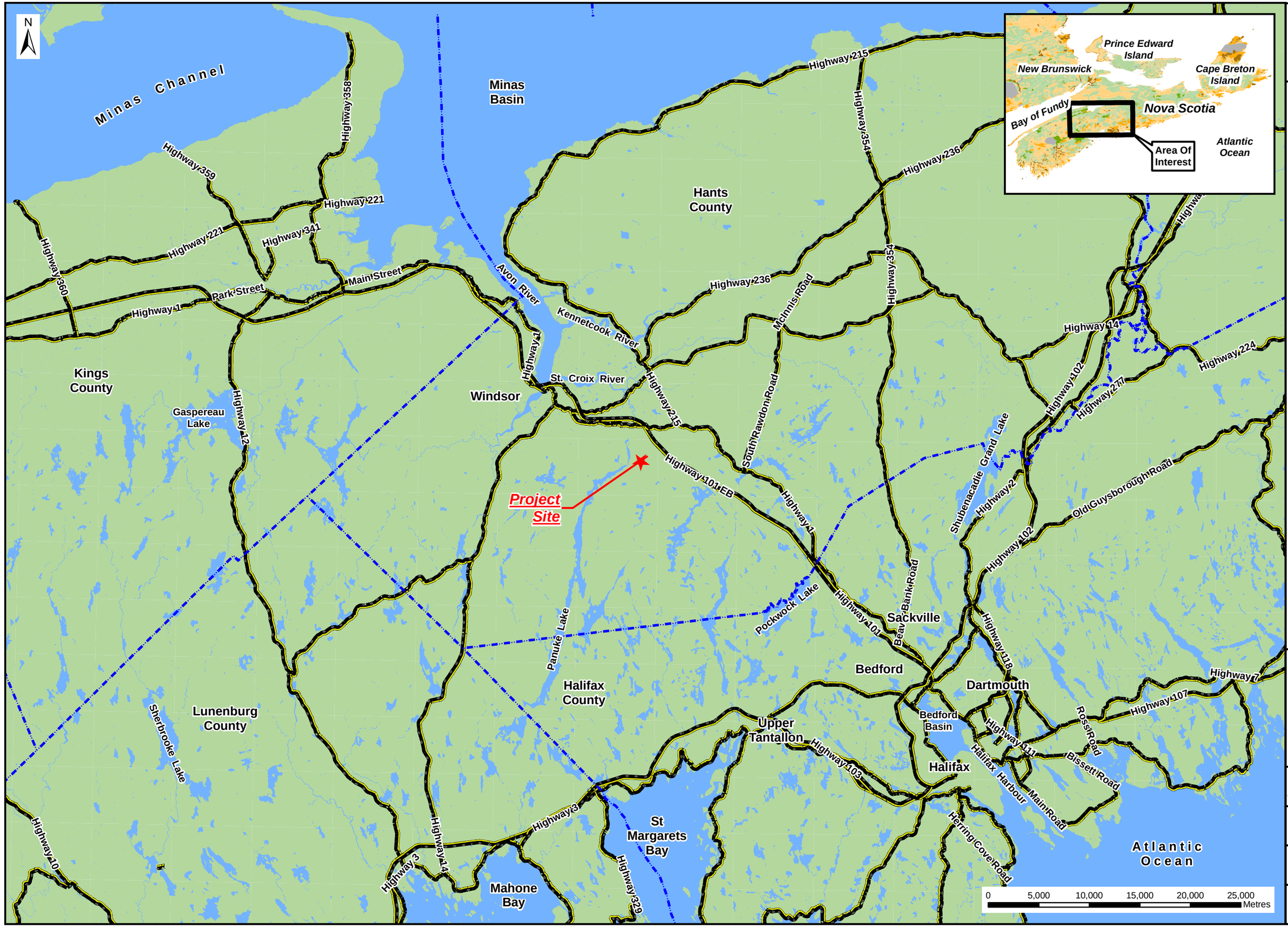
The Project is committed to sharing economic opportunities with the local community, throughout the development and life-span of the Project via the use of local skills and labour where possible, municipal tax revenue, and on-going energy literacy/education. The Project team has created a Community Liaison Committee (CLC), which will help to identify Project-related opportunities and benefits for the local community.

### 1.2 Project Summary

This section of the Environmental Assessment (EA) report provides a summary of the Project, description of the proponent, and regulatory requirements. The structure of the overall document and the investigators and authors involved are also provided.

**Table 1.1: Project Summary**

| | |
|---|---|
| **General Project Information** | Minas Energy, on behalf of AREA, intends to construct and operate a 16.4 MW expansion of the existing Ellershouse Wind Farm. The expansion will consist of seven 2.35 MW turbines. |
| **Project Name** | Ellershouse Wind Farm Expansion |
| **Proponent Name** | Minas Energy, acting on behalf of AREA |
| **Proponent Contact Information** | Chris Peters<br>Minas Energy<br>3 Bedford Hills Rd.,<br>Bedford, NS<br>B4A 1J5<br>Phone: (902) 799-0365<br>Fax: (902) 835-8062<br>Email: chris.peters@minasenergy.com<br><br>Shelley Rector<br>AREA<br>274 Main Street<br>Antigonish, NS B2G 2C4<br>Phone: 902-870-6205<br>Fax: 902-863-0460<br>Email: srector@townofantigonish.ca |
| **Project Location** | • The Project site is located south of the existing Ellershouse Wind Farm in the community of Ellershouse, approximately 11 km southeast of Windsor, Nova Scotia in the Municipality of the District of West Hants (Drawing 1.1). |




***Notes:***

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

***Legend:***

- County Boundary
- Major Roads and Highways
- Water Bodies

# *Ellershouse Wind Farm Expansion - Site Location*

Strum Consulting — 20 Years Taking Charge

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:350,000 | Drawing #: 1.1 |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |

| | |
|---|---|
| | • The approximate center of the Project site is located at 4974413m N, 419173m E.<br>• Project lands include Property Identification Number (PID) 45007903. |
| **Landowner(s)** | Atlantic Star Forestry |
| **Closest distance from a turbine to a permanent structure** | 871 m – permanent residence (Turbine 9) |
| **Expected rated capacity of proposed project in MW** | 16.4 MW |

### 1.3 Proponent Description

AREA is a partnership between the municipal utilities of the Towns of Berwick, Mahone Bay and Antgionish. The purpose of AREA is to provide the following municipal services:

- production of electrical energy;
- the purchase from, sale to, and management of electrical energy and services involving municipal electric commissions in Nova Scotia, Nova Scotia municipalities which operate electric utilities, and other customers eligible under the Open Access Transmission Tariff or other enabling legislation; and
- the ownership of physical facilities to provide these services.

The towns each operate electric utilities and distribute power to customers within their service areas.

The Berwick Electric Commission (BEC) operates the distribution system serving the Town of Berwick and some adjacent areas of Kings County. This includes line construction and maintenance, meter installations and meter reading, hydro control and maintenance, and standby duty and trouble calls. Operationally, the BEC employs three powerline technicians who conduct meter work and hydro operations as well. The Mahone Bay Electric Utility supplies electricity to approximately 725 customers located within the Town of Mahone Bay, as well, 26 customers residing near the Town limit in the Maders Cove area. The Town purchases electricity from Nova Scotia Power Inc. (NSPI), and distributes it to customers from the electrical substation located on Pond Street. The Town's Electrical Department is staffed by two powerline technicians. The Town of Antigonish is the largest of five municipally owned and operated electric utilities in the province of Nova Scotia. The utility serves 3000 residential customers and over 500 commercial customers in the Town and surrounding area, known as the fringe.

AREA will own the Project and has commissioned Minas to develop the Project on its behalf. The development team at Minas has significant experience working on energy projects with local communities throughout the Maritimes. A member of Scotia Investments Ltd., Minas traces its roots to R. A. Jodrey, one of Nova Scotia's most successful entrepreneurs, whose first company was incorporated in 1927. Minas' involvement in energy development began in 1935 when Mr. Jodrey endeavored to develop hydroelectric power to gain control of his companies' energy destiny. Today, Minas continues to operate the resulting 2 MW and 3 MW facilities on the St. Croix River system, and has a portfolio of power projects under development including wind and tidal energy. Minas is also a berth holder at the Fundy Ocean Research Center for Energy and is an active trader of

carbon credits. On May 12, 2011, Mr. Jodrey was named the first Energy Pioneer by the Maritimes Energy Association.

## 1.4 Regulatory Framework

### 1.4.1 Federal

A federal EA is not required for the Project as it is not located on federal land or listed as a physical activity that constitutes a "designated project" as listed under the Regulations Designating Physical Activities of the *Canadian Environmental Assessment Act (CEAA) (*2012).

Additional federal requirements are provided in Section 11.2 and 17.0.

### 1.4.2 Provincial

The Project is subject to a Class I EA as defined by the Environmental Assessment Regulations under the Nova Scotia *Environment Act (*NS*EA)*. As such, the proponents are required to register the Project with Nova Scotia Environment (NSE) and subsequently comply with the Class I registration process as defined by the document “A Proponent’s Guide to Environmental Assessment” (NSE 2014).

The use of provincial roads during the construction, operation, and decommissioning phases of the Project will be in compliance with the “Nova Scotia Temporary Workplace Traffic Control Manual” (NSTIR 2009).

Additional provincial permits will be required as outlined in Section 16.

### 1.4.3 Municipal

A Municipal Planning Strategy (the Strategy) and Land use By-law exists in the Municipality of the District of West Hants, which require approval for wind power projects. Approval for ‘Large Wind Turbines’ (>100 kW production capacity) is only considered by development agreement (Municipality of the District of West Hants 2008a and b). A summary of the applicable sections of the Strategy and By-Law is provided in Appendix A.

All required municipal permits (Section 16) and approvals will be obtained prior to construction.

## 1.5 Structure of Document

Table 1.2 outlines the content of each section of the EA report.

**Table 1.2: EA Report Structure**

| Section | Content |
|---|---|
| Section 1 | Project Information |
| Section 2 | Project Description including an overview of Project location, activities and schedule |
| Section 3 | Project Schedule |
| Section 4 | General Environmental Mitigation/Best Practices |
| Section 5 | Environmental Management |

| | |
|---|---|
| Section 6 | Project Scope |
| Section 7 | EA Methodology |
| Section 8 | Biophysical Environment |
| Section 9 | Socio-Economic Environment |
| Section 10 | Cultural and Heritage Resources. |
| Section 11 | Other Considerations |
| Section 12 | Consultation and Engagement |
| Section 13 | Effects Assessment |
| Section 14 | Effects of the Environment on the Project |
| Section 15 | Cumulative Effects Assessment |
| Section 16 | Other Approvals |
| Section 17 | Conclusions |
| Section 18 | References |

### 1.6 Author of the Environmental Assessment

This EA was completed by Strum Consulting, an independent, multi-disciplinary team of consultants with extensive experience in undertaking EAs across Atlantic Canada and internationally. This report was prepared and reviewed by:

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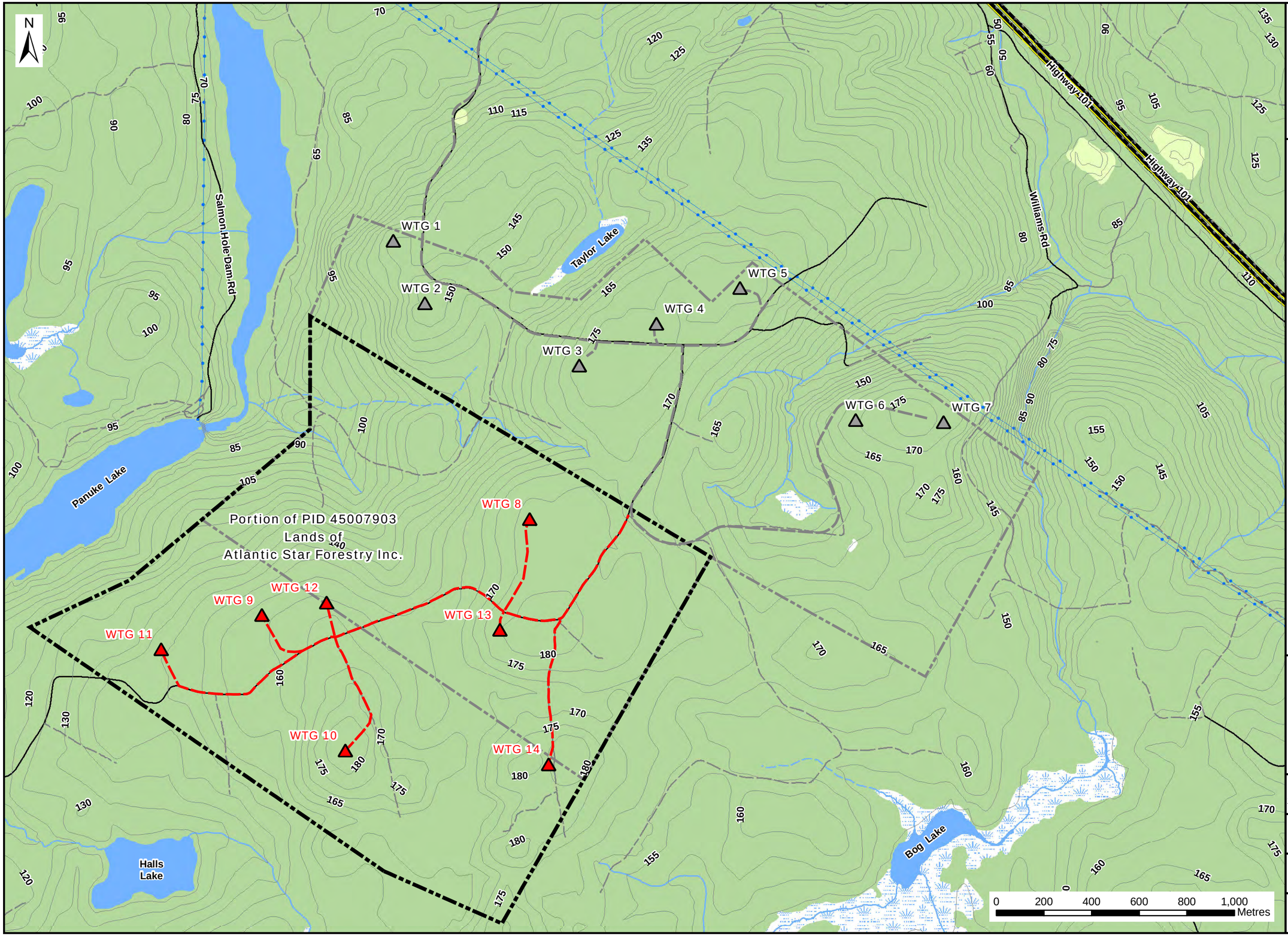
## 2.0 PROJECT DESCRIPTION

### 2.1 Turbine Specifications

The Project will be powered by seven wind turbines, rated at 2.35 MW, for a nominal capacity of 16.4 MW in total. Under normal conditions the turbines will operate 24 hours per day, 7 days per week. The Enercon E92 has been selected as the turbine model for the Project. Specifications are provided in Table 2.1.

Drawing 2.1 provides the turbine and access road layout.




***Notes:***

1. Reference: Digital Topographic Mapping & Property Management Unit MU9940 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Site Features & Project / Propety Boundaries are Approximate. This Plan is for Presentation only & Not Intended for Legal Use

***Legend:***

- Existing Turbines
- Proposed Turbines
- Existing Access Road
- Proposed Access Road
- Expansion Project Site
- Former Project Site Boundary
- Contours (m)
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

# *Ellershouse Wind Farm Expansion - Proposed Turbine and Road Layout*

Strum 20 YEARS Taking Charge CONSULTING

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:15,000 | Drawing #: **2.1** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |

**Table 2.1: Turbine Technical Specifications Enercon E92**

| Turbine Component | Enercon E92 Specifications |
|---|---|
| Rated capacity | 2.35 MW |
| Rotor diameter | 92 m |
| Hub height | 98 m |
| Cut – out wind speed | 28.0 – 34 m/s (with ENERCON storm control) |
| Number of blades | 3 |
| Swept area | 6,648 $m^2$ |
| Rotor speed (variable) | 5 – 16 rpm |
| Pitch control | ENERCON single blade pitch system, one independent pitch system per rotor blade with allocated emergency supply |
| Generator | ENERCON direct-drive annular generator |
| Brake system | 3 independent pitch control systems with emergency power supply, rotor brake, rotor lock |
| Yaw control | Active via adjustment gears, load-dependent damping |
| Remote monitoring | ENERCON SCADA |

## 2.2 Project Phases

The proposed Project will include three phases: site preparation and construction; operations and maintenance; and decommissioning. Activities and requirements associated with each phase are discussed in the following sections. Standard environmental mitigations that have been incorporated into the Project design are presented in Section 4.0.

### 2.2.1 Site Preparation and Construction

Services required prior to and during construction include, but are not limited to:

- Staging and storage facilities;
- Temporary offices;
- Laydown areas for construction and maintenance equipment;
- Temporary sanitary facilities;
- Water and rinsing facilities;
- Utilities and communications; and
- Garbage collection and off-site disposal.

Site preparation activities include:

- Land surveys for placement of roads, turbines, and associated works;
- Geotechnical investigations;
- Placement of erosion and sedimentation control measures; and
- Clearing of trees and grubbing areas for construction.

General construction activities include:

- Access road upgrading and construction;
- Laydown area and turbine pad construction;

- Transportation of turbine components;
- Turbine assembly;
- Construction of collection system and substation;
- Grid connection;
- Removal of temporary works and site restoration; and
- Commissioning.

Weather constraints may affect the proposed schedule and weather dependent activities (*e.g.,* turbine delivery construction) which have been scheduled to occur during optimal time frames to minimize delay. For example, the delivery of the turbine pieces will occur outside of the spring weight restrictions, which are pursuant to Subsection 20(1) of Chapter 371 of the Revised Status of Nova Scotia, *The Public Highways Act (*1989*).*

Equipment needs will likely include:

- Light trucks;
- Drilling rigs;
- Backhoes; and
- Bunch feller (and similar harvesting equipment).

*Access Road Construction*
Approximately 3.5 km of the existing access road will be used to access the Project site. The detailed design phase of the Project will determine which portions of the existing road will require upgrades or modification. Approximately 3 km of new road construction is required to provide direct access to the turbines. The new access road is expected to be constructed to a standard carriageway width of 6 m; plus ditches sloped at a ratio of 2:1. There will be areas where the road width could increase to 11 m to accommodate cut and fill areas and/or wide turns. Conversely, areas of flat straightaways can allow for a road surface as narrow as 4.5 m.

During the construction phase, the Project roads will be maintained with additional stone or periodic grading. Any material removed for road construction will be stored or disposed of in accordance with regulations and best practices for road construction. Any material stored on-site will be accompanied with appropriate erosion and sedimentation control measures, or re-used.

The following equipment is typically used during road upgrading and construction:

- Excavators;
- Dump trucks;
- Bull dozers;
- Rollers;
- Graders;
- Crusher; and
- Light trucks.

*Laydown Area and Turbine Pad Construction*
General activities during the creation of the laydown and turbine pad construction areas may include:

- Installation of erosion and sedimentation control measures;
- Removal of vegetation;
- Removal of overburden and soils;
- Blasting/chipping of bedrock (to be determined);
- Pouring and curing of concrete pads (complete with reinforcing steel);
- Placement of competent soils to bring area to grade;
- Compaction of soils; and
- Excavation for electrical conduits and fibre optic communication trenches.

The tower foundations will be approximately 15 m diameter (typical for a 2 MW wind turbine) and extend to a depth of 3 m below grade. Each turbine pad and laydown area is expected to be approximately 100 m x 100 m. The exact arrangement of each turbine pad and crane pad will be designed to suit the specific requirements of the turbine and the surrounding topography during the detailed design process.

The construction of a typical turbine pad (from clearing to final preparation for erecting of the turbine) can take between 1 to 4 months, depending on weather, soil, and construction vehicle access.
The following equipment may be used for the laydown area and turbine pad construction:

- Excavators;
- Dump trucks;
- Bull dozers;
- Rollers;
- Graders;
- Crusher (not required if a local quarry can supply gravel sizes);
- Concrete trucks;
- Light cranes; and
- Light trucks.

*Transportation of Turbine Components*
A detailed transportation study was completed by the turbine supplier as part of the design phase of the Ellershouse Wind Farm Phase I, in 2014. The means for equipment and materials to be delivered to the Project site will follow the routes identified in the original transportation study, which involved using Hartville, Ellershouse and Hartville Quarry roads for turbine delivery. At certain locations, turning radii will need to be widened and some roads on the Project site will need to be modified.

The following permits are expected to be required:

- Work Within Highway Right of Way Permit (NSTIR): required if removing access signs and guard rails.

- Overweight Special Moves Permit (Service NS and Municipal Relations): to transport oversized and overweight components. In some cases, due to the size and weight of the components, some may only be transported on Sundays.
- Provincial road weight restrictions, especially Spring Weight Restrictions, for heavier equipment and materials that will be transported to the Project site.
- Access points will be designed with proper height and width to accommodate large trucks and will adhere to commercial stopping sight distances.

The transportation route is expected to require a few slight road modifications, mostly involving the removal of signage and guardrails. To mitigate any negative effects on motorists where modification is required, a notice will be placed in public areas to inform local residents of signage removal or road infrastructure alterations. Removed signage and guardrails will be immediately replaced and appropriate temporary signage will be provided as necessary to ensure travelling public safety. Upgrades will also be made to roads and overhead wires, branches, and signs if conflicts arise. For areas requiring modifications, these will be completed to relevant specifications and any areas requiring reinstatement will also be completed as requested.

To the extent possible, transportation through Halifax will avoid high traffic times (*e.g.*, 7-9 am and 3-6 pm; Monday to Friday). All travel will be conducted using safe work practices for transporting oversized loads.

Transport of equipment will be via a minimum number of vehicles to minimize impacts to road-way flow and impacts on air quality due to exhaust.

During the Project's construction phase, trucks and other vehicles will be frequently visiting the Project site resulting in increased vehicular sound. To mitigate this effect, vehicles will only be visiting and working on-site during normal daytime hours of operation, where possible, and will avoid high-traffic times of day to reduce local traffic congestion.

*Turbine Assembly*

The wind turbine assembly includes tower sections, the nacelle, the hub, and three-blade rotors (i.e., a total of eight major components). All sections will be delivered by several flatbed trucks and the pieces will require a crane for removal from the vehicle at each of the prepared turbine pads.

The tower sections will be erected in sequence on the turbine foundation, followed by the nacelle, hub, and rotors. Rotors are usually attached to the hub on the ground prior to lifting. This assembly will occur with the use of cranes. Erection will depend on weather, specifically wind and lightening conditions. Typical assembly duration should be between 2 to 5 days.

The following equipment is expected to be used for turbine assembly:

- Main crane unit (up to 400' high in some cases);
- Assembly cranes; and
- Manufacturer's support vehicles.

*Collection System and Substation*
The Project will connect to the existing substation constructed during the initial phase of the Ellershouse Wind Farm. The substation is located nearby turbine 1, approximately 600 m from the northern project boundary of the Ellershouse expansion area. The collection system will adjoin to the current network and continue to follow the new road network (where practical).

*Grid Connection*
Electricity produced by this Project will be fed into the grid at NSPI's St Croix 17V substation and the electricity will be delivered to the electric utilities of the towns of Berwick, Mahone Bay and Antigonish under contract.

The following equipment is expected to be used during the grid connection process:

- Excavator and/or back hoe;
- Bucket trucks;
- Light cranes; and
- Light trucks.

*Removal of Temporary Works and Site Restoration*
Once construction has been completed, all temporary works will be removed and the site will be appropriately graded.

The following equipment is expected to be used this process:

- Excavator and/or back hoe;
- Grader;
- Hydroseeder; and
- Light trucks.

*Commissioning*
The turbines will undergo a series of tests for mechanical, electrical, and controls prior to unit start-up sequence. Once the start-up sequence has been initiated, another series of performance checks for safety systems will be completed. When the turbines have cleared all tests, the commissioning of the units can begin.

Commissioning will require coordination with NSPI as electrical energy will need to be managed both within the substations and on the transmission line. These performance tests will be completed by qualified wind power technicians and NSPI employees.

Additional testing may also be required for transformers, power lines, and substation components, all of which will be performed by qualified engineers and technical personnel.

2.2.2 Operations and Maintenance
Maintenance will conform to manufacturer equipment specifications, industry best management practices (BMPs), and standard operating procedures.

The life span of the Project is estimated to be a minimum of 20 years. During this time, roads will be used to access the turbines by staff and maintenance personnel. The roads will be maintained with additional gravel and grading, as required. During the winter months, all roads will be plowed, sanded, and/or salted, as required for safe driving and to ensure access in the event of an emergency.

A vegetation management plan will be initiated to ensure that access roads and turbine locations remain clear of vegetation. Timing of vegetation management will depend on site specific conditions.

Due to the potential for public access to the wind farm, signage will be affixed and maintained on all access roads to provide essential safety information such as emergency contacts and telephone numbers, speed limits, and the hazards associated with being within close proximity to the turbines (*i.e.*, ice throw). These signs will be maintained during the life of the Project.

Scheduled maintenance work will be carried out on a periodic basis. Maintenance work may require the use of a variety of cranes for brief periods of time for replacement of blades or other turbine components. The most common vehicle during maintenance work will be light/medium pickup trucks.

### 2.2.3 Decommissioning

As noted above, the operational life of the Project is estimated to be a minimum of 20 years. Prior to year 20, NSE will be either provided with decommissioning plans or a copy of the new power purchase agreement.

Generally, the decommissioning phase will follow the same steps as the construction phase:

- Dismantling and removal of the turbines from the Project site.
- Decommissioning of the turbine foundations as per the conditions of the land lease agreement.
- Removal, recycling (where possible), and disposal of collection system, conductor, and poles with NSPI's permission/cooperation.
- Removal of all other equipment and reinstatement and stabilization of land.

## 3.0 PROJECT SCHEDULE

Table 3.1 presents the Project schedule from EA registration to Project decommissioning.

**Table 3.1: Project Schedule**

| Project Activity | Timeline |
|---|---|
| EA Registration | November 2016 |
| Post-EA Environmental Monitoring Programs | 2017/2018 |
| Geotechnical Assessment | Winter/Spring 2017 |
| Engineering Design | Winter/Spring 2017 |
| Municipal Decision on Development Agreement | Winter/Spring 2017 |
| Clearing | Winter 2017 |
| Construction | Spring/Summer 2017 |
| Commissioning | Fall 2017 |
| Operation | Winter 2018 |
| Decommissioning | TBD |

## 4.0 GENERAL ENVIRONMENTAL MITIGATION

The following general environmental mitigation is considered to be standard practice and will be implemented as part of the Project design. Specific mitigation, monitoring, and follow-up that may be required to address residual environmental effects are discussed in Section 13.

### 4.1 Clearing and Grubbing

- Environmentally sensitive features will be identified and clearly marked where feasible (*e.g.,* watercourses, wetlands, areas of high archaeological potential).
- All watercourses will be kept free of chips and debris resulting from clearing activities.
- Appropriate erosion and sedimentation controls will be implemented to stabilize the slopes/banks on either side of watercourses and prevent sediment run-off.

### 4.2 Blasting (if required)

- Blasting will be conducted in accordance with provincial legislation and subject to terms and conditions of applicable permits.
- All blasts are to be conducted and monitored by certified professionals.
- Once the location of any required blasting is confirmed and the geotechnical investigation is completed, the need to implement mitigation measures or monitoring programs will be evaluated.
- If required, all protective measures will be outlined in the Environmental Protection Plan (EPP) and approved by NSE in advance of blasting activities.
- Landowners will be notified of any blasting activities.
- Following any blasting or disturbance of soils or bedrock, exposed soils or bedrock will be recovered with soil and re-vegetated as required to minimize any exposure.
- Blasting near watercourses will only occur in consultation with Fisheries and Oceans Canada (DFO), and will follow the requirements of the *Fisheries Act* (1985) as well as the requirement of the DFO Factsheet: “Blasting – Fish and Fish Habitat Protection” (DFO 2010); and/or the DFO “Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters” (Wright and Hopky 1998), as applicable.

- If sulphide bearing materials are identified through pre-construction geotechnical surveys, these areas will be referenced in the EPP.
- Rock removal in known areas of elevated potential will conform to relevant legislation (*e.g.,* the Sulphide Bearing Material Disposal Regulations of the NS*EA*), and in consultation with relevant regulatory departments).

**4.3 Transportation**

- A notice will be placed in public areas along Hartville and Ellershouse Roads to inform local residents of signage removal or road infrastructure alterations. Removed signage and guardrails will be immediately replaced and appropriate temporary signage will be provided as necessary to ensure public safety.
- To the extent possible, transportation of materials through Halifax will avoid high traffic times (7-9 am and 3-6 pm; Monday to Friday). All travel will be conducted using safe work practices for transporting oversized loads. Consideration will be given to transporting turbine blades and other oversized loads at night to avoid high traffic periods and allow lane closures, as necessary, to navigate turns along the route.
- Equipment transport will utilize a minimum number of vehicles to minimize effects to road-way flow and effects to air quality from exhaust.
- Upgrades will be made to roads and overhead wires, branches, and signs if conflicts arise. Modifications and subsequent reinstatement will be completed to NSTIR specifications.

**4.4 Avifauna**

- Tree clearing activities will be executed in a manner that complies with the *Migratory Bird Convention Act* (*MBCA*) and the *Species at Risk Act* (*SARA*), specifically to avoid incidental take.
- Primary mitigation for avifauna will be through Project planning and scheduling of clearing activities, on a best-efforts basis, to avoid key migratory bird nesting periods.
- Should vegetation clearing be required during nesting periods, searches for migratory bird nests will be undertaken within the area to be disturbed, in consultation with Canadian Wildlife Service (CWS), and all identified nests will be flagged.

**4.5 Dust and Noise**

- Where required, dust will be controlled by using water or a suitable, approved dust suppressant.
- Construction equipment will be maintained in good working order and properly muffled.
- Noise control measures (*e.g.,* sound barriers, shrouds, enclosures) will be used where warranted.
- All reasonable efforts will be made to restrict construction-related noise and lighting to between the hours of 9am-6pm, wherever possible. During specific phases of construction, completion of some activities (*e.g.*, "flying" of rotors and towers) may be required outside of these hours due to the nature of the Project.
- Engine idling will be restricted.

### 4.6 Erosion and Sedimentation Control

Contractors will use the erosion and sedimentation control measures listed below at all sites where soil or sub-soil has been exposed and there is potential for erosion:

- A site specific erosion and sedimentation control plan will be developed during the design phase of the Project.
- The area of exposed soil will be limited, and the length of time soil is exposed without mitigation (*e.g.,* mulching, seeding, rock cover) will be minimized through scheduled work progression.
- Both temporary and permanent control measures for erosion and sedimentation will be implemented in an appropriate time frame.
- Erosion and sedimentation control structures will be maintained and inspected regularly with particular emphasis before and after forecasted heavy rain events, and with consideration of the timing and types of activities involved.
- Existing roads and access routes will be used to the extent feasible.
- With the exception of temporary water crossing locations, travel through wetlands and within watercourse buffers with machinery will be avoided, when feasible. If travel through a wetland is required, the appropriate mitigation measures will be employed, (*e.g.,* geotextile matting, work timed to occur during frozen ground conditions, and travel routed through drier portions of the wetland).
- Care will be taken to ensure that the potential for surface run-off containing suspended materials or other harmful substances is minimized.
- Where necessary, erosion and sedimentation control measures will remain in place after work is completed, areas have stabilized, and natural re-vegetation occurs. All temporary erosion and sedimentation control materials will eventually be removed from the construction site.
- Permits/approvals related to site construction will be kept on-site.

### 4.7 Wetlands

- Wetlands will be avoided to the extent possible. Where unavoidable, wetland crossings/alteration will be completed in accordance with the Nova Scotia Wetland Conservation Policy and the wetland alteration application process during the permitting stage of the Project.
- Crossing of wetlands will not result in permanent diversion, restriction or blockage of natural flow, such that hydrologic function of wetlands will be maintained.
- Run-off from construction activities will be directed away from wetlands.
- Any wash water from the cleaning of construction vehicles will be disposed of on-site, using standard industry practices and following environmental regulations/guidelines for the protection of wetlands.
- Work vehicles and/or heavy equipment will be cleaned and inspected prior to use to prevent the introduction of weed/invasive/non-native species to sensitive habitats such as wetlands.

### 4.8 Dangerous Goods Management

- All fuels and lubricants used during construction will be stored according to containment methods in designated areas, located a minimum 30 m from surface waters and wetlands.

- Where possible, refueling in the field will not occur within 30 m of watercourses, water bodies or wetlands.
- Storage of all hazardous materials will comply with Workplace Hazardous Materials Information System (WHMIS) requirements. Appropriate material safety data sheets will be located at the storage site.
- Transportation of dangerous goods will comply with the *Transportation of Dangerous Goods Act* (1992).
- Equipment will be kept in good working order, will be inspected regularly, and any observed leaks will be repaired.

### 4.9 Waste

- Solid wastes, including waste construction material, will be disposed of in approved facilities.
- Temporary storage of waste materials on-site will be located at least 30 m from known watercourses, wetlands, and water bodies.
- Waste materials will be removed from the site by a qualified waste hauler and disposed/recycled in accordance with provincial waste regulations. All applicable materials will be stored as per WHMIS requirements and transported as per requirements of the *Transportation of Dangerous Goods Act* (1992).

### 4.10 Excavation and Site Reinstatement

- All soils removed during the excavation phase will be stored according to provincial regulations and best practice guidelines.
- Any soil needed for backfilling, after foundations have been poured, will be stored temporarily adjacent to the excavations until needed. Any remaining excavated material will be used on-site or removed and sent to an approved facility.
- Prior to excavation activities, erosion and sedimentation control measures will be deployed and assessed on a regular basis.
- Once backfilled material has stabilized, temporary erosion and sedimentation controls will be removed. Attention will be paid during site reinstatement to ensure areas will promote wildlife return to the area, to the extent possible.

## 5.0 ENVIRONMENTAL MANAGEMENT

### 5.1 Environmental Protection Plan

An EPP will be developed following EA approval of the Project. The EPP will be approved by NSE prior to start of construction of the Project and will detail best practices and mitigative measures to be employed during construction to minimize potential environmental impacts. The EPP document is the primary mechanism for ensuring that mitigation is implemented, as determined through the EA process, to avoid or mitigate potential adverse environmental effects that might otherwise occur from construction activities, and as required by applicable agencies through permitting processes.

The EPP is a plan for all Project personnel, including contractors, and describes the responsibilities, expectations, and methods for environmental protection associated with Project activities. The EPP will incorporate:

- means to comply with requirements of relevant legislation;
- environmental protection measures identified as part of the EA; and
- environmental commitments made as part of the EA.

A suggested Table of Contents for the EPP is provided in Appendix B.

## 6.0 PROJECT SCOPE

As a Class 1 EA, this registration document and supporting studies have been developed to meet all requirements under Section 9(1A) of the NS*EA.*

In addition, the document has been prepared using the following provincial guidelines:

- "A Proponent's Guide to Wind Power Projects: Guide for preparing an Environmental Assessment" (NSE 2012a); and
- "A Proponent's Guide to Environmental Assessment", published by the Environmental Assessment Branch of NSE and revised in 2009 (NSE 2014).

The following regulatory bodies have been contacted by the Project team to provide input into the Project planning process and advice regarding the EA scope:

- CWS;
- Nova Scotia Department of Communities, Culture and Heritage;
- NSE; and
- Nova Scotia Department of Natural Resources (NSDNR).

During the EA review process, additional consultation may be required with these and other agencies.

### 6.1 Site Sensitivity

Potential wind farms are assigned a category level, according to a matrix provided in "A Proponent's Guide to Wind Power Projects" (NSE 2012a). This matrix considers the overall Project size and the sensitivity of the Project site to determine the category level. The category level then outlines guidance with respect to the collection of baseline data for the EA, as well as post-construction monitoring requirements.

As the Project consists of an additional seven turbines, it is considered a medium project. Based on the known existence of a bird species ranked 'At Risk' by NSDNR; and the presence of a bat hibernaculum less than 25 km from the Project site, the Project is classified as having a 'Very High' potential sensitivity. Overall, the Project has therefore been determined to be a Category 4.

### 6.2 Assessment Scope

EA is a planning tool used to predict the environmental effects of a proposed project, identify measures to mitigate adverse environmental effects, and predict whether there will be significant adverse environmental effect after mitigation is implemented.

The EA focuses on specific environmental components called valued environmental components (VECs). VECs are specific components of the biophysical and human environments that, if altered by the Project, may be of concern to regulatory agencies, Aboriginals, stakeholders, resource managers, scientists, and/or the general public. VECs incorporate biological systems as well as human, social, and economic conditions that are affected by changes in the biological environment. As such, VECs can relate to ecological, social, cultural, or economic systems that comprise the environment as a whole.

The scope of the assessment for this Project includes: selection and preliminary assessment of potential interactions; identification of VECs; identification of environmental effects; and identification of the standards or thresholds that are used to determine the significance of residual environmental effects. This scoping relies upon direction from regulatory authorities; consideration of input from stakeholders; and the professional judgment of the Project team.

### 6.3 Spatial and Temporal Boundaries of the Assessment

For this Project, unless otherwise identified, the assessment of effects was undertaken for the area identified as the Ellershouse Wind Farm Expansion Project site (Drawing 2.1). Prior surveys completed in 2013, within and/or in close proximity to the expansion area Project site were also incorporated into the effects assessment. This area is identified as the Former Project Site Boundary (Drawing 2.1). For the purpose of data collection and the socio-economic environment, the Municipality of the District of West Hants was considered. In addition, structures located within a 2 km buffer of the Project site were assessed as potential receptors for the purposes of evaluating potential impacts from sound.

The temporal scope of this assessment covers the construction, operation, and decommissioning phases of the Project, and associated activities, as described in Sections 2.2.1, 2.2.2, and 2.2.3. Accidents, malfunctions, and unplanned events are addressed separately.

### 6.4 Site Optimization

As part of the Project planning process, a detailed constraints analysis was conducted to ensure that potential effects to the environment and neighboring residents were minimized. This analysis was continually updated and refined based on the results of Project specific desktop studies, modeling, and field assessments. As a result, several layout iterations were reviewed to reflect a growing knowledge of the Project site and surrounding community. Specifically, layout modifications were incorporated into the planning process in consideration of the following:

- Sighting within an optimal wind regime;
- Avoidance of interference with telecommunication and radar systems;
- Maintenance of a vegetated buffer between turbine locations and field identified watercourses;
- Avoidance of lakes, or other visible open water bodies as identified in 1:50,000 provincial mapping;
- Maintenance of a minimum 30 m (from tip of blade) buffer between turbine locations and field identified wetlands (NSE standard). NSDNR requests that larger buffer distances (*i.e.*, 70-80 m from the tip of blade) are incorporated into Project design where a species of conservation

interest (SOCI) has been identified during breeding season within a wetland. Where appropriate, this buffer has been incorporated into Project planning.
- Avoidance of known protected areas, field identified archaeological resources, significant habitats, wildlife sites, provincial parks or reserves;
- Avoidance of Mi'kmaq resources;
- Maintenance of a minimum 550 m setback (NSE standard) between turbines and occupied dwellings, cottages, camps, daycares, hospitals, and schools;
- Predictive sound modeling results to meet NSE standards (*i.e.,* 40 dBA for dwellings, daycares, hospitals, and schools);
- Predictive shadow flicker modeling results to meet NSE standards (*i.e.,* no more than 30 hours of flicker over a year and no more than 30 minutes of flicker on the worst day); and
- Maintenance of the municipal setback from adjoining property (lot) lines, which is consistent with the height of the tower plus the distance from the top of the tower to the highest extended tip of the rotor blades.

In addition to the general planning "constraints" and minimum setbacks mentioned above, the Project site and associated layout offers considerable development and ecological advantages that were incorporated into the Project design to minimize potential effects to surrounding land uses, local residents and environmental features. These include:

- Accommodation of a large residential setback of over 870 m, well in excess of the NSE Standard;
- The use of a site that has been previously disturbed by forestry activities (*i.e.*, tree clearing and logging trails/roads throughout the Project site);
- Expanding an existing site, which incorporates 3.5 km of existing roads into the Project design, minimizing overall new road disturbance impacts and clearing requirements;
- No wetland or watercourse alterations required at turbine locations;
- No new watercourse crossings associated with roads; and
- Locating turbines closer together, minimizing the geographic extent of disturbance.

This siting exercise, using the above noted constraints and setbacks, resulted in the current turbine locations that this EA was based on. Through this process, these locations were selected to provide a minimal disturbance to surrounding land uses, local residents and environmental features. Expanding the existing wind farm presents the best available option for the Proponent to increase its renewable energy generation with the least probability of adversely impacting the environment. Utilizing the existing system (where possible) of access roads and connection to the grid, avoids the need for new construction and disturbance or further habitat fragmentation.

## 7.0 ENVIRONMENTAL ASSESSMENT METHODOLOGY

The methodological framework used in this EA has been developed to meet the requirements of the N*SEA*. This framework is based on a structured approach that:

- focuses on issues of greatest concern;

- considers Aboriginal concerns as well as concerns raised by the public and other stakeholders; and
- integrates mitigative measures into Project design.

The methodology provides an overview of the baseline conditions and an assessment of VECs that reflect key issues of concern. Within the specified spatial and temporal boundaries, the potential for interaction between individual VECs and Project activities are determined. Where there is potential for Project-related environmental effects, each effect is assessed using the results of preliminary investigations, guidance from regulators, and the collective knowledge and expertise of the Project team. The residual Project-related environmental effects, (*i.e.*, after mitigation has been applied), are characterized using specific criteria (direction, magnitude, geographic extent, duration, frequency, and reversibility) that are applied to each VEC. The significance of these residual effects is then determined based on pre-defined and VEC-specific thresholds.

Project-related environmental effects are assessed and include potential interactions; mitigation and environmental protection measures proposed to reduce or eliminate adverse environmental effects; and the characterization of the residual environmental effects of the Project. The ultimate focus of the assessment is on residual environmental effects that remain after planned mitigation has been applied.

### 7.1 Preliminary VEC Selection

A preliminary assessment of potential interactions between selected environmental components and the Project was undertaken to identify VECs. This preliminary assessment is summarized in Table 7.1. For some of the identified environmental components, additional information has been provided in the report. Many of the interactions can be addressed using industry BMPs and adhering to existing regulations to mitigate potential effects. Where environmental BMPs and regulations are considered to be insufficient to fully mitigate potential effects, or where additional information is required, the components are identified as VECs and are therefore subject to further assessment in Section 13.0. Specific environmental requirements and mitigation practices are identified in the effects assessment and will be refined in subsequent environmental regulatory permitting processes.

**Table 7.1: VEC Selection Table**

| Environmental Component | Description | Assessed further? | Applicable Section in the Report |
|---|---|---|---|
| Atmospheric Environment | Atmospheric environment includes consideration of air quality and climate conditions. Concerns include:<br><br>• Dust generation from construction and operation activities.<br>• Interaction with air quality due to exhaust emissions, including greenhouse gas emissions from Project equipment and vehicles during construction and operation.<br><br>Only minimal amounts of dust and air emissions are expected. Mitigation for these potential effects is provided in Section 4. | No | Section 8.1 |

| Environmental Component | Description | Assessed further? | Applicable Section in the Report |
|---|---|---|---|
| | Project-related emissions are anticipated to be temporary, localized, and minor in nature. Measurable changes to the atmospheric environment are not expected. | | |
| Geophysical Environment | Geophysical components include consideration of hydrogeology, groundwater, and bedrock and surficial geology. Concerns include:<br><br>• Damage from blasting to domestic water sources.<br>• Localized disturbances to surface soils and shallow bedrock.<br>• Potential for acid rock drainage (ARD) at the site.<br>• Presence of radon gas.<br><br>Once the location of any required blasting is confirmed and the geotechnical investigation is completed, the need to implement mitigation measures or monitoring programs will be evaluated.<br><br>The likelihood of ARD to occur at the site will be determined following the results of the geotechnical evaluation. If ARD is found to be present, it will be handled in accordance with the Sulphide Bearing Material Disposal Regulations under the NS*EA*.<br><br>As a proactive measure, any structures placed at the Project site can be provided with venting if radon is suspected. Further mitigation for disturbance or exposure of this rock type (*e.g.* from blasting) will be outlined in the EPP.<br><br>Project-related effects on the geophysical environment are anticipated to be temporary, localized, and minor in nature. Measurable changes to the geophysical environment are not expected. | No | Section 8.2 |

| Environmental Component | Description | Assessed further? | Applicable Section in the Report |
|---|---|---|---|
| Freshwater Environment | Freshwater environments involve consideration of fish and fish habitat and water quality which may be impacted by watercourse crossings, erosion and sedimentation etc. Concerns include:<br>• Loss or damage to fish habitat.<br>• Decreased water quality.<br>• Mortality of aquatic species.<br><br>Based on the proposed Project layout, no watercourse alterations will be required therefore impacts to the freshwater environment are not expected. | No | Section 8.3 |
| Terrestrial Habitat, Flora and Fauna (including wetlands) | Terrestrial habitat involves consideration of general and specialized terrestrial habitats, such as wetlands, as well as terrestrial flora and fauna *(Note: Birds and rare species have been considered separately)*. Concerns include:<br><br>• Habitat fragmentation.<br>• Introduction of invasive species.<br>• Damage to wetland ecosystems.<br>• Mortality of some smaller faunal species due to clearing activities.<br>• Loss of vegetation and effects to fauna and flora species due to herbicide application (vegetation management).<br><br>Habitat fragmentation is considered to be minimal due to the small-scale clearing required.<br><br>Environmental protection practices will be incorporated into clearing and grubbing activities as described in Section 4. Mitigation to control and prevent the introduction of invasive species is provided in Section 4 and will be included as part of the Project Vegetation Management Plan.<br><br>Avoidance of wetland habitat has been taken into consideration in Project planning and design including access roads and placement of turbines. Additional mitigative measures provided in Section 4 will be employed to protect wetland habitat.<br><br>It is expected that temporary sensory disturbance related to the site preparation and construction phases of the Project will not persist in the long-term. Sensory disturbance related to turbine operations will be negligible. | No | Section 8.4, 8.5, and 8.6 |

| Environmental Component | Description | Assessed further? | Applicable Section in the Report |
|---|---|---|---|
| | Mortality of fauna will be minimal due to the utilization of existing access roads, small scale clearing requirements and attention to seasonal mitigation.<br><br>Project-related effects on the terrestrial environment are anticipated to be temporary, localized, and minor in nature. Measurable changes to the terrestrial habitat and flora and fauna are not expected. | | |
| Species of Conservation Interest (SOCI) | SOCI are those species assessed as being at risk or sensitive to some degree. For the purposes of this EA, SOCI include those species listed as:<br>• "Endangered", "Threatened", or "Special Concern" under *SARA;* and<br>• "Endangered", "Threatened " or "Vulnerable" under the Nova Scotia *Endangered Species Act* (NS *ESA*)<br><br>Consideration is also given to species:<br>• Ranked as "At Risk", "May be at Risk" or "Sensitive" under the NSDNR General Status Ranks of Wild Species in Nova Scotia;<br>• Listed "Endangered", "Threatened", or "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC);and<br>• Ranked as "S1", "S2" or "S3" by ACCDC.<br><br>Based on the above criteria, five terrestrial fauna SOCI have the potential to occur at the Project site. No plant SOCI were identified at the Project site.<br><br>Concerns include:<br>- Sensory disturbance.<br>- Direct and indirect adverse environmental effects to habitat (loss or alteration).<br>- Effects to fish passage/migration.<br>- Direct mortality of individuals.<br><br>Loss of terrestrial fauna SOCI is considered minimal due to the utilization of existing access roads, small scale clearing requirements, and attention to seasonal mitigation. However, due to special status under federal and provincial federal legislation/guidance, aquatic and terrestrial fauna SOCI are considered further in the assessment as a VEC. | Yes | Sections 8.3, 8.5, 8.6 and 14.2.1 |

| Environmental Component | Description | Assessed further? | Applicable Section in the Report |
|---|---|---|---|
| Avifauna | The effects of wind turbines on avifauna are variable and depend on factors such as the development design, topography of the area, habitats affected, and the bird community in the wind farm area. Concerns include:<br><br>• Mortality resulting from collision.<br>• Habitat alteration.<br>• Sensory disturbance.<br><br>The requirements as set out in the *MBCA* will be adhered to for clearing activities (Section 4).<br><br>Due to the potential effects of wind turbines on avifauna, this component is considered for further assessment. | Yes | Sections 8.7 and 14.2.2 |
| Bats | The installation of wind turbines has the potential to impact bats both directly and indirectly. Concerns include:<br><br>• Mortality resulting from collision and/or barotrauma.<br>• Habitat alteration.<br>• Sensory disturbance.<br><br>The significance of these impacts at the population level depends on a number of biotic and abiotic variables, including the number of individuals affected and the stability of the population, season, physiologic condition of the individuals affected, and weather factors.<br><br>Due to the potential effects of wind turbines on bat populations, this component is considered for further assessment. | Yes | Sections 8.8 and 14.2.3 |
| Local Economy/Land Use/Recreation and Tourism | Socio-economic aspects such as economy, land use/value, and recreation and tourism may be affected by the Project; however these effects may be positive and/or negative.<br><br>The Project will likely create more local jobs, increase municipal tax revenues, and encourage “energy literacy” at local schools, thereby resulting in a positive change for community.<br><br>Impacts to land use are not expected in the area since the Project is located on privately owned land adjacent to the existing Ellershouse Wind Farm. Research has consistently demonstrated that, in a variety of spatial settings and across a wide temporal scale, sale prices for homes surrounding wind | No | Section 9.0 |

| Environmental Component | Description | Assessed further? | Applicable Section in the Report |
|---|---|---|---|
| | energy facilities are not significantly different from those attained for homes sited away from wind energy facilities.<br><br>The Project represents a small footprint on privately owned land. Though the property is frequently used by various recreational groups (ATV and snowmobile associations), the Project team is working with these groups to ensure continued access.<br><br>Effects on the socio-economic environment are expected to be positive in nature, or temporary, localized, and minor in nature. Measurable changes to the local economy, recreation and tourism are not expected. | | |
| Human Health | The public is often concerned about the potential for impacts to human health from wind turbines. Concerns include:<br><br>• Sound (addressed as a separate section).<br>• Shadow flicker (addressed as a separate section).<br>• Infrasound.<br>• Electromagnetic fields (EMF).<br>• Effects to air quality from dust and air emissions.<br>• Risk of ice throw.<br><br>A literature review regarding the potential for impacts to human health from wind turbines was completed (Appendix C). The main findings from this review are as follows:<br><br>• There is no evidence that the levels of infrasound produced by the turbines present a risk to human health.<br>• There is no discernible evidence that there are health risks associated with EMFs.<br>• Effects to air quality are expected to be temporary, minor, and localized in nature (refer also to Section 4.4 and to 'Atmospheric Environment', above).<br>• Setbacks and safety awareness measures minimize any potential risk from ice throw.<br><br>Effects to human health are considered minimal or non-existent due to the size and location of the wind farm, mitigation, and setback distances. | No | Section 11, Appendix C |

| Environmental Component | Description | Assessed further? | Applicable Section in the Report |
|---|---|---|---|
| Cultural and Heritage Resources | If present, cultural and heritage resources may be affected by ground disturbance during construction and decommissioning activities.<br><br>An Archeological Resource Impact Assessment (ARIA) indicated that no impacts to cultural and heritage resources are expected.<br><br>Procedures related to potential discovery of archaeological items or sites during construction will be described in the EPP. | No | Section 10 |
| Shadow Flicker | Shadow flicker can occur when rotating blades cast flickering shadows during times of direct sunlight.<br><br>Modeling results indicate that all residential receptors are predicted to comply with the industry standard of no more than 30 hours of shadow flicker per year and no more than 30 minutes of shadow flicker on the worst day.<br><br>Shadow flicker, therefore, is not expected to be an issue at any existing residence/dwelling in the vicinity of the Project. | No | Section 11.1 |
| Electromagnetic Interference (EMI) | The rotating blades and support structures of wind turbines can interfere with various types of electromagnetic signals emitted from telecommunication and radar systems.<br><br>An EMI study was completed for this Project. Correspondence was submitted to relevant agencies in November 2016. Some responses are still pending however no objections regarding EMI effects associated with the Project have been provided to date. | No | Section 11.2 |
| Visual Landscape | Wind farms produce visual effects to the local landscape.<br><br>A visual assessment was completed for the Project. Predicted view planes generated by the assessment are presented in Section 11.3.<br><br>Effects to the visual landscape are considered minimal to non-existent due to the size and location of the wind farm and setback distances. | No | Section 11.3 |
| Sound | Sound is generated during all phases of the wind farm. Concerns include:<br><br>• Noise during construction and decommissioning | No | Section 11.4 |

| Environmental Component | Description | Assessed further? | Applicable Section in the Report |
|---|---|---|---|
| | phases.<br>• Annoyance and unpleasantness, for local residents in close vicinity, from turbine blades during operation.<br><br>Construction and decommissioning phases will be short-term. Effects of noise created during these phases are expected to be temporary, minor, and localized in nature.<br><br>Modeling results for wind farm operation indicate that all residential receptors are predicted to comply with the NSE standard of 40 dBA (exterior of the residence). Effects from sound during operation are therefore considered minimal due to the size and location of the wind farm and setback distances. Post-construction monitoring will be completed during operation, as required. | | |

Based on the preliminary assessment of potential interactions summarized in Table 7.1, the VECs addressed in this EA are as follows:

- SOCI;
- Avifauna; and
- Bats.

## 8.0 BIOPHYSICAL ENVIRONMENT

### 8.1 Atmospheric Environment

8.1.1 Weather and Climate

Nova Scotia's climate is quite varied and is largely governed by coastal influences and elevation (Davis and Browne 1996). The Project site (centered at 44°55'3.86"N, 64° 1'43.58"W) lies along the border of the Rawdon/Wittenburg Hills Ecodistrict and the St. Margaret's Bay Ecodistrict (Neily et al. 2005). With elevations of 180-210 m, the Rawdon/Wittenburg Hills tend to experience cooler temperatures and considerably more moist than the adjacent lowlands. The southern portion of the Project site lies at the northern extent of the St. Margaret's Bay Ecodistrict which slopes to the south-southeast from an elevation of 150 m at Panuke Lake to sea level along the Atlantic coast (Neily et al. 2005). Forestry is the dominant land use in the area, with agriculture being practised on a small-scale. The typical growing season in the area of the Project site is 196 days (Webb and Marshall 1999).

Local temperature and precipitation data were obtained from the Salmon Hole meteorological station (44°56'00.000" N, 64°02'00.000" W) located approximately 1.77 km northwest of the Project site. For the period from 1981-2010, the mean annual temperature was 6.8°C, with a mean daily high of

12.1°C and a mean daily low of 1.5°C (EC 2016a). January and February were the coldest months (-6.4 °C and -5.1°C, respectively), while the warmest months were July and August (19.5 °C and 19.1°C, respectively) (EC 2016a).

From 1981-2010, mean annual snowfall was 211 cm and rainfall was 1,182 mm (EC 2016a). Most snowfall is received in January and December (62.4 cm and 43.1 cm, respectively), while the rainiest months are May and November (126.3 mm and 137.4 mm, respectively) (EC 2016a).

Environment Canada (EC) measures wind conditions in Nova Scotia at those meteorological stations that are under long term observation. The closest such station to the Project site is the Halifax Stanfield International Airport meteorological station (44°53'00.000"N, 63°31'00.000"W) located 41.8 km east of the Project site. The Canadian Climate Normals (1981-2010) for this station indicate an annual wind speed of 16.5 km/h, most commonly out of the south (EC 2016b). The maximum hourly wind speed for this station was 93 km/h, recorded on November 4, 2007, with the highest single wind gust measuring at 132 km/h on December 26, 1976 (EC 2016b). According to the NS Wind Atlas (NSDE 2016), average wind speeds at 30 m and 50 m above the ground at the Project site range from 18.0-23.4 km/h, and range from 21.6 –25.2 km/h at 80 m above the ground.

8.1.2 Air Quality

The electricity sector is the largest contributor of greenhouse gas (GHG) emissions in Nova Scotia (NSDE 2015). In the past decade, Nova Scotia has seen a shift in electricity generation with reliance on fossil fuels decreasing from 88% in 2005, to 74% in 2014 (NSDE 2015). Currently, more than 25% of the province's electricity comes from clean renewables, and is predicted to rise to 40% by 2018. Because of the continued reliance on coal and other fossil fuels for electricity, every MW of wind power installed reduces GHG emissions by as much as 2,500 tonnes per year (NSDE 2011). By reducing Nova Scotia's reliance on fossil fuels, wind energy will therefore contribute to improving local air quality (NSDE 2011).

Nova Scotia monitors air quality at six stations throughout the province. Measured parameters include ground-level ozone ($O_3$), particulate matter (PM2.5), and nitrogen dioxide ($NO_2$), and these values are used to calculate a score on the Air Quality Health Index (AQHI) (EC 2016c). The AQHI is a scale from 1-10+, in which scores represent the following health risk categories: Low (1-3), Moderate (4-6), High (7-10), and Very High (10+). The AQHI monitoring station closest to the Project site is located at Kentville, approximately 41 km northwest of the Project site. The AQHI at this site is usually low at all times of the year (EC 2016c).

Mitigation measures for potential effects to the atmospheric environment are provided in Section 4.0.

## 8.2 Geophysical Environment

8.2.1 Physiography and Topography

The northwestern portion of the Project site lies within the Rawdon/Wittenburg Hills Ecodistrict of the Eastern Ecoregion (Neily et al. 2005). The ecodistrict is located on two slate ridges which rise notably above the surrounding valleys of the Stewiacke, Musquodoboit and Shubenacadie rivers. The northeast trending ridges are comprised of folded Meguma Group slate with sandy clay loams

along the side slopes. The southeastern portion of the Project site lies within the St. Margaret's Bay Ecodistrict of the Western Ecoregion which encompasses the eastern portion of the South Mountain granitic batholith. This gently tilting upland ranges from 150m near Panuke Lake to sea level along the Atlantic coast. Predominant soils are well drained sandy loam that has developed on granitic till.

Elevation at the Project site ranges from 130 m to 185 m above sea level.

8.2.2 Surficial Geology

Surficial geology of the site consists of stony till plain otherwise referred to as ground moraine along the northwestern portion of the site. The southeastern portion is characterized as glacially scoured basins and knobs, overlain by thin, discontinuous veneer of till (Drawing 8.1). Till thickness ranges from 0 – 20 m, creating a flat to rolling topography with many surface boulders (Stea *et al.* 1992).

8.2.3 Bedrock Geology

Bedrock geology varies across the Project site with Middle-Late Devonian Granodiorite in the south and Cambrian – Ordovician aged metamorphic rocks of the Goldenville Formation in the center of the site, and the Halifax Formation to the north (Keppie 2000) (Drawing 8.2). Granite bedrock in this region is typically composed of a quartz-feldspar-biotite granite which intruded the lower metamorphic rocks. The Goldenville Formation is composed of alternate bands of quartzite and slate. The younger Halifax Formation is present in a syncline forming a uniform succession of rusty weathering, banded slates and argillites, commonly interbedded with relatively narrow bands of siltstones and chloritic, dense quartzites (Trescott 1969).

According to the NSE Well Log Database (NSE 2015a), there are 10 wells identified within 2 km of the Project site, ranging in depths from 17.4 m to 97.4 m. The majority of wells were drilled through slate (5), with shale (1), quartzite (1) and sandstone (1) also encountered. Surficial material was predominately clay ranging from 2.1 m to 60.9 m in thickness, with sand, gravel and boulders also observed.

Bedrock containing sulphide bearing minerals (*e.g.*, pyrite, pyrrhotite) can potentially generate acid run-off if fresh surfaces are exposed to oxygen and water. The physical disruption of such bedrock leads to oxidation of iron-sulphide minerals and the generation of ARD (Fox *et al*. 1997). Construction activities in the presence of ARD can result in the acidification of surface and groundwater and promote the mobilization and leaching of toxic contaminants into the environment, including heavy metals. The likelihood of ARD to occur will be determined following the results of the geotechnical evaluation.

Based on a review of local surficial and bedrock geology, and in consideration of anticipated site use and development associated with the Project, the likelihood of encountering bedrock mineralogy that would be harmful to human health or the environment is low. Radon is present in some bedrock types similar to granite at this Project site; however, radon gas released from bedrock quickly becomes air borne and presents no risk. Though some radioactive shows have been recorded in bedrock similar to the type at the Project site, no shows or radioactive mineralogy above ambient levels are known within the boundaries of the Project site.

N

Salmon Hole Dam Rd

Taylor Lake

Panuke Lake

Halls Lake

Bog Lake

Williams Rd

Highway 101

Highway 101

WTG 1

WTG 2

WTG 3

WTG 4

WTG 5

WTG 6

WTG 7

WTG 8

WTG 9

WTG 10

WTG 11

WTG 12

WTG 13

WTG 14

Portion of PID 45007903
Lands of
Atlantic Star Forestry Inc.

0 200 400 600 800 1,000
Metres

***Notes:***

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre. Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, 1:500,000, by R. R. Stea, H. Conley and Y. Brown, 1992. Digital Product Compiled by R. R. Stea and B. E. Fisher.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

***Legend:***

- Existing Turbines
- Proposed Turbines
- Existing Access Road
- Proposed Access Road
- Expansion Project Site
- Former Project Site Boundary
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Water Bodies

**Surficial Geology By Unit**

- Bedrock
- Kame Fields and Esker Systems
- Organic Deposits
- Silty Till Plain
- Stony Till Plain

# *Ellershouse Wind Farm Expansion - Surficial Geology*


Strum Consulting 20 YEARS Taking Charge

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*Bedford * Antigonish * Moncton * Deer Lake*


| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:15,000 | Drawing #: **8.1** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |

N

WTG 1
WTG 2
WTG 3
WTG 4
WTG 5
WTG 6
WTG 7
WTG 8
WTG 9
WTG 10
WTG 11
WTG 12
WTG 13
WTG 14

Salmon Hole Dam Rd
Williams Rd
Highway 101
Highway 101
Taylor Lake
Panuke Lake
Halls Lake
Bog Lake

Portion of PID 45007903
Lands of
Atlantic Star Forestry Inc.

0 200 400 600 800 1,000 Metres

***Notes:***

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre. Nova Scotia Department of Natural Resources, Minerals and Energy Branch. Map ME 2000-1, Geological Map of the Province of Nova Scotia, Compiled by J. D. Keppie.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

***Legend:***

- Existing Turbines
- Proposed Turbines
- Existing Access Road
- Proposed Access Road
- Expansion Project Site
- Former Project Site Boundary
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Water Bodies
- Water Bodies

**Bedrock Geology By Formation**

- Halifax Formation
- Goldenville Formation
- Middle - Late Devonian Granodiorite

# *Ellershouse Wind Farm Expansion - Bedrock Geology*


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| Date: | Project #: |
|---|---|
| September 2016 | 16-5807 |
| Scale: 1:15,000 | Drawing #: **8.2** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |

8.2.3 Hydrogeology and Groundwater

*Groundwater Quantity*
Water supplies near the Project site are generally derived from individually drilled or dug wells. A summary of the pertinent (within 2 km of the Project site) well properties included in NSE Well Log Database (NSE 2015a) is presented in Table 8.1.

**Table 8.1: Summary of Drilled Well Records**

| | Drilled Date (yr) | Well Depth (m) | Casing Length (m) | Estimated Yield (Lpm) | Water Level (m) | Overburden Thickness (m) | Water Bearing Fractures (m) |
|---|---|---|---|---|---|---|---|
| Minimum | 1968 | 17.4 | 3.0 | 4.54 | 1.0 | 2.1 | 7.0 |
| Maximum | 2001 | 97.4 | 59.0 | 36.3 | 13.0 | 60.9 | 94.5 |
| Average | 1984 | 46.8 | 16.2 | 17.9 | 8.0 | 38.3 | 43.7 |
| Number of well records | 10 | 10 | 9 | 10 | 5 | 9 | 9 |

Source: NSE 2015a

Based on short term driller's estimates for the wells in Table 8.1, the average yield is approximately 17.9 Lpm (4.7 gpm) and average well depth is approximately 46.8 m (153.5 ft). These measurements represent very short term yields estimated by the driller at the completion of well construction. Fracture depths ranged from 7.0 m (23.0 ft) to 94.5 m (328.3 ft). The closest drilled well to the Project site is located at the end of Salmon Hole Dam Road, approximately 850 m from the nearest turbine location (Turbine 11).

The NSDNR Pump Test Database (NSDNR 2014) provides longer term yields for select wells throughout the province. One regional well, drilled through the Halifax Formation located within 7 km of the Project site, indicates a long term safe yield ($Q_{20}$) of 95 Lpm (25 gpm) and an apparent transmissivity of 10.32 $m^2$/day.

NSE maintains the Nova Scotia Groundwater Observation Well Network (NSE 2015b). The nearest observation well to the Project site is located approximately 11.4 km north, in Smileys Provincial Park, near the community of MaKay Section. This well was drilled to a depth of 9.8 m through clay and gravel.The well had been constructed in 1967 as a water supply for the park and was converted to an observation well in 2011 because it was no longer in use as a water supply well. In 2014, the average water elevation was 29.05 m above sea level and the annual water level fluctuation was 2.85 m. The average depth to water in this well since 2014 was 5.95 m below top of casing.

*Groundwater Quality*
Groundwater in slate, quartzite and granite are usually calcium bicarbonate waters low in dissolved solids and hardness. Groundwater within the metamorphic bedrock of the Goldenville and Halifax Formations are often slightly acidic and sometimes contain iron, manganese, and occasionally arsenic (Trescott 1969).

Mitigation measures for potential effects to the geophysical environment are provided in Section 4.0.

### 8.3 Freshwater Environment

The Project site lies within the St. Croix River Watershed (1DE). Headwaters for the St. Croix River originate at Panuke Lake, flowing north-northwest where the river enters a broad glacial river valley, where it becomes tidal, creating an estuary for its remaining route to the Minas Basin several kilometres downriver from the Town of Hantsport. The St. Croix River merges with the Avon River north of the town of Windsor.

Prominent water bodies in watershed include Panuke Lake, Big St. Margaret's Bay Lake, and Long Lake. The closest water body to the Project site is Panuke Lake, located approximately 580 m from the turbine 11.

A total of twenty-six lakes within Hants County are included in the Nova Scotia Lake Inventory Program (NSE 2012b), which determines the baseline biophysical attributes of lakes throughout the province. Cameron Lake, Cochran Lake, Five Mile Lake, Lily Lake and Panuke Lake are all located within 10 km of the Project site. However data from these sampling events were completed between 10 and 30 years ago, therefore are considered outdated.

No lakes or water bodies are present within the Project site boundaries (Drawing 8.3).

No watercourses were observed within 100 m of the proposed turbine locations and no mapped watercourses are present within 300 m of the proposed turbine locations. No watercourses were observed along the proposed access road.

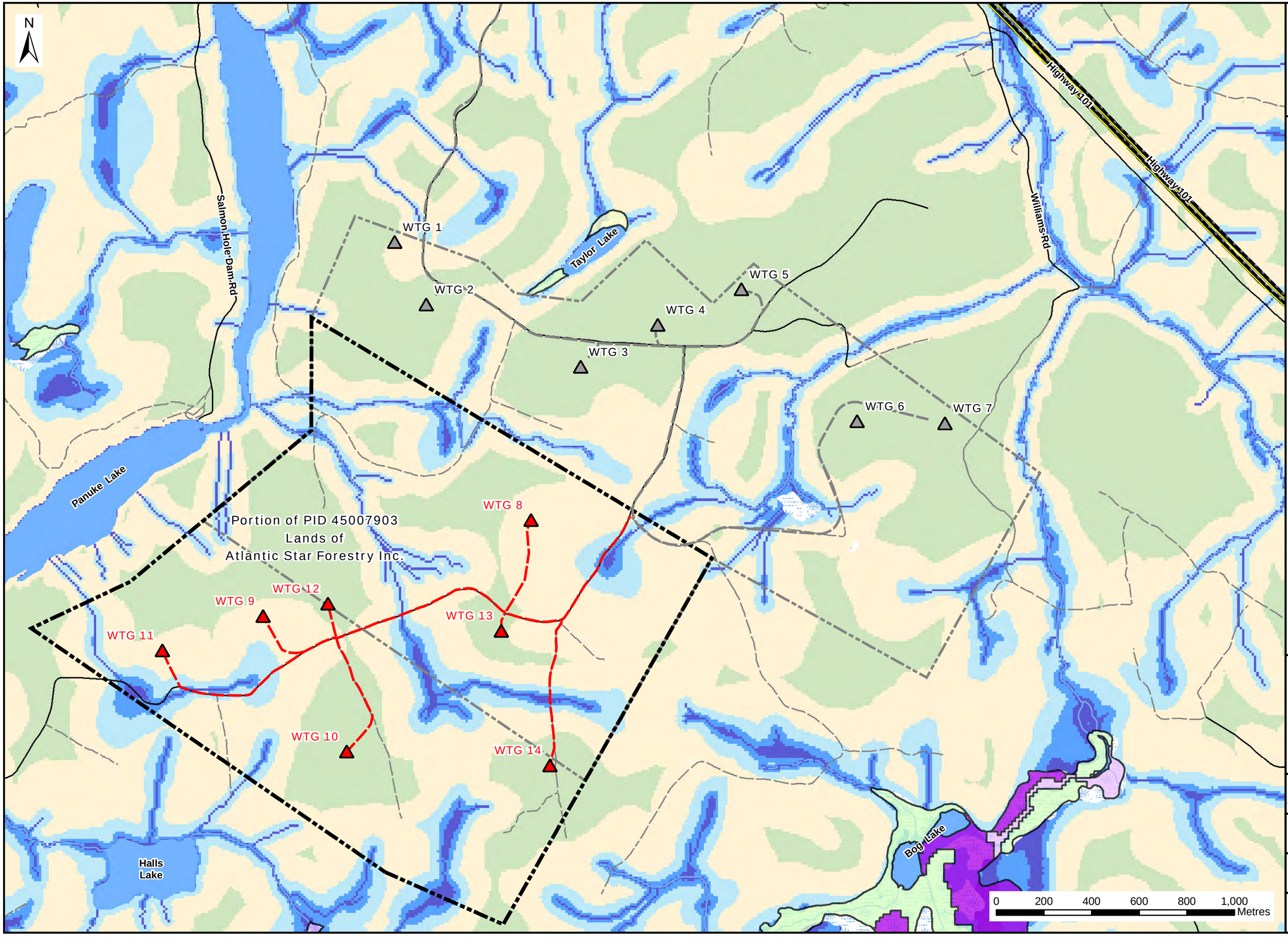
#### 8.3.1 Watercourse Alterations

Based on the proposed Project layout, no watercourse alterations will be required for the Ellershouse Wind Farm Expansion.

### 8.4 Terrestrial Habitat

Forests in this ecodistrict are commonly comprised of red spruce (*Picea rubens*) forests on all slope positions throughout the area and mixedwood forests on hilly topography underlain by moist, fine textured soils (Neily et al. 2005). Pure stands of tolerant softwood or hardwood may occur, forming a classic mix of the sugar maple (*Acer saccharum)*, yellow birch (*Betula alleghaniensis)*, beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), red spruce and hemlock (*Tsuga canadensis*) with scattered white pine. Black spruce (*Picea mariana*) and white pine (*Pinus strobus*) typically occupy the shallow, drier soils (Neily et al. 2005).

Habitat mapping (NSDNR 2012a) suggests that the vast majority of the Project site is forested, with mixed wood and softwood stands being the dominant habitat features (Table 8.2; Drawing 8.5).




***Notes:***

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre. Wetland Inventory & Wet Areas Mapping by Nova Scotia Department of Natural Resources (NS DNR).
2. Projection: NAD83(CSRS), UTM Zone 20 North.

***Legend:***

- Proposed Turbines
- Existing Turbines
- Proposed Access Road
- Existing Access Road
- Expansion Project Site
- Former Project Site Boundary
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Mapped Stream
- Mapped Indefinite Stream
- Mapped Wet Area
- Water Bodies

**NS DNR Wetland Inventory**

**(Habitat)**

- Bog or Fen
- Fen
- Marsh
- Salt Marsh
- Swamp

**Depth to Water Table (m)**

- 0 - 0.10 m
- 0.11 - 0.50 m
- 0.51 - 2 m
- 2.01 - 10 m
- > 10 m

# *Ellershouse Wind Farm Expansion - Desktop Review Results*

Strum Consulting — 20 Years Taking Charge

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:15,000 | Drawing #: **8.3** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |

**Table 8.2: Habitat Types at the Project Site**

| Habitat Type | Area (Ha) | Proportion of Project Site (%) |
|---|---|---|
| Mixed wood | 193.3 | 55.0% |
| Softwood | 100.0 | 28.4% |
| Plantation | 44.1 | 12.5% |
| Hardwood | 14.3 | 4.1% |
| **Total** | **351.7** | **100.00%** |

Source: NSDNR 2012a

Aerial imagery combined with field observations; however, reveal that the proportion of intact forest stands is currently less than habitat mapping suggests, due to recent forestry activities at the Project site. Field observations indicate much of the Project site has been cutover within the last 5 years, and forestry activity is ongoing. Intact forest stands at the Project site are varied in their composition and successional stage. Balsam fir (*Abies balsamea*), red maple, red spruce (*Picea rubens*), black spruce, and yellow birch characterize the canopy in most stands. Tolerant hardwoods, in general, are lacking from the site despite the prominence of well drained hilltops on the landscape.

Owing to the well-drained nature of the soils, wetland habitat is limited at the Project site. Wetlands present are for the most part treed or shrub swamps that form in flat areas and at the base of slopes and are covered by dense layer of speckled alder (*Alnus incana*), or other hardwood shrubs such as yellow or white birch (*Betula papyrifera*), growing under a hardwood or mixed-wood tree canopy. Wetlands also occur in open areas that may have been disturbed by forestry activities. These wetlands are often covered by a dense layer of opportunistic herbs such as woolgrass (*Scirpus cyperinus*), fringed sedge (*Carex crinita*) and soft rush (*Juncus effusus*).

It is expected that an area of approximately 1 ha will be disturbed around each turbine location. Field observations indicate that only one of the proposed turbine locations (Turbine 13) is within an intact area of middle aged to mature mixed wood forest. The remaining turbine locations consist for the most part of immature regenerating mixed wood forest that is characterized by young balsam fir, red spruce, and yellow birch trees growing amongst thickets of opportunists like raspberry (*Rubus idaeus*) and blackberry (*Rubus fruiticosus*).

### 8.4.1 Wetlands

A desktop identification of the location and extent of potential wetlands across the Project site was completed by reviewing the following information sources:

- Satellite and aerial photography;
- Nova Scotia Wet Areas Mapping database (WAM) (NSDNR 2012b);
- Nova Scotia Geomatics Centre; and
- NS Significant Species and Habitat Database (NSDNR 2016).

A review of the NS Significant Species and Habitat Database revealed no areas of wetland habitat present within the Project site (Drawing 8.3). The nearest mapped wetland to a proposed turbine location is approximately 800 m south of turbine 10.

WAM indicates the potential for wetland habitat and/or watercourses in several areas throughout the Project site. However the proposed turbine locations are in areas with low potential for wetland habitat and/or watercourses. Satellite imagery does not indicate any open areas that may represent open bog, marsh or fen type wetlands in areas near the proposed turbine locations.

A total of five wetlands were observed throughout the Project site within a 30 m easement of the proposed access roads (Drawing 8.4 A-D). No wetlands were found within 100 m of a proposed turbine location. The wetlands on the Project site are all treed swamps, which have been bisected by the installation of logging roads that run through the Project site, and have thus suffered a good deal of disturbance. The soil within these wetlands is for the most part a shallow mucky or peaty organic soil layer that occurs on a restrictive rock surface. No watercourses were observed to be associated with any of the five wetlands on the site, but several ephemeral drainage features, including roadside ditches, were observed to contribute to or drain water from the wetlands.

Detailed wetland characterizations are provided in Table D1 (Appendix D).

Based on the current layout, it is expected that minor wetland alterations will be required in areas where upgrades and/or modifications to the access roads are required. Detailed design will determine the exact number and total area of alterations required. However, impacts to individual wetlands along the road will be very limited and will represent small areas to facilitate road upgrades/modifications (where required) for the safe passage of Project infrastructure. Where alterations are required along the existing road, hydrological function and connectivity of all wetlands will be maintained. No wetland alterations will be required in association with turbine pad locations.

A provincial wetland alteration permit will be sought for the alteration location as required by the Nova Scotia Wetland Alteration Application process. This will be done during the permitting stage of the Project and will include a characterization of wetland function affected by the development footprint. Detailed mitigation measures and BMPs to reduce adverse effects on the altered wetland, as well as the adjacent, non-altered wetlands will be outlined as part of this process. Compensation for direct impacts to the wetland will be provided in accordance with NSE requirements.

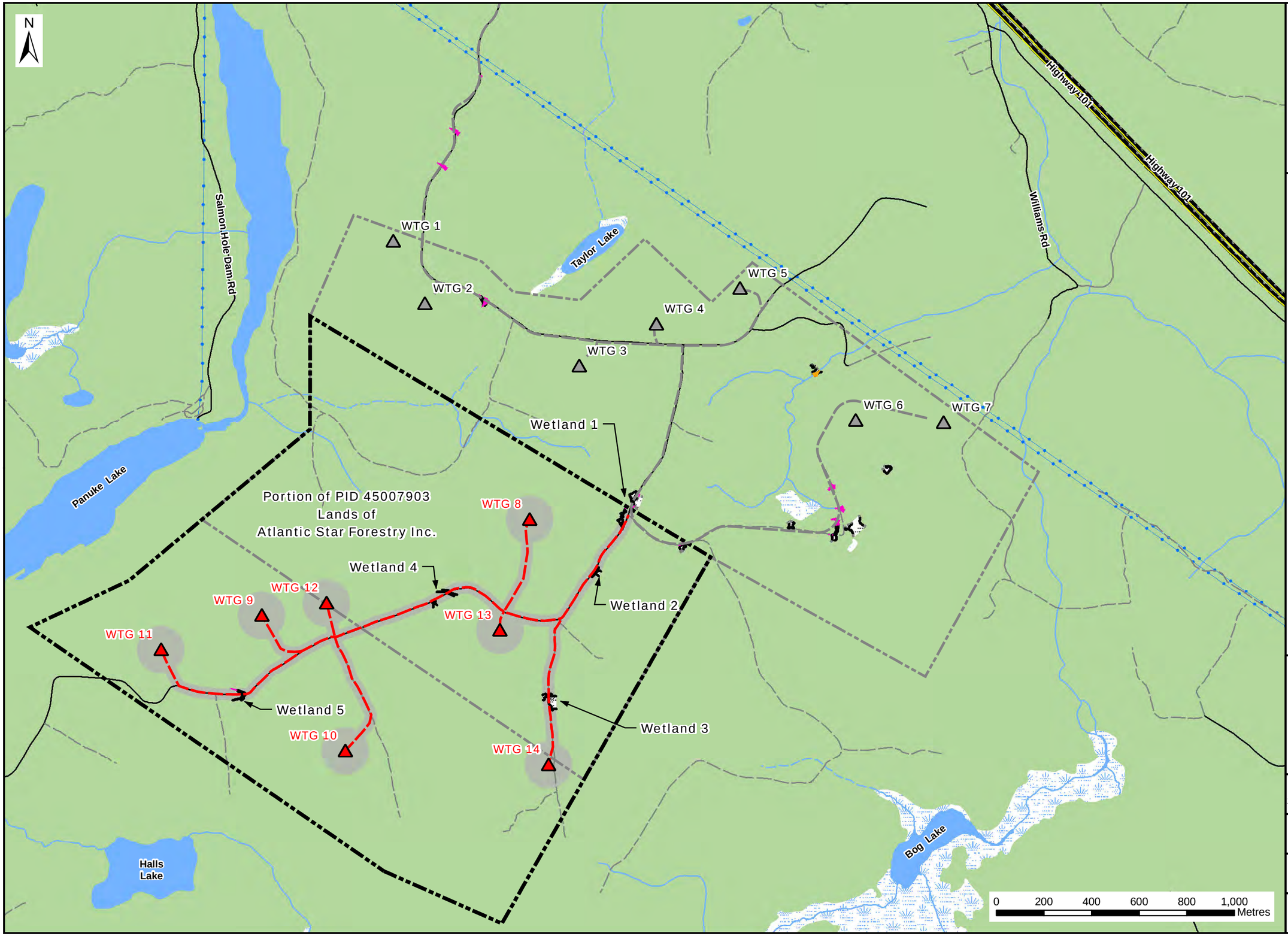
### 8.5 Terrestrial Vegetation

ACCDC records indicate that 429 flora species have been identified within 100 km of the Project site. Of the 429 species identified by ACCDC, 291 SOCI were identified within 100 km of the Project site. This preliminary list was used to develop a short list of plant SOCI that might be present at the Project site. The short list of plant SOCI is provided in Table E1 (Appendix E).

A plant survey was completed on the Project site on August 3 and 4, 2016. A complete list of plant species identified during the surveys is provided in Table E2 (Appendix E). No plant SOCI were observed on the Project site.

### 8.6 Terrestrial Fauna

Information regarding terrestrial fauna for the Project site, including any SOCI, was obtained through a combination of desktop review and field studies.




***Notes:***

1. Reference: Digital Topographic Mapping & Property Management Unit MU9940 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Site Features & Project / Propety Boundaries are Approximate. This Plan is for Presentation only & Not Intended for Legal Use.
4. GPS Data Collected is Typically to +/-5m Accuracy.

***Legend:***

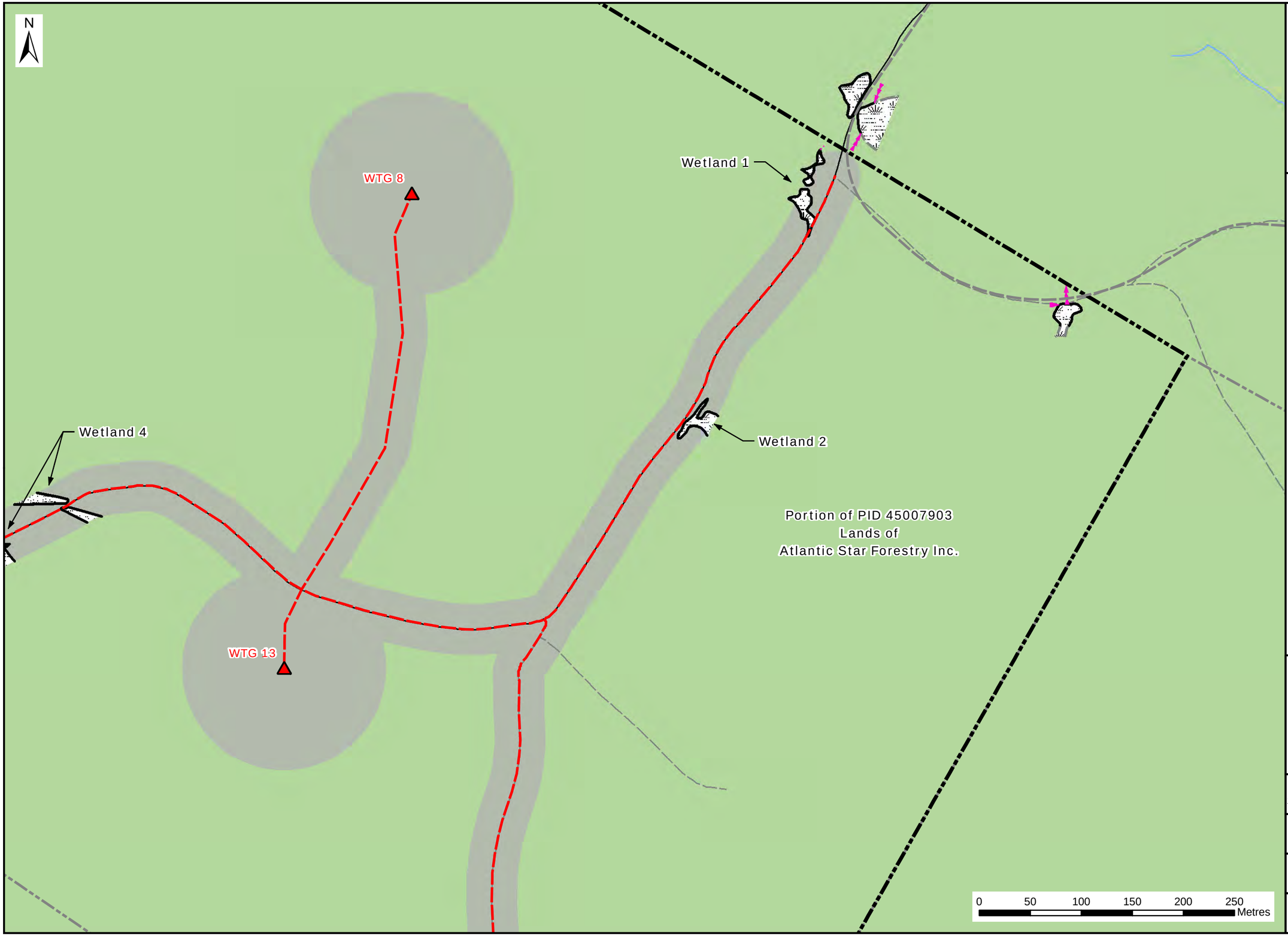
- Existing Turbines
- Proposed Turbines
- Existing Access Road
- Proposed Access Road
- Field Identified Watercourse
- Field Identified Drainage Channel
- Confirmed Wetland Boundary
- Approximate Wetland Boundary
- Field Identified Wetlands
- Expansion Project Site
- Former Project Site Boundary
- Approximate Assessment Area
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Mapped Wet Area

# *Ellershouse Wind Farm Expansion - Survey Results*

Strum Consulting — 20 Years Taking Charge

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:15,000 | Drawing #: **8.4A** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |




***Notes:***

1. Reference: Digital Topographic Mapping & Property Management Unit MU9940 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
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***Legend:***

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# *Ellershouse Wind Farm Expansion - Survey Results*

Strum 20 YEARS Taking Charge CONSULTING

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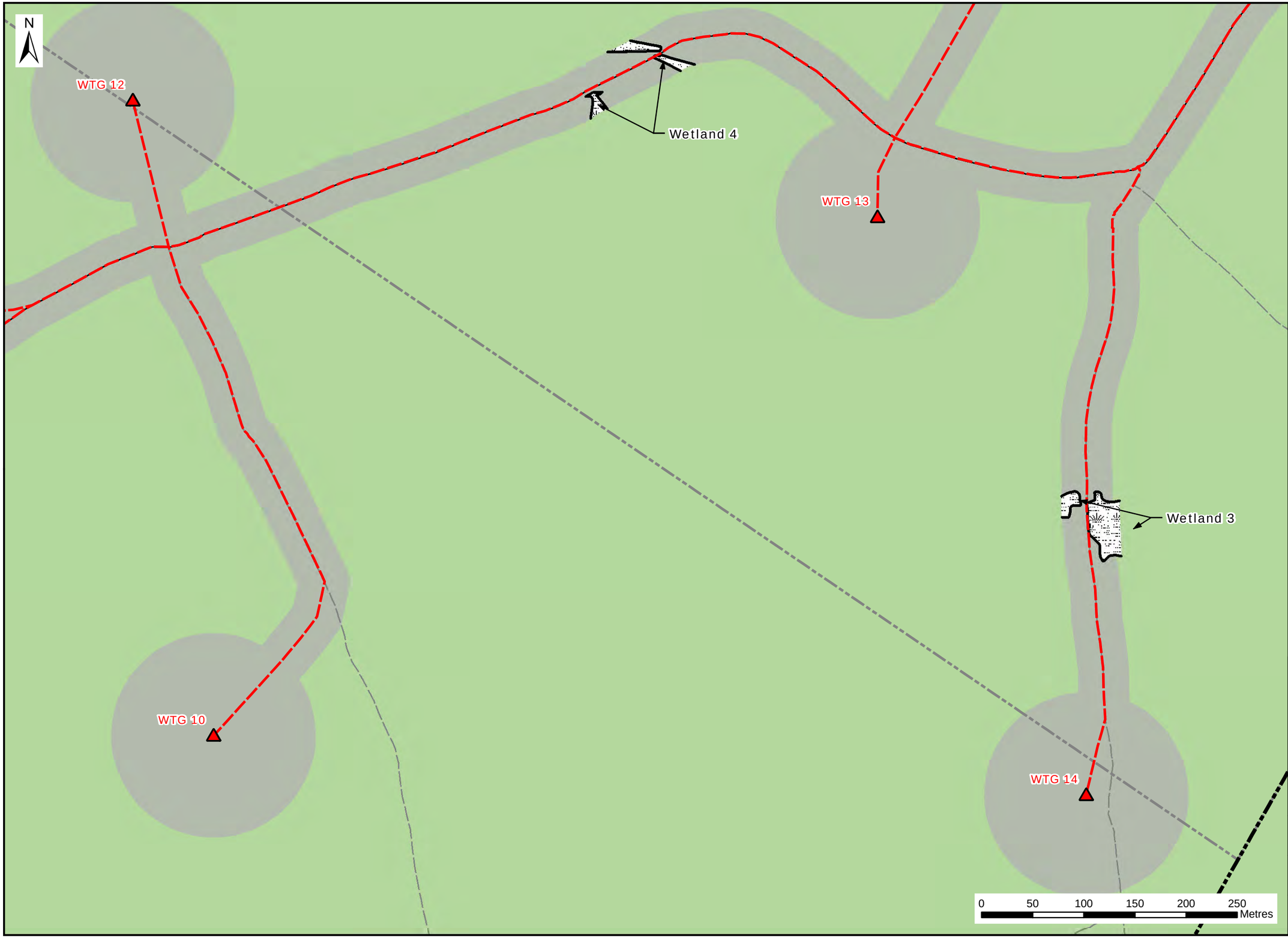
*Bedford * Antigonish * Moncton * Deer Lake*

| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:3500 | Drawing #: **8.4B** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |




***Notes:***

1. Reference: Digital Topographic Mapping & Property Management Unit MU9940 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Site Features & Project / Propety Boundaries are Approximate. This Plan is for Presentation only & Not Intended for Legal Use.
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***Legend:***

- Existing Turbines
- Proposed Turbines
- Existing Access Road
- Proposed Access Road
- Field Identified Watercourse
- Field Identified Drainage Channel
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- Approximate Wetland Boundary
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# *Ellershouse Wind Farm Expansion - Survey Results*


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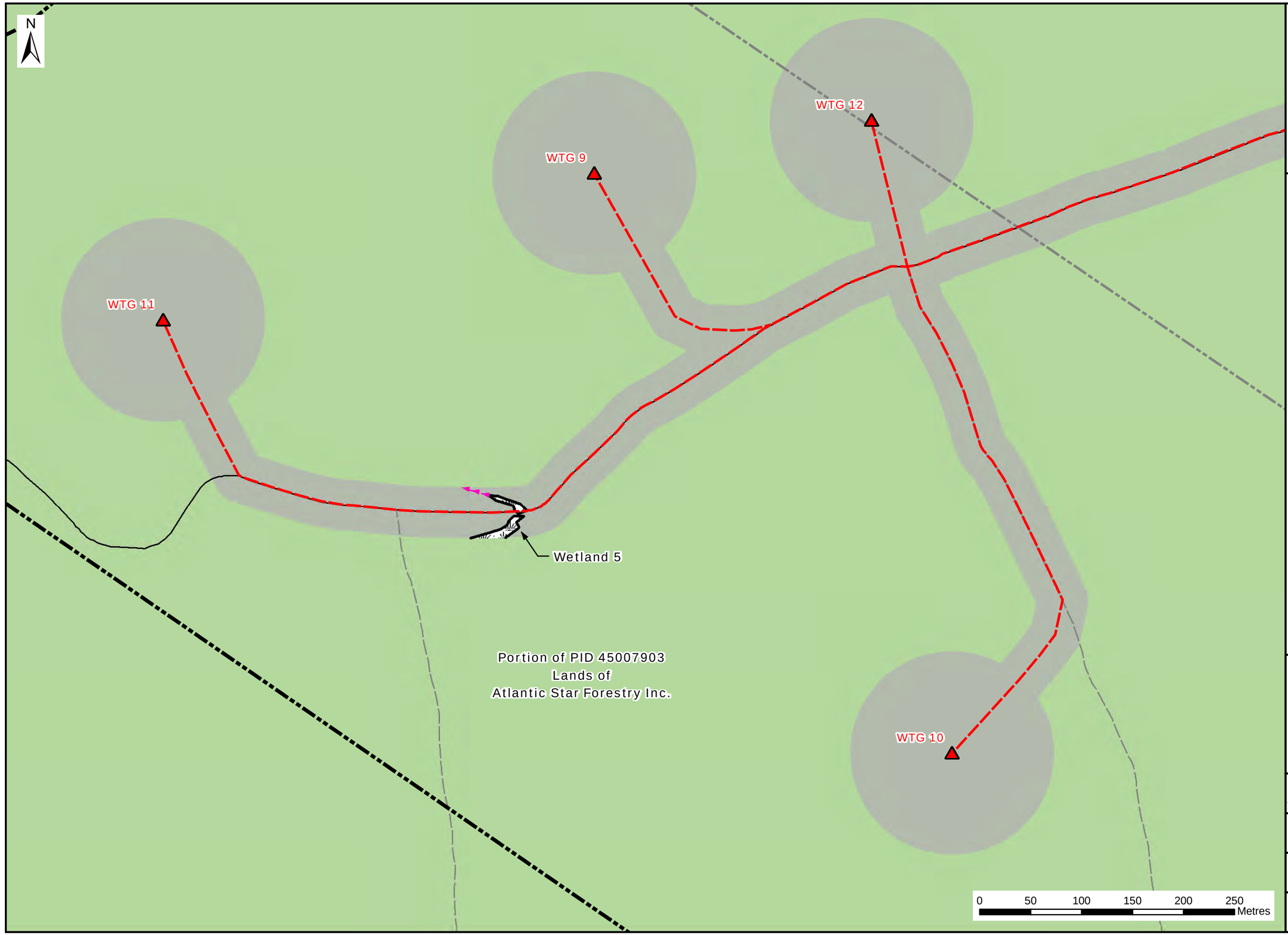
| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:3500 | Drawing #: **8.4C** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |




***Notes:***

1. Reference: Digital Topographic Mapping & Property Management Unit MU9940 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Site Features & Project / Propety Boundaries are Approximate. This Plan is for Presentation only & Not Intended for Legal Use.
4. GPS Data Collected is Typically to +/-5m Accuracy.

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- Existing Turbines
- Proposed Turbines
- Existing Access Road
- Proposed Access Road
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- Field Identified Drainage Channel
- Confirmed Wetland Boundary
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- Mapped Wet Area

# *Ellershouse Wind Farm Expansion - Survey Results*

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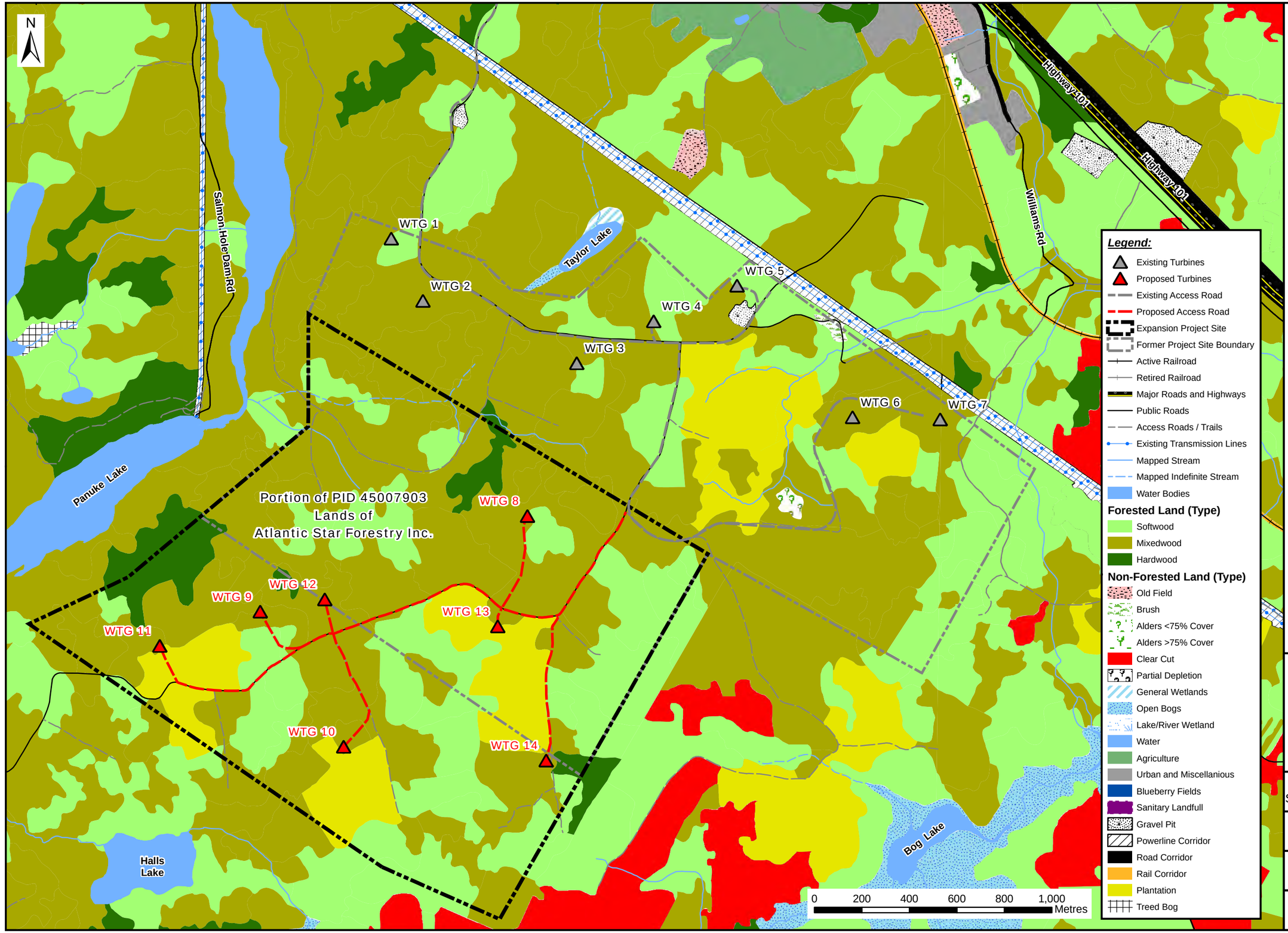
| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:3500 | Drawing #: **8.4D** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |




***Notes:***

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre. Forestry Inventory by Nova Scotia Department of Natural Resources (NS DNR).
2. Projection: NAD83(CSRS), UTM Zone 20 North.

# *Ellershouse Wind Farm Expansion - Habitat Cover*

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| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:15,000 | Drawing #: **8.5** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |

The desktop component included a review of the NS Significant Species and Habitat Database (NSDNR 2016) and ACCDC data (ACCDC 2016) for species recorded within a 100 km radius of the Project site. A comparison of habitat mapping data to known habitat requirements for species expected to occur within the area, and for all SOCI, was also completed.

8.6.1 Mammals

The Nova Scotia Significant Species and Habitat Database (NSDNR 2016) contains 11 unique species and/or habitat records pertaining to terrestrial mammals within a 100 km radius of the Project site. These records include:

- Six records that are classified as "Deer Wintering", which relate to known over-wintering habitat for White-tailed deer (*Odocoileus virginianus*);
- One record that is classified as 'Species of Risk", which pertains to Southern flying squirrel (*Glaucomys volans*);
- Four records classified as "Species of Concern", which relate to Fisher (*Martes pennanti*) and Long-tailed Shrew (*Sorex dispar*); and
- Two records classified in the database as "Other Habitat", relating to American Beaver (*Castor canadensis*) and American Black Bear (*Ursus americanus*).

No records that relate to terrestrial mammal habitat are within 10 km of the Project site.

The ACCDC database (2016) indicates that seven species of terrestrial mammals (excluding bats) have been recorded within a 100 km radius of the Project site (Table 8.3).

**Table 8.3: Mammal Species Recorded within a 100 km radius of the Project Site**

| Common Name | Scientific Name | *SARA* Status[1] | NS *ESA* Status[2] | COSEWIC Status[3] | NSDNR Status[4] | NS S-Rank[5] |
|---|---|---|---|---|---|---|
| American Marten | *Martes americana* | Not Listed | Endangered | Not Listed | At Risk | S1 |
| Fisher | *Martes pennanti* | Not Listed | Not Listed | Not Listed | Sensitive | S3 |
| Long-tailed shrew | *Sorex dispar* | Special Concern | Not Listed | Not at Risk | Sensitive | S2 |
| Lynx | *Lynx canadensis* | Not Listed | Endangered | Not at Risk | At Risk | S1 |
| Mainland moose | *Alces americanus* | Not Listed | Endangered | Not Listed | At Risk | S1 |
| Southern bog lemming | *Synaptomys cooperi* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Southern flying squirrel | *Glaucomys volans* | Special Concern | Not Listed | Not at Risk | Sensitive | S2S3 |

Source: ACCDC 2016

[1]Government of Canada 2012; [2]NS *ESA* 2013; [3]COSEWIC 2012; [4]NSDNR 2010; [5]ACCDC 2016

Of note is that sightings of many of the most common species are unreported to ACCDC, and are therefore under-represented or absent from the database. Consequently, a review of the ACCDC data reveals predominantly rare or noteworthy species despite the fact that these species certainly represent a small fraction of the existing mammal community in an area.

Field studies (between August and November 2016) of mammalian fauna at the Project site consisted of direct observation of individuals, as well as the indirect identification of species by sound and/or sign (*e.g.,* scat, tracks, scent, dens, lodges, etc). Mammals observed during the 2013 field studies have also been included in this section. In addition, targeted pellet count surveys were completed for Mainland moose in May and November 2013. Of the seven transects completed during the 2013 pellet count surveys, three were located within the proposed expansion area and the remaining four transects were located within 1 km of the expansion area. Due to the close proximity of the previous surveys, consistent habitat cover and connectivity to the proposed Project site, the results gathered in 2013 are deemed representative of the conditions to be expected within the proposed Project site. A detailed methodology for pellet count surveys is provided in Appendix F.

Table 8.4 lists the mammal species observed/identified at or near the Project site during the 2013 and 2016 field studies.

**Table 8.4: Mammal Species Observed during Field Studies**

| Common Name | Scientific Name | *SARA* Status[1] | NS *ESA* Status[2] | COSEWIC Status[3] | NSDNR Status[4] | NS S-Rank[5] |
|---|---|---|---|---|---|---|
| American black bear | *Ursus americanus* | Not Listed | Not Listed | Not at Risk | Secure | S5 |
| American porcupine | *Erethizon dorsatum* | Not Listed | Not Listed | Not Listed | Secure | S5 |
| Bobcat | *Lynx rufus* | Not Listed | Not Listed | Not Listed | Secure | S5 |
| Snowshoe hare | *Lepus americanus* | Not Listed | Not Listed | Not Listed | Secure | S5 |
| White-tailed deer | *Odocoileus virginianus* | Not Listed | Not Listed | Not Listed | Secure | S5 |

[1]Government of Canada 2012; [2]NS *ESA* 2013; [3]COSEWIC 2012; [4]NSDNR 2010; [5]ACCDC 2016

Priority mammal species include:

- American Marten – “Endangered” (NS *ESA*), “At Risk” (NSDNR), “S1” (ACCDC);
- Fisher – “Sensitive” (NSDNR), “S3” (ACCDC);
- Long-tailed shrew – “Special Concern” (SARA), “Sensitive” (NSDNR), “S2” (ACCDC);
- Lynx – “Endangered” (NS *ESA*), “At Risk” (NSDNR), “S1” (ACCDC);
- Mainland moose – “Endangered” (NS *ESA*), “At Risk” (NSDNR), “S1” (ACCDC);
- Southern bog lemming – “S3” (ACCDC); and
- Southern flying squirrel – “Special Concern” (SARA), “Sensitive” (NSDNR), “S2S3” (ACCDC).

*American Marten*

American marten prefer mature coniferous forests, and have been more recently observed in mixed forests and cutovers (MTRI 2008). Although these types of habitat are prevalent at the Project site,

the current known distribution of the American marten in Nova Scotia is limited to Cape Breton and the southwestern part of the province, near Yarmouth (NSDNR 2015). ACCDC data indicate that the closest observation of this species to the Project site was 93.9 km.

It is therefore unlikely that the Project will interact with and/or impact American marten populations and no further consideration of effects and mitigation for this species has been undertaken.

*Fisher*
Fisher prefer dense, mature to old-growth forests with continuous overhead cover (Allen 1983). Generally considered a forest-interior species (OMNR 2000), Fisher require large tracts of well-connected habitat (Meyer 2007).

Fisher are distributed throughout mainland Nova Scotia, and trapping data suggests population concentrations in Cumberland, Colchester, and Pictou counties; just 29 Fisher have been harvested from Hants County since 2007, representing 3.5% of the provincial total during that time (NSDNR 2015).

ACCDC data indicate that the closest observation of this species to the Project site was 45.3 ± 5.0 km. No indication of Fisher was observed during field surveys. However, mid-aged mixed wood stands in the interior of the site may provide suitable canopy closure and coarse woody debris of sufficient diameter for Fisher. While these intact stands are likely too small to form a core area within a Fisher home range, it is possible that they provide habitat connectivity for dispersing juveniles in search of a permanent territory. While trapping data suggests that the density of the Fisher population in the area of the Project site is low, harvest can be influenced by both density and trapper effort.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 13.2.1.

*Long-tailed shrew*
Long-tailed shrew are closely associated with steep, talus slopes, usually close to running water, and the presence of rocks is considered a principal habitat component (Kirkland 1981).

Thought to be found only in the Cobequid Mountains (Scott 1987; Woolaver *et al*. 1998), more recent research has identified an additional population of Long-tailed Shrew near Wolfville at Stewart Mountain, approximately 41 km to the north of the Project site (Shafer and Stewart 2006).

ACCDC data indicate that the closest observation of this species to the Project site was 44.6 km. No indication of Long-tailed shrew was observed during field studies. Slopes of sufficient grade (≥25%) are present to the north of the Project site within the boundaries of the original Ellershouse Wind Farm Project site along a mapped watercourse. Although habitat in this area was not surveyed extensively, boulders were observed at the base of the slope which could indicate suitable boulder talus in the area of the watercourse. Given that a known population exists in the region, and that slopes with a grade consistent with known habitat requirements are present, it is possible that Long-

tailed Shrew occur near the Project site. Presence/absence of this small mammal can only be verified through the implementation of a targeted live-trapping program.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 13.2.1.

*Lynx*
The distribution of Canada lynx is limited to the availability of extensive coniferous forests and distribution of Snowshoe hare (Lepus americanus) (main prey item), and in Nova Scotia the Canada lynx is limited to the Cape Breton Highlands (MTRI 2008). Although individuals may travel great distances in times of food scarcity (as cited in Parker 2001), potentially passing through the Project site, the possibility of this occurring during the construction phase of the Project is highly unlikely.

ACCDC data indicate that the closest observation of this species to the Project site was 77.3 ± 1.0 km.

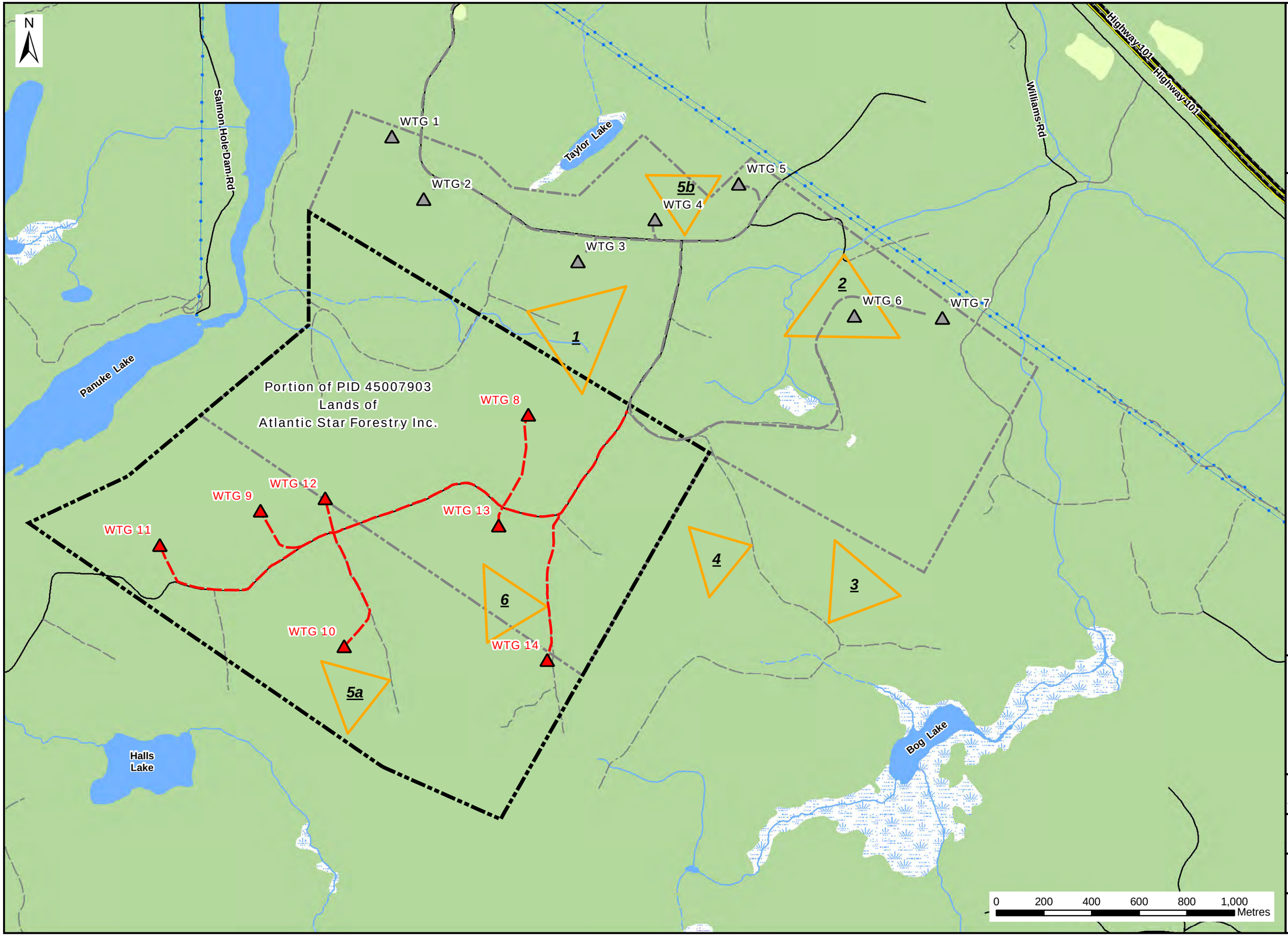
The Project, therefore, will not have any impact on Lynx and no further consideration of effects and mitigation for this species has been undertaken.

*Mainland Moose*
Habitat requirements for Mainland moose change throughout the year. Early successional growth, such as that provided by regenerating cutovers, offers quality foraging habitat for moose, and interspersed wetlands provide suitable summer habitat for cows and calves (Parker 2003; Snaith and Beazley 2004). Mature softwood forest is used as escape cover throughout the year, and also provides thermal relief during the summer months (Broders *et al*. 2012) and relief from deep snows in winter (Telfer 1970).

Five significant concentration areas for Mainland moose have been identified in Nova Scotia (NSDNR 2012c). The Project site is situated in close proximity to the northern extent of one such concentration area. The closest observation of Mainland Moose contained within the ACCDC database (ACCDC 2016) is approximately 20.3 km.

No evidence of Mainland moose was observed at the Project site during targeted pellet-group surveys conducted in May and November 2013 (Drawing 8.6). The highly fragmented nature of the general landscape has resulted in a habitat patchwork that appears to provide for the varied requirements of this species. Mid-aged forest stands in the Project site's interior may provide escape cover and relief from deep snows and hot summer temperatures, especially along south facing slopes, while regenerating cutovers may provide suitable forage as they age. It is therefore possible that Mainland Moose occur at the Project site.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 13.2.1.




***Notes:***

1. Reference: Digital Topographic Mapping & Property Management Unit MU9940 by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Site Features & Project / Propety Boundaries are Approximate. This Plan is for Presentation only & Not Intended for Legal Use
4. GPS Data Collected is Typically to +/-5m Accuracy.

***Legend:***

- Existing Turbines
- Proposed Turbines
- Existing Access Road
- Proposed Access Road
- Moose Survey Transect
- Expansion Project Site
- Former Project Site Boundary
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

# *Ellershouse Wind Farm Expansion - Moose Survey Transects*

Strum Consulting — 20 Years — Taking Charge

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

| | |
|---|---|
| Date: September 2016 | Project #: 16-5807 |
| Scale: 1:15,000 | Drawing #: **8.6** |
| Drawn By: H. Serhan | |
| Checked By: S. Duncan | |

*Southern bog lemming*
Southern bog lemming is widely distributed thought southeastern Canada from the maritime provinces to southeastern Manitoba. The prime habitat for lemmings is in moist, grassy areas around sphagnum bogs, swamps and stream edges but can inhabit a wide range of less preferred habitats, such as shrubby grasslands, mixed forests, wet meadows, pasture lands, woodland clearings, and even clearcuts (Naughton 2014).

ACCDC data indicate that the closest observation of this species to the Project site was 44.6 km. No indication of Southern bog lemming was observed during field studies. As there are no open wet areas characterized by grassy or mossy substrate in or near the Project site, this species is not likely to occur. The Project is therefore not expected to have any impact on the Southern bog lemming, and no further consideration of effects and mitigation for this species has been undertaken.

*Southern flying squirrel*
Southern flying squirrel requires mast bearing trees for forage and tree cavities for nesting and in the Atlantic Region, southern flying squirrels select older forest stands (COSEWIC 2006). In Nova Scotia, the species demonstrates a particular affinity to red oak (*Quercus rubra*) which is most commonly found in mixed wood stands as opposed to pure hardwood stands (Lavers 2004).
In Nova Scotia, Southern flying squirrel occur primarily in a region bounded by the South Mountain in the north, Kentville in the east, New Ross in Lunenburg County to the south, and extends to Kejiimkujik National Park in the west (COSEWIC 2006). This range extends to within approximately 6 km of the Project site.

ACCDC data indicate that the closest observation of this species to the Project site was 28.9 km. No indication of Southern flying squirrel was observed during field studies, although the species' nocturnal habits mean it is unlikely to be identified in the absence of targeted surveys. Habitat mapping indicates a small amount of red oak at the Project site, and tolerant hardwoods are present which may include other mast bearing trees such as American beech (*Fagus grandifolia*). However, these tree species are at best a minor component of the stands at the Project site. The forestry activity on the Project site has removed much of the quality hardwood trees from the area, so suitable habitat for this species is sparse. Therefore, it is unlikely that Southern flying squirrel occurs at the Project site. The Project is therefore not expected to have any impact on Southern flying squirrel and no further consideration of effects and mitigation for this species has been undertaken.

### 8.6.2 Herpetofauna
The Nova Scotia Significant Species and Habitat Database (NSDNR 2016) contains 203 unique species and/or habitat records pertaining to reptiles and amphibians within a 100 km radius of the Project site. These records include:

- 179 records that are classified in the database as "Species at Risk", which relate to Wood turtle (*Glyptemys insculpta*);
- One record classified as "Species of Concern", related to Painted Turtle (*Chrysemys picta*); and
- Twenty-three records classified as "Other Habitat", which also relates to Wood turtle.

No records that relate to herpetofauna habitat are within 10 km of the Project site.

Data from the ACCDC (2016) indicate that five species of herpetofauna have been recorded within a 100 km radius of the Project site (Table 8.5).

**Table 8.5: Herpetofauna Species Recorded by ACCDC within a 100 km radius of the Project Site**

| Common Name | Scientific Name | *SARA* Status[1] | NS *ESA* Status[2] | COSEWIC Status[3] | NSDNR Status[4] | NS S-Rank[5] |
|---|---|---|---|---|---|---|
| Blanding's Turtle | *Emydoidea blandingii* | Endangered | Endangered | Endangered | At Risk | S1 |
| Eastern Ribbon Snake | *Thamnophis sauritus* | Threatened | Threatened | Threatened | At Risk | S2S3 |
| Four-toed Salamander | *Hemidactylium scutatum* | Not Listed | Not Listed | Not at Risk | Secure | S3 |
| Snapping Turtle | *Chelydra serpentina* | Special Concern | Vulnerable | Special Concern | Sensitive | S3 |
| Wood Turtle | *Glyptemys insculpta* | Threatened | Threatened | Threatened | Sensitive | S2 |

Source: ACCDC 2016

[1]Government of Canada 2012; [2]NS *ESA* 2013; [3]COSEWIC 2012; [4]NSDNR 2010; [5]ACCDC 2016

The same data limitations and interpretations as noted for the mammalian fauna (Section 8.6.1) are also applicable to the reptile and amphibian data.

Field studies of amphibian and reptile species were conducted in conjunction with other surveys between August and November 2016. Amphibian and reptiles observed during the 2013 field studies have also been included in this section. Species were either identified directly through visual observation, or indirectly using other evidence (*e.g.,* calls, egg masses, tadpoles, etc.). Table 8.6 lists the amphibian and reptile species identified at or near the Project site during the 2013 and 2016 field studies.

**Table 8.6: Herpetofauna Species Recorded During Field Studies**

| Common Name | Scientific Name | *SARA* Status[1] | NS *ESA* Status[2] | COSEWIC Status[3] | NSDNR Status[4] | NS S-Rank[5] |
|---|---|---|---|---|---|---|
| Green frog | *Lithobates clamitans* | Not Listed | Not Listed | Not Listed | Secure | S5 |
| Spring peeper | *Pseudacris crucifer* | Not Listed | Not Listed | Not Listed | Secure | S5 |

[1]Government of Canada 2012; [2]NS *ESA* 2013; [3]COSEWIC 2012; [4]NSDNR 2010; [5]ACCDC 2016

Priority herpetofauna species include:

- Blanding's turtle – "Endangered" (SARA), "Endangered" (NS *ESA*), "Endangered" (COSEWIC), "At Risk" (NSDNR), "S1" (ACCDC);
- Eastern ribbon snake – "Threatened" (*SARA*), "Threatened" (NS *ESA*), "Threatened" (COSEWIC), "At Risk" (NSDNR), "S2S3" (ACCDC);
- Four-toed Salamander – "S3" (ACCDC);
- Snapping turtle – "Special Concern" (SARA), "Vulnerable" (NS *ESA*), "Special Concern" (COSEWIC), "Sensitive" (NSDNR), "S3" (ACCDC);

- Wood turtle – "Threatened" (SARA), "Threatened" (NS *ESA*), "Threatened" (COSEWIC), "Sensitive" (NSDNR), "S2" (ACCDC).

None of the priority species listed above were observed during field studies.

*Blanding's turtle*
Blanding's turtle make use of a variety of wetland habitats including lakes, ponds, brooks, creeks, and marshes (COSEWIC 2005), and are closely associated with areas of extensive beaver activity (TBTRT 2012).

The known range of this species in Nova Scotia is restricted to the southwestern interior of the province where there are five disjunct populations within the Medway, Mersey, and Sissiboo River watersheds (TBTRT 2012). ACCDC data indicate that the closest observation of this species to the Project site was 70.6 km. The geographic separation from the range of Blanding's turtle in Nova Scotia means that the Project it is highly unlikely that species occurs at the Project site.

The Project is therefore not expected to have any impact on Blanding's turtle and no further consideration of effects and mitigation for this species has been undertaken.

*Eastern ribbon snake*
Eastern ribbon snake is a semi-aquatic species typically found in freshwater habitats including wetlands, still water streams and marshes (COSEWIC 2002).

In Nova Scotia, concentrations of Eastern ribbonsnake are thought to be limited to interior portions of the Mersey, Medway, and LaHave River watersheds in the southwestern region of the province, although recent discoveries have expanded the known range of this species to include the Petite Rivière watershed (Gilhen *et al*. 2012). Nonetheless, the Project site has substantial geographic separation from the species' known range in Nova Scotia; it is therefore highly unlikely that Project Eastern ribbon snake occurs at the Project site. ACCDC data indicate that the closest observation of this species to the Project site was 77.5 km.

The Project is therefore not expected to have any impact on Eastern ribbon snake and no further consideration of effects and mitigation for this species has been undertaken.

*Four-toed Salamander*
The four-toed salamander has a limited range in Canada (Desroches and Rodrigue 2004), with Nova Scotia situated near the species northern range limit. Although not believed to be sensitive or at risk in Nova Scotia, the four-toed salamander has been found at a relatively small number of widely separated localities (Gilhen 1984). The species is closely associated with sphagnum bogs.

No indication of four-toed salamander was observed during field studies. ACCDC data indicate that the closest observation of this species to the Project site was 3.3 km northwest within a pond on Salmon Hole Dam Road. Multiple areas of treed swamp wetland habitat exists within the Study area however no areas of sphagnum bog were identified, therefore, it is unlikely that four-toed salamander will be impacted by Project activities

*Snapping turtle*
Snapping turtle, despite its conservation status, is considered relatively common in mainland Nova Scotia (Davis and Browne 1996). Common snapping turtle habitat is usually associated with slow moving water of moderate depth, with a muddy bottom and dense vegetation. Established populations are typically found in ponds, lakes, and river edges (COSEWIC 2008).

The species has a widespread distribution across Nova Scotia, including the central mainland region within which the Study area is located (COSEWIC 2008). ACCDC records indicate that the closest observation of this species to the Study area was 4 ± 10 km away in the vicinity of the Salmon Hole dam.

No indication of Common snapping turtle was observed during field studies. While the mapped watercourses in the northern portion of the Study area (Drawing 8.3 and 8.4) present potential Common snapping turtle habitat, no watercourses were identified to intersect Project infrastructure (e.g. access roads). It is therefore unlikely that Common snapping turtle will be impacted by Project activities.

*Wood turtle*
Wood turtle requires three key habitat components: a watercourse, sandy substrate for nesting, and a forested area for thermal relief during the summer months (MacGregor and Elderkin 2003). Ideal streams have a clear, moderate flow, a hard bottom composed of sand or gravel, and are seven to 100 feet wide (MacGregor and Elderkin 2003).

The species is found throughout the province but seems to be most abundant in central Nova Scotia (MacGregor and Elderkin 2003). ACCDC data indicate that the closest observation of this species to the Project site was 6.5 ± 5 km.

No indication of Wood turtle was observed during field studies. No watercourses are present within the Project site; however suitable watercourse and associated riparian habitat are present in close proximity to the site (Drawing 8.4B). It's possible that dispersing Wood turtles may travel from this habitat through the site in search of territories in surrounding lands, but due to a lack of prevalent watercourse features in the area of the Project site, the likelihood that this species breeds or nests in the Project site is low.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 13.2.1.

### 8.6.3 Butterflies and *Odonates*

The Nova Scotia Significant Species and Habitats (NSDNR 2016) database identifies two significant habitat features relating to butterflies and *Odonates* within a 100 km radius of the Project site. These records include:

- One record classified as 'Species of Concern', both of which relate to Jutta arctic (*Oeneis jutta*); and
- One record classified as 'Other Habitat' pertaining to Hoary elfin (*Callophrys polios*).

The database contains no records of butterflies or *Odonates* within a 10 km radius of the Project site.

The ACCDC database contains records of 53 unique taxa of butterfly and Odonates within a 100 km radius of the Project site (Table 8.7).

**Table 8.7: Unique Butterfly and Odonate Species Recorded within a 100 km radius of the Project Site**

| Common Name | *Scientific Name* | *SARA* Status[1] | NS *ESA* Status[2] | COSEWIC Status[3] | NSDNR Status[4] | NS S-Rank[5] |
|---|---|---|---|---|---|---|
| Acadian Hairstreak | *Satyrium acadica* | Not Listed | Not Listed | Not Listed | Undetermined | S1 |
| Aphrodite Fritillary | *Speyeria aphrodite* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Arctic Fritillary | *Boloria chariclea* | Not Listed | Not Listed | Not Listed | Sensitive | S2 |
| Baltimore Checkerspot | *Euphydryas phaeton* | Not Listed | Not Listed | Not Listed | Secure | S2S3 |
| Banded Hairstreak | *Satyrium calanus* | Not Listed | Not Listed | Not Listed | Undetermined | S2 |
| Banded Hairstreak | *Satyrium calanus falacer* | Not Listed | Not Listed | Not Listed | At Risk | S2 |
| Bog Elfin | *Callophrys lanoraieensis* | Not Listed | Not Listed | Not Listed | May Be At Risk | S3 |
| Bronze Copper | *Lycaena hyllus* | Not Listed | Not Listed | Not Listed | Secure | S2 |
| Brook Snaketail | *Ophiogomphus aspersus* | Not Listed | Not Listed | Not Listed | May Be At Risk | S2S3 |
| Clamp-Tipped Emerald | *Somatochlora tenebrosa* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Common Roadside-Skipper | *Amblyscirtes vialis* | Not Listed | Not Listed | Not Listed | Secure | S3S4 |
| Compton Tortoiseshell | *Nymphalis l-album* | Not Listed | Not Listed | Not Listed | Secure | S1S2 |
| Delicate Emerald | *Somatochlora franklini* | Not Listed | Not Listed | Not Listed | Sensitive | S2S3 |
| Eastern Comma | *Polygonia comma* | Not Listed | Not Listed | Not Listed | At Risk | S1? |
| Eastern Red Damsel | *Amphiagrion saucium* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Ebony Boghaunter | *Williamsonia fletcheri* | Not Listed | Not Listed | Not Listed | May Be At Risk | S2 |
| Elfin Skimmer | *Nannothemis bella* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Extra-Striped Snaketail | *Ophiogomphus anomalus* | Not Listed | Not Listed | Not Listed | Not Assessed | S1 |
| Forcipate Emerald | *Somatochlora forcipata* | Not Listed | Not Listed | Not Listed | May Be At Risk | S2S3 |
| Green Comma | *Polygonia faunus* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Grey Comma | *Polygonia progne* | Not Listed | Not Listed | Not Listed | Secure | S3S4 |
| Grey Hairstreak | *Strymon melinus* | Not Listed | Not Listed | Not Listed | Secure | S1S2 |
| Harlequin Darner | *Gomphaeschna furcillata* | Not Listed | Not Listed | Not Listed | Sensitive | S3 |
| Harpoon Clubtail | *Gomphus descriptus* | Not Listed | Not Listed | Not Listed | Sensitive | S2S3 |
| Henry's Elfin | *Callophrys henrici* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Jutta Arctic | *Oeneis jutta* | Not Listed | Not Listed | Not Listed | May Be At Risk | S3 |
| Juvenal's Duskywing | *Erynnis juvenalis* | Not Listed | Not Listed | Not Listed | Secure | S3S4 |
| Kennedy's Emerald | *Somatochlora kennedyi* | Not Listed | Not Listed | Not Listed | May Be At Risk | S1S2 |
| Lance-Tipped Darner | *Aeshna constricta* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Little Wood-satyr | *Megisto cymela* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Maine Snaketail | *Ophiogomphus mainensis* | Not Listed | Not Listed | Not Listed | May Be At Risk | S2S3 |
| Milbert's Tortoiseshell | *Aglais milberti* | Not Listed | Not Listed | Not Listed | Secure | S2 |

| Common Name | *Scientific Name* | *SARA* Status[1] | NS *ESA* Status[2] | COSEWIC Status[3] | NSDNR Status[4] | NS S-Rank[5] |
|---|---|---|---|---|---|---|
| Monarch | *Danaus plexippus* | Special Concern | Not Listed | Special Concern | Sensitive | S2B |
| Mottled Darner | *Aeshna clepsydra* | Not Listed | Not Listed | Not Listed | Secure | S3 |
| Northern Cloudywing | *Thorybes pylades* | Not Listed | Not Listed | Not Listed | Sensitive | S2S3 |
| Northern Pygmy Clubtail | *Lanthus parvulus* | Not Listed | Not Listed | Not Listed | Secure | S3S4 |
| Ocellated Darner | *Boyeria grafiana* | Not Listed | Not Listed | Not Listed | Sensitive | S3 |
| Orange Bluet | *Enallagma signatum* | Not Listed | Not Listed | Not Listed | May Be At Risk | S2 |
| Pepper and Salt Skipper | *Amblyscirtes hegon* | Not Listed | Not Listed | Not Listed | Secure | S2S3 |
| Prince Baskettail | *Epitheca princeps* | Not Listed | Not Listed | Not Listed | Sensitive | S2 |
| Quebec Emerald | *Somatochlora brevicincta* | Not Listed | Not Listed | Not Listed | May Be At Risk | S1 |
| Question Mark | *Polygonia interrogationis* | Not Listed | Not Listed | Not Listed | Secure | S3B |
| Rusty Snaketail | *Ophiogomphus rupinsulensis* | Not Listed | Not Listed | Not Listed | May Be At Risk | S2S3 |
| Satyr Comma | *Polygonia satyrus* | Not Listed | Not Listed | Not Listed | Sensitive | S1? |
| Seaside Dragonlet | *Erythrodiplax berenice* | Not Listed | Not Listed | Not Listed | Sensitive | S2S3 |
| Skillet Clubtail | *Gomphus ventricosus* | Not Listed | Not Listed | Endangered | May Be At Risk | S1 |
| Spot-Winged Glider | *Pantala hymenaea* | Not Listed | Not Listed | Not Listed | Sensitive | S2?B |
| Striped Hairstreak | *Satyrium liparops* | Not Listed | Not Listed | Not Listed | Undetermined | S2S3 |
| Striped Hairstreak | *Satyrium liparops strigosum* | Not Listed | Not Listed | Not Listed | Sensitive | S2S3 |
| Taiga Bluet | *Coenagrion resolutum* | Not Listed | Not Listed | Not Listed | May Be At Risk | S1S2 |
| Vernal Bluet | *Enallagma vernale* | Not Listed | Not Listed | Not Listed | Undetermined | S3 |
| Vesper Bluet | *Enallagma vesperum* | Not Listed | Not Listed | Not Listed | Sensitive | S2S3 |
| Zebra Clubtail | *Enallagma vesperum* | Not Listed | Not Listed | Not Listed | Sensitive | S2S3 |

Source: ACCDC 2016

[1]Government of Canada 2012; [2]NS *ESA* 2013; [3]COSEWIC 2012; [4]NSDNR 2010; [5]ACCDC 2016

In August 2016 a Viceroy (*Limenitis archippus*) was observed during a field study. This specie is fairly common in Nova Scotia and is ranked as “Secure” by NSDNR and “S4” by ACCDC.

Priority butterfly and *Odonate* species include:

- Acadian hairstreak – “Undetermined” (NSDNR), “S1” (ACCDC);
- Arctic fritillary – “Sensitive” (NSDNR), “S3” (ACCDC);
- Banded hairstreak – “At Risk” (NSDNR), “S2” (ACCDC);
- Bog elfin – “May be at Risk” (NSDNR), “S3” (ACCDC);
- Brook snaketail – “May be at Risk” (NSDNR), “S2S3” (ACCDC);
- Delicate emerald – “Sensitive” (NSDNR), “S2S3” (ACCDC);
- Eastern comma – “At Risk “ (NSDNR), “S1” (ACCDC);
- Ebony boghaunter – “May be at Risk” (NSDNR), “S2” (ACCDC);
- Forcipate emerald – “May be at Risk” (NSDNR), “S2S3” (ACCDC);
- Harlequin darner – “Sensitive” (NSDNR), “S3” (ACCDC);

- Harpoon clubtail – “Sensitive” (NSDNR), “S2S3” (ACCDC);
- Jutta arctic – “May be at Risk” (NSDNR), “S3” (ACCDC);
- Kennedy's emerald – “May be at Risk” (NSDNR), “S1S2” (ACCDC);
- Maine snaketail – “May be at Risk” (NSDNR), “S2S3” (ACCDC);
- Monarch – “Special Concern” (SARA), “Special Concern” (COSEWIC), “Sensitive” (NSDNR), “S2B” (ACCDC);
- Northern cloudywing – “Sensitive” (NSDNR), “S2S3” (ACCDC);
- Ocellated darner – “Sensitive” (NSDNR), “S3” (ACCDC);
- Orange bluet – “May be at Risk” (NSDNR), “S2” (ACCDC);
- Prince baskettail – “Sensitive” (NSDNR), “S2” (ACCDC);
- Quebec emerald – “May be at Risk” (NSDNR), “S1” (ACCDC);
- Rusty snaketail – “May be at Risk” (NSDNR), “S2S3” (ACCDC);
- Satyr comma – “Sensitive” (NSDNR), “S1” (ACCDC);
- Seaside dragonlet – “Sensitive” (NSDNR), “S2S3” (ACCDC);
- Skillet clubtail – “Endangered” (COSEWIC), “May be a Risk” (NSDNR), “S1” (ACCDC);
- Spot-winged glider – “Sensitive” (NSDNR), “S2B” (ACCDC);
- Striped hairstreak – “Sensitive” (NSDNR), “S2S3” (ACCDC);
- Taiga bluet – “May be at Risk” (NSDNR), “S1S2” (ACCDC);
- Vesper bluet – “Sensitive” (NSDNR), “S2S3” (ACCDC); and
- Zebra clubtail – “May be at Risk” (NSDNR), “S1S2” (ACCDC).

*Monarch*

Only the Monarch has been granted a designated conservation status at either the provincial or federal level. This species can be found in open-habitats with abundant wildflower growth. Milkweed (*Asclepias* sp.) is a critical element of breeding habitat, whereas asters (*Asteraciae* sp.) and goldenrods (*Solidago* sp.) provide necessary food resources during migration (MTRI 2008).

Nova Scotia falls within the breeding range of this migratory species (COSEWIC 2010), and individuals can be found throughout the province from May to October (Maritime Butterfly Atlas 2012).

No indication of Monarch was observed during field surveys. Open habitat at the Project site is prevalent, particularly in cutovers areas and along roadsides (Drawing 8.5). Considering the widespread distribution of the species in Atlantic Canada, it is possible that Monarch occurs at the Project site, particularly during the migratory period (late summer/early fall). However, it is unlikely that the Project site provides sufficient nectar resources to support a large congregation of migratory Monarchs.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 13.2.1.

The requirements as set out in *SARA* and NS *ESA* will be adhered to for Project activities. Additional general mitigation measures for terrestrial fauna are provided in Section 4.0. Where required, species-specific mitigation is provided in Section 13.